

**Python  
AND ALGORITHMIC THINKING  
FOR THE COMPLETE BEGINNER  
Second Edition**

**The Answers**

**Aristides S. Bouras**

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#### **Warning and Disclaimer**

This book is designed to provide the answers to all of the review questions, as well as the solutions to all review exercises of the book "PYTHON AND ALGORITHMIC THINKING FOR THE COMPLETE BEGINNER – Second Edition". Every effort has been taken to make this book compatible with all releases of Python 3.x, and it is almost certain to be compatible with any future releases of Python.

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## How to Report Errata

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Although I have taken great care to ensure the accuracy of the content of this book, mistakes do occur. If you find a mistake in this book, either in the text or the code, I encourage you to report it to me. By doing so, you can save other readers from frustration and, of course, help me to improve the next release of this book. If you find any errata, please feel free to report them by visiting the following address:

<https://www.bouraspage.com/report-errata>

Once your errata are verified, your submission will be accepted and the errata will be uploaded to my website, and added to any existing list of errata.

# Chapter 1

---

## 1.7 Review Questions: True/False

- |          |           |
|----------|-----------|
| 1. false | 12. false |
| 2. false | 13. false |
| 3. true  | 14. false |
| 4. false | 15. true  |
| 5. false | 16. true  |
| 6. true  | 17. false |
| 7. true  | 18. false |
| 8. false | 19. true  |
| 9. false | 20. false |
| 10. true | 21. false |
| 11. true | 22. true  |

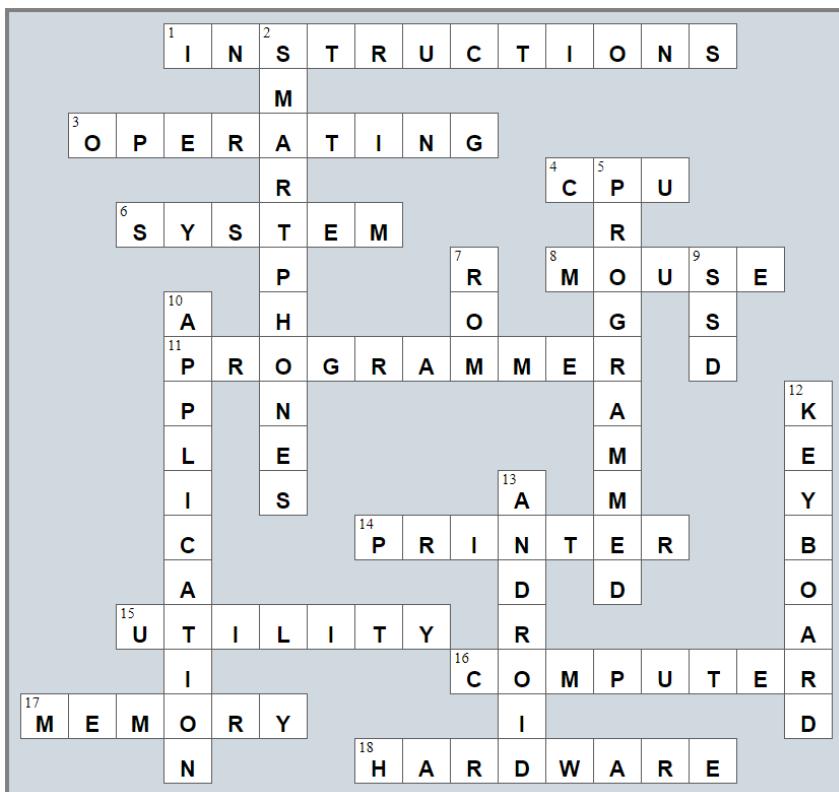
## 1.8 Review Questions: Multiple Choice

- |      |       |
|------|-------|
| 1. b | 7. c  |
| 2. d | 8. b  |
| 3. b | 9. c  |
| 4. c | 10. b |
| 5. f | 11. a |
| 6. d |       |

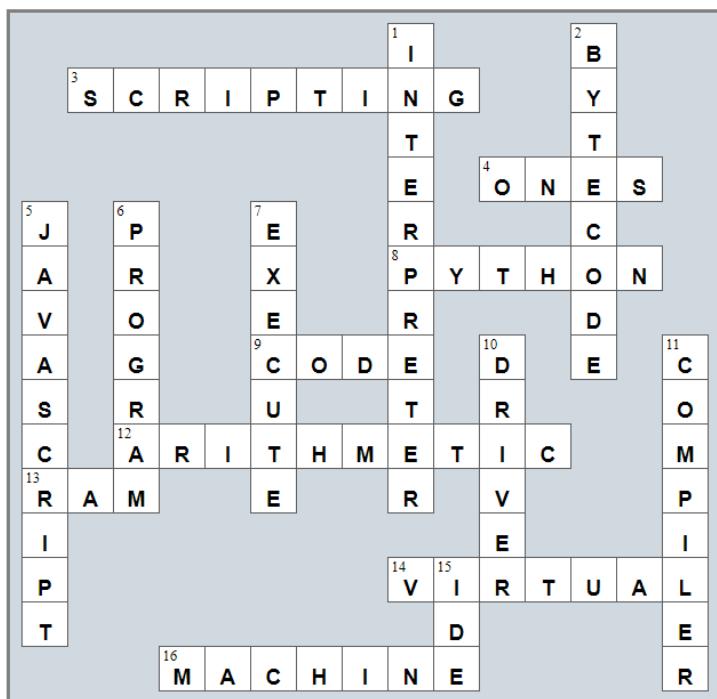
## Review in “Introductory Knowledge”

### Review Crossword Puzzles

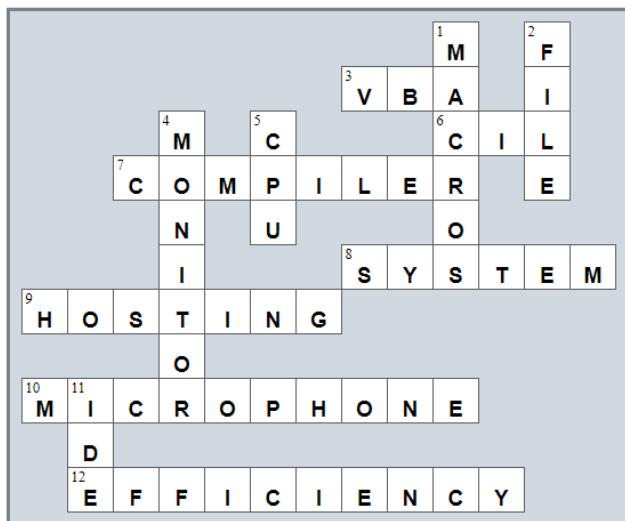
1.



2.



3.



# Chapter 4

---

## 4.16 Review Questions: True/False

- |           |           |
|-----------|-----------|
| 1. true   | 22. true  |
| 2. false  | 23. false |
| 3. false  | 24. false |
| 4. false  | 25. false |
| 5. false  | 26. false |
| 6. true   | 27. true  |
| 7. false  | 28. true  |
| 8. true   | 29. false |
| 9. true   | 30. false |
| 10. true  | 31. false |
| 11. false | 32. false |
| 12. false | 33. false |
| 13. true  | 34. true  |
| 14. true  | 35. false |
| 15. false | 36. false |
| 16. true  | 37. false |
| 17. false | 38. false |
| 18. false | 39. true  |
| 19. false | 40. true  |
| 20. true  | 41. false |
| 21. true  |           |

## 4.17 Review Questions: Multiple Choice

- |      |       |
|------|-------|
| 1. c | 6. a  |
| 2. b | 7. b  |
| 3. c | 8. d  |
| 4. a | 9. a  |
| 5. a | 10. d |

# Chapter 5

---

## 5.8 Review Questions: True/False

- |          |           |
|----------|-----------|
| 1. false | 10. false |
| 2. false | 11. true  |
| 3. true  | 12. false |
| 4. false | 13. true  |
| 5. false | 14. true  |
| 6. true  | 15. true  |
| 7. false | 16. true  |
| 8. false | 17. false |
| 9. true  |           |

## 5.9 Review Questions: Multiple Choice

- |      |      |
|------|------|
| 1. e | 5. c |
| 2. a | 6. c |
| 3. d | 7. d |
| 4. b |      |

## 5.10 Review Exercises

- 1 - c, 2 - d, 3 - a, 4 - b
- 1 - d, 2 - c, 3 - b, 4 - a
- 3.

Value	Data Type	Declaration and Initialization
The name of my friend	String	name = "Mark"
My address	String	address = "254 Lookout Rd. Wilson, NY 27893"
The average daily temperature	Float	average = 70.3
A telephone number	String	phone_number = "1-891-764-2410"
My Social Security Number (SSN)	String	ssn = "123-45-6789"
The speed of a car	Float	speed = 90.5
The number of children in a family	Integer	children = 3

# Chapter 6

---

## 6.4 Review Questions: True/False

1. true
2. true
3. true
4. false
5. false

## 6.5 Review Questions: Multiple Choice

1. a
2. c
3. b
4. b

# Chapter 7

---

## 7.6 Review Questions: True/False

- |           |           |
|-----------|-----------|
| 1. false  | 14. false |
| 2. true   | 15. false |
| 3. false  | 16. true  |
| 4. false  | 17. false |
| 5. false  | 18. true  |
| 6. false  | 19. false |
| 7. false  | 20. false |
| 8. false  | 21. false |
| 9. true   | 22. true  |
| 10. false | 23. false |
| 11. false | 24. false |
| 12. true  |           |
| 13. false |           |

## 7.7 Review Questions: Multiple Choice

- |      |      |      |
|------|------|------|
| 1. c | 4. d | 7. d |
| 2. c | 5. b | 8. c |
| 3. b | 6. d |      |

## 7.8 Review Exercises

1. ii, iv, v, ix, x
2. i. String, ii. Boolean, iii. String, iv. String, v. Float, vi. Integer
3. i. d, ii. f, iii. c, iv. e
4. i. 27, ii. 28
5. i. 5, ii. 6
6. i. 1, ii. 0, iii. 1, iv. 1, v. 0, vi. 1
7. i.  $2 * 3$ , ii. 4.0
8. i. 2, ii. 0, iii. 1, iv. 0, v. 0, vi. 0
9. i. 2.0, ii. 10.5
10. My name is George Malkovich
11. i.  $(-3)$ , ii. 1
12. California California

# Chapter 8

---

## 8.2 Review Questions: True/False

- |          |          |
|----------|----------|
| 1. false | 3. false |
| 2. true  | 4. false |

## 8.3 Review Exercises

### 1. Solution

---

For the input value of 3

Step	Statement	a	b	c	d
1	a = int(input())	3	?	?	?
2	a = (a + 1) * (a + 1) + 6 / 3 * 2 + 20	40.0	?	?	?
3	b = a % 13	40.0	1.0	?	?
4	c = b % 7	40.0	1.0	1.0	?
5	d = a * b * c	40.0	1.0	1.0	40.0
6	print(a, ", ", b, ", ", c, ", ", d)	It displays: 40.0, 1.0, 1.0, 40.0			

For the input value of 4

Step	Statement	a	b	c	d
1	a = int(input())	4	?	?	?
2	a = (a + 1) * (a + 1) + 6 / 3 * 2 + 20	49.0	?	?	?
3	b = a % 13	49.0	10.0	?	?
4	c = b % 7	49.0	10.0	3.0	?
5	d = a * b * c	49.0	10.0	3.0	1470.0
6	print(a, ", ", b, ", ", c, ", ", d)	It displays: 49.0, 10.0, 3.0, 1470.0			

For the input value of 1

Step	Statement	a	b	c	d
1	a = int(input())	1	?	?	?
2	a = (a + 1) * (a + 1) + 6 / 3 * 2 + 20	28.0	?	?	?
3	b = a % 13	28.0	2.0	?	?
4	c = b % 7	28.0	2.0	2.0	?
5	d = a * b * c	28.0	2.0	2.0	112.0
6	print(a, ", ", b, ", ", c, ", ", d)	It displays: 28.0, 2.0, 2.0, 112.0			

### 2. Solution

---

For the input values of 8, 4

Step	Statement	a	b	c	d	e
1	a = float(input())	<b>8.0</b>	?	?	?	?
2	b = float(input())	8.0	<b>4.0</b>	?	?	?
3	c = a + b	8.0	4.0	<b>12.0</b>	?	?
4	d = 1 + a / b * c + 2	8.0	4.0	12.0	<b>27.0</b>	?
5	e = c + d	8.0	4.0	12.0	27.0	<b>39.0</b>
6	c += d + e	8.0	4.0	<b>78.0</b>	27.0	39.0
7	e -= 1	8.0	4.0	78.0	27.0	<b>38.0</b>
8	d -= c + d % c	8.0	4.0	78.0	<b>-78.0</b>	38.0
9	print(c, ", ", d, ", ", e)	It displays: 78.0, -78.0, 38.0				

For the input values of 4, 4

Step	Statement	a	b	c	d	e
1	a = float(input())	<b>4.0</b>	?	?	?	?
2	b = float(input())	4.0	<b>4.0</b>	?	?	?
3	c = a + b	4.0	4.0	<b>8.0</b>	?	?
4	d = 1 + a / b * c + 2	4.0	4.0	8.0	<b>11.0</b>	?
5	e = c + d	4.0	4.0	8.0	11.0	<b>19.0</b>
6	c += d + e	4.0	4.0	<b>38.0</b>	11.0	19.0
7	e -= 1	4.0	4.0	38.0	11.0	<b>18.0</b>
8	d -= c + d % c	4.0	4.0	38.0	<b>-38.0</b>	18.0
9	print(c, ", ", d, ", ", e)	It displays: 38.0, -38.0, 18.0				

# Chapter 9

---

## 9.5 Review Exercises

### 1. Solution

---

The statement `S = S1 + S3 + SS` is wrong. It must be `S = S1 + S3 + S5`

### 2. Solution

---

For the input values of 5, 5

Step	Statement	a	b	c	d	e
1	<code>a = float(input())</code>	<b>5.0</b>	?	?	?	?
2	<code>b = float(input())</code>	5.0	<b>5.0</b>	?	?	?
3	<code>c = a + b</code>	5.0	5.0	<b>10.0</b>	?	?
4	<code>d = 5 + a / b * c + 2</code>	5.0	5.0	10.0	<b>17.0</b>	?
5	<code>e = c - d</code>	5.0	5.0	10.0	17.0	<b>-7.0</b>
6	<code>c += d + c</code>	5.0	5.0	<b>37.0</b>	17.0	-7.0
7	<code>e -= 1</code>	5.0	5.0	37.0	17.0	<b>-8.0</b>
8	<code>d += c + a / b</code>	5.0	5.0	37.0	<b>55.0</b>	-8.0
9	<code>print(c, ", ", d, ", ", e)</code>	It displays: 37.0, 55.0, -8.0				

For the input values of 4, 8

Step	Statement	a	b	c	d	e
1	<code>a = float(input())</code>	<b>4.0</b>	?	?	?	?
2	<code>b = float(input())</code>	4.0	<b>8.0</b>	?	?	?
3	<code>c = a + b</code>	4.0	8.0	<b>12.0</b>	?	?
4	<code>d = 5 + a / b * c + 2</code>	4.0	8.0	12.0	<b>13.0</b>	?
5	<code>e = c - d</code>	4.0	8.0	12.0	13.0	<b>-1.0</b>
6	<code>c += d + c</code>	4.0	8.0	<b>37.0</b>	13.0	-1.0
7	<code>e -= 1</code>	4.0	8.0	37.0	13.0	<b>-2.0</b>
8	<code>d += c + a / b</code>	4.0	8.0	37.0	<b>50.5</b>	-2.0
9	<code>print(c, ", ", d, ", ", e)</code>	It displays: 37.0, 50.5, -2.0				

### 3. Solution

---

For the input value of 0.50

Step	Statement	a	b	c
1	<code>b = float(input())</code>	?	<b>0.50</b>	?
2	<code>c = 5</code>	?	0.50	<b>5</b>

<b>3</b>	c = c * b	?	0.50	<b>2.5</b>
<b>4</b>	a = 10 * c / 2	<b>12.5</b>	0.50	2.5
<b>5</b>	print(a)	It displays: 12.5		

For the input value of 3

Step	Statement	a	b	c
<b>1</b>	b = float(input())	?	<b>3.0</b>	?
<b>2</b>	c = 5	?	3.0	<b>5</b>
<b>3</b>	c = c * b	?	3.0	<b>15.0</b>
<b>4</b>	a = 10 * c / 2	<b>75.0</b>	3.0	15.0
<b>5</b>	print(a)	It displays: 75.0		

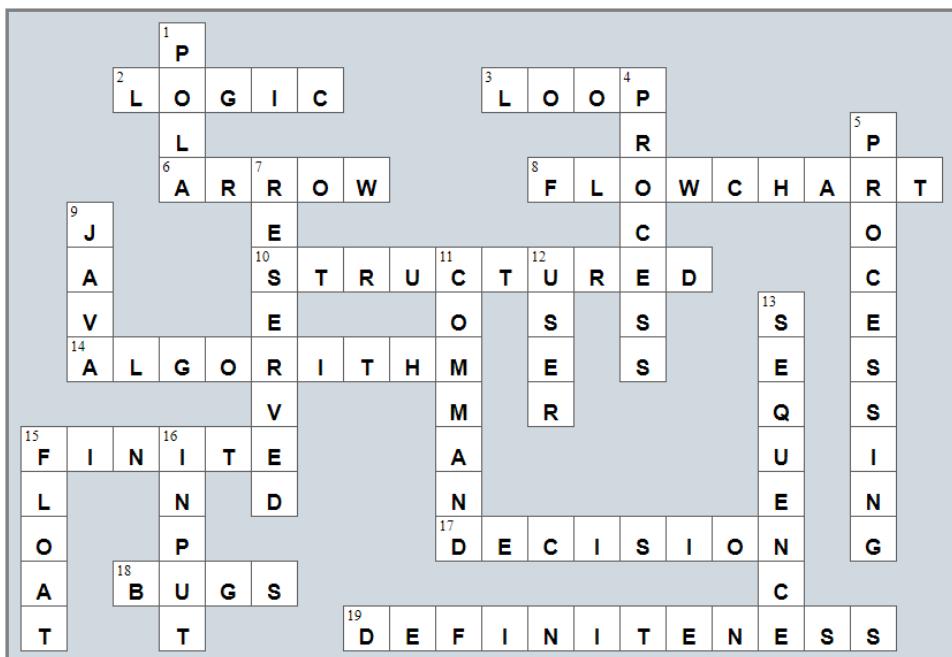
For the input value of 15

Step	Statement	a	b	c
<b>1</b>	b = float(input())	?	<b>15.0</b>	?
<b>2</b>	c = 5	?	15.0	<b>5</b>
<b>3</b>	c = c * b	?	15.0	<b>75.0</b>
<b>4</b>	a = 10 * c / 2	<b>375.0</b>	15.0	75.0
<b>5</b>	print(a)	It displays: 375.0		

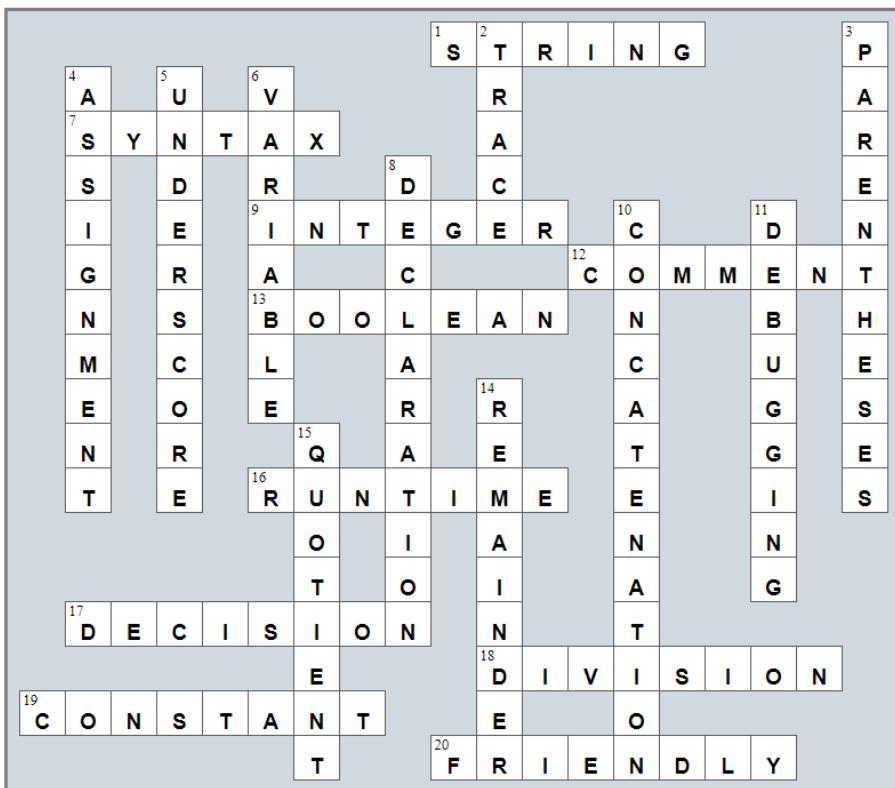
## Review in “Getting Started with Python”

### Review Crossword Puzzles

1.



2.



# Chapter 10

---

## 10.2 Review Exercises

### 1. Solution

---

```
b = float(input("Enter base: "))
h = float(input("Enter height: "))

area = 0.5 * b * h

print(area)
```

### 2. Solution

---

```
angle1 = float(input("Enter 1st angle: "))
angle2 = float(input("Enter 2nd angle: "))

angle3 = 180 - angle1 - angle2

print(angle3)
```

### 3. Solution

---

```
g1 = int(input("Enter 1st grade: "))
g2 = int(input("Enter 2nd grade: "))
g3 = int(input("Enter 3rd grade: "))
g4 = int(input("Enter 4th grade: "))

average = (g1 + g2 + g3 + g4) / 4

print(average)
```

### 4. Solution

---

```
PI = 3.14159

r = float(input("Enter radius: "))

perimeter = 2 * PI * r

print(perimeter)
```

### 5. Solution

---

```
PI = 3.14159

d = float(input("Enter diameter (in meters): "))

volume = 4 / 3 * PI * (d / 2) ** 3
```

```
    print(volume)
```

## 6. Solution

---

Only a), e) and g) are syntactically correct. The latter is more user friendly.

## 7. Solution

---

```
PI = 3.14159

d = float(input("Enter diameter: "))

radius = d / 2
perimeter = 2 * PI * radius
area = PI * radius ** 2
volume = 4 / 3 * PI * radius ** 3

print(radius, perimeter, area, volume)
```

## 8. Solution

---

```
charge = float(input("Enter charge for a meal: "))

tip = charge * 10 / 100
tax = charge * 7 / 100

total = charge + tip + tax

print(total)
```

## 9. Solution

---

```
a = float(input("Enter acceleration in m/sec2: "))
t = float(input("Enter time traveled in sec: "))

s = 0.5 * a * t * t

print(s)
```

## 10. Solution

---

```
f = float(input("Enter temperature in Fahrenheit: "))

c = 5 / 9 * (f - 32)

print(c)
```

## 11. Solution

---

```
w = int(input("Enter weight in pounds: "))
```

```
h = int(input("Enter height in inches: "))

bmi = w * 703 / (h * h)

print(bmi)
```

### 12. Solution

---

```
s_total = float(input("Enter subtotal: "))
g_rate = float(input("Enter gratuity rate (0 - 100): "))

tip = s_total * g_rate / 100

total = s_total + tip

print("Tip is $", tip, " and Total is $", total , sep = "")
```

### 13. Solution

---

```
VAT = 0.20

btax_price1 = float(input("Enter before-tax price 1: "))
btax_price2 = float(input("Enter before-tax price 2: "))
btax_price3 = float(input("Enter before-tax price 3: "))

atax_price1 = btax_price1 + btax_price1 * VAT
atax_price2 = btax_price2 + btax_price2 * VAT
atax_price3 = btax_price3 + btax_price3 * VAT

avg = (atax_price1 + atax_price2 + atax_price3) / 3

print(avg)
```

### 14. Solution

---

```
VAT = 0.20

atax_price = float(input("Enter after-tax price: "))

btax_price = atax_price / (1 + VAT)

print(btax_price)
```

### 15. Solution

---

```
i_price = float(input("Enter price: "))
discount = float(input("Enter discount (0 - 100): "))

f_price = i_price - i_price * discount / 100
saved = i_price - f_price
```

```
    print(f_price, saved)
```

### 16. Solution

---

```
VAT = 0.20

i_kWh = int(input("Enter kWh at the beginning of the month: "))
f_kWh = int(input("Enter kWh at the end of the month: "))

kWh_consumed = f_kWh - i_kWh

cost = kWh_consumed * 0.06
cost += cost * VAT

print(kWh_consumed, cost)
```

### 17. Solution

---

```
month = int(input("Enter current month: "))
day = int(input("Enter current day: "))

days_passed = (month - 1) * 30 + day
days_left = 360 - days_passed

print(days_left)
```

# Chapter 11

---

## 11.3 Review Questions: True/False

- |          |          |           |
|----------|----------|-----------|
| 1. true  | 5. false | 9. true   |
| 2. false | 6. false | 10. true  |
| 3. false | 7. true  | 11. false |
| 4. false | 8. true  | 12. false |

## 11.4 Review Questions: Multiple Choice

- |      |      |      |
|------|------|------|
| 1. d | 3. b | 5. a |
| 2. d | 4. c | 6. b |

## 11.5 Review Exercises

### 1. Solution

---

For the input value of 9

Step	Statement	a	b	c
1	a = float(input())	9.0	?	?
2	a += 6 / math.sqrt(a) * 2 + 20	33.0	?	?
3	b = round(a) % 4	33.0	1	?
4	c = b % 3	33.0	1	1
5	print(a, ", ", b, ", ", c)	It displays: 33.0, 1, 1		

For the input value of 4

Step	Statement	a	b	c
1	a = float(input())	4.0	?	?
2	a += 6 / math.sqrt(a) * 2 + 20	30.0	?	?
3	b = round(a) % 4	30.0	2	?
4	c = b % 3	30.0	2	2
5	print(a, ", ", b, ", ", c)	It displays: 30.0, 2, 2		

### 2. Solution

---

For the input value of -2

Step	Statement	a	b	c
1	a = int(input())	-2	?	?
2	b = abs(a) % 4 + a ** 4	-2	18	?
3	c = b % 5	-2	18	3
4	print(b, ", ", c)	It displays: 18, 3		

For the input value of -3

Step	Statement	a	b	c
1	<code>a = int(input())</code>	-3	?	?
2	<code>b = abs(a) % 4 + a ** 4</code>	-3	<b>84</b>	?
3	<code>c = b % 5</code>	-3	84	<b>4</b>
4	<code>print(b, ", ", c)</code>	It displays: 84, 4		

### 3. Solution

---

```
import math

radians = float(input("Enter angle in radians: "))

degrees = radians * 180 / math.pi

print(degrees)
```

### 4. Solution

---

```
import math

a = float(input("Enter right angle side A of a right-angled triangle: "))
b = float(input("Enter right angle side B of a right-angled triangle: "))

hypotenuse = math.sqrt(a ** 2 + b ** 2)

print(hypotenuse)
```

### 5. Solution

---

```
import math

th = float(input("Enter angle θ (in degrees) of a right-angled triangle: "))
adjacent = float(input("Enter length of adjacent side: "))

opposite = math.tan(th * math.pi / 180) * adjacent

print(opposite)
```

# Chapter 12

---

## 12.2 Review Exercises

### 1. Solution

---

- i. a, e, g, h
- ii. c, f

### 2. Solution

---

- i.  $y = (x + 3)^{5w} / (7(x - 4))$
- ii.  $y = (3x^2 - x^{3/4})^{1/5}$
- iii.  $y = \text{math.sqrt}(x^4 - 2x^3 - 7x^2 + x) / (4(7x^4 - 3x^3 - 4x^3)^{(7x^2 + x)} * (1/3))$
- iv.  $y = x / (x - 3(x - 1)) + x^{(x-1)/5} / ((x^3 - 2)^{(x-1)/3})$
- v.  $y = (\text{math.sin}(\text{math.pi}/3) - \text{math.cos}(\text{math.pi}/2 * w))^2$
- vi.  $y = (\text{math.sin}(\text{math.pi}/2 * x) + \text{math.cos}(3\text{math.pi}/2 * w))^{3/((\text{math.tan}(2\text{math.pi}/3 * w) - \text{math.sin}(\text{math.pi}/2 * x))^{0.5} + 6)}$

### 3. Solution

---

```
import math

x = float(input("Enter value for x: "))

y = math.sqrt(x) * (x**3 + x**2)

print(y)
```

### 4. Solution

---

```
x = float(input("Enter value for x: "))

y = 7 * x / (2 * x + 4 * (x * x + 4))

print(y)
```

### 5. Solution

---

```
import math

x = float(input("Enter value for x: "))
w = float(input("Enter value for w: "))

y = x ** (x + 1) / (math.tan(2 * w / 3 + 5) - math.tan(x / 2 + 1)) ** 3

print(y)
```

## 6. Solution

---

```
x = float(input("Enter value for x: "))
w = float(input("Enter value for w: "))

y = (3 + w) / (6 * x - 7 * (x + 4)) + x * (3 * w + 1) ** (1 / 5) * (5 * x + 4) / ((x ** 3 + 3) * (x -
1) ** 7)

print(y)
```

## 7. Solution

---

```
import math

x = float(input("Enter value for x: "))
w = float(input("Enter value for w: "))

y = x ** x / (math.sin(2 * w / 3 + 5) - x) ** 2 + (math.sin(3 * x) + w) ** (x + 1) / math.sqrt(7 * w)
** (3 / 2)

print(y)
```

## 8. Solution

---

```
import math

a = float(input("Enter length A: "))
b = float(input("Enter length B: "))
c = float(input("Enter length C: "))

semi = (a + b + c) / 2
area = math.sqrt(semi * (semi - a) * (semi - b) * (semi - c))

print(area)
```

# Chapter 13

---

## 13.2 Review Exercises

### 1. Solution

---

```
n = int(input("Enter an integer: "))

last_digit = n % 10
result = last_digit * 8

print(result)
```

### 2. Solution

---

```
number = int(input("Enter a five-digit integer: "))

digit5 = number % 10
r = number // 10

digit4 = r % 10
r = r // 10

digit3 = r % 10
r = r // 10

digit2 = r % 10
digit1 = r // 10

reversed_number = digit5 * 10000 + digit4 * 1000 + digit3 * 100 + digit2 * 10 + digit1
print(reversed_number)
```

However, using the `divmod()` function it can become:

```
number = int(input("Enter a five-digit integer: "))

r, digit5 = divmod(number, 10)
r, digit4 = divmod(r, 10)
r, digit3 = divmod(r, 10)
digit1, digit2 = divmod(r, 10)

reversed_number = digit5 * 10000 + digit4 * 1000 + digit3 * 100 + digit2 * 10 + digit1
print(reversed_number)
```

### 3. Solution

---

```
n = int(input("Enter an integer: "))

result = n % 2
```

```
print(result)
```

#### 4. Solution

---

```
n = int(input("Enter an integer: "))

result = 1 - n % 2

print(result)
```

#### 5. Solution

---

```
number = int(input("Enter an elapsed time in seconds: "))

weeks = number // 604800      # 60 * 60 * 24 * 7 = 604800
r = number % 604800

days = r // 86400            # 60 * 60 * 24 = 86400
r = r % 86400

hours = r // 3600
r = r % 3600

minutes = r // 60
seconds = r % 60

print(weeks, "week(s)", days, "day(s)", hours, "hour(s)", minutes, "minute(s) and", seconds, "second(s)")
```

However, using the `divmod()` function it can become:

```
number = int(input("Enter a period of time in seconds: "))

weeks, r = divmod(number, 604800)      # 60 * 60 * 24 * 7 = 604800
days, r = divmod(r, 86400)                # 60 * 60 * 24 = 86400
hours, r = divmod(r, 3600)
minutes, seconds = divmod(r, 60)

print(weeks, "week(s)", days, "day(s)", hours, "hour(s)", minutes, "minute(s) and", seconds, "second(s)")
```

#### 6. Solution

---

```
amount = int(input("Enter amount of money to withdraw: "))

usd20, r = divmod(amount, 20)
usd10, r = divmod(r, 10)
usd5, usd1 = divmod(r, 5)

print(usd20, "note(s) of $20", usd10, "note(s) of $10", usd5, "note(s) of $5 and", usd1, "note(s) of $1")
```

#### 7. Solution

---

```
steps = int(input("Enter number of steps: "))
```

```
distance = steps * 25

miles, r = divmod(distance, 63360)
yards, r = divmod(r, 36)
feet, inches = divmod(r, 12)

print(miles, "mile(s)", yards, "yard(s)", feet, "foot/feet and", inches, "inch(es)")
```

# Chapter 14

---

## 14.4 Review Questions: True/False

- |          |           |           |
|----------|-----------|-----------|
| 1. true  | 7. true   | 13. false |
| 2. false | 8. false  | 14. true  |
| 3. false | 9. true   | 15. true  |
| 4. true  | 10. false | 16. true  |
| 5. true  | 11. false |           |
| 6. false | 12. true  |           |

## 14.5 Review Questions: Multiple Choice

- |      |      |      |
|------|------|------|
| 1. d | 4. d | 7. c |
| 2. b | 5. b | 8. a |
| 3. a | 6. b | 9. c |

## 14.6 Review Exercises

### 1. Solution

---

```
first_name = input("First name: ")
middle_name = input("Middle name: ")
last_name = input("Last name: ")
title = input("Title: ")

print(title, first_name, middle_name, last_name)
print(first_name, middle_name, last_name)
print(last_name, ", ", first_name, sep = "")
print(last_name, ", ", first_name, " ", middle_name, sep = "")
print(last_name, ", ", first_name, " ", middle_name, ", ", title, sep = "")
print(first_name, last_name)
```

### 2. Solution

---

```
import random
import string

alphabet = string.ascii_lowercase

random_word = alphabet[random.randrange(26)].upper() + \
    alphabet[random.randrange(26)] + \
    alphabet[random.randrange(26)] + \
    alphabet[random.randrange(26)] + \
    alphabet[random.randrange(26)]

print(random_word)
```

### 3. Solution

---

```
import random
```

```

name = input("Enter name: ")

x = name.lower().replace(" ", "")

secret_password = x[random.randrange(len(x))] + \
                  x[random.randrange(len(x))] + \
                  x[random.randrange(len(x))] + \
                  str(random.randrange(1000, 10000))

print(secret_password)

```

#### 4. Solution

---

##### First approach

```

number = int(input("Enter a three-digit integer: "))

#Convert the number to string
number_string = str(number)

#Reverse the string
reversed_string = number_string[2] + number_string[1] + number_string[0]

#Convert the reversed string to integer
reversed_number = int(reversed_string)

print(reversed_number)

```

##### Second approach

```

number = int(input("Enter an integer: "))

#Convert the number to string
number_string = str(number)

#Reverse the string
reversed_string = number_string[::-1]

#Convert the reversed string to integer
reversed_number = int(reversed_string)

print(reversed_number)

```



*The advantage of this approach is that the user is allowed to enter any integer, no matter how small or large!*

##### Third approach

```

number = int(input("Enter an integer: "))

reversed_number = int(str(number) [::-1])

print(reversed_number)

```

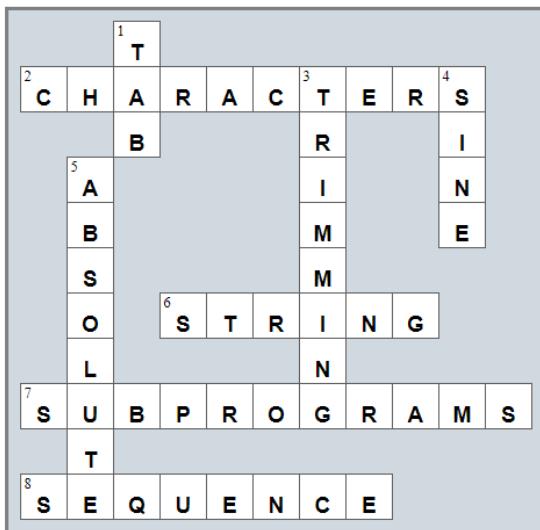


*The advantage of this approach is that the user is allowed to enter any integer, no matter how small or large!*

## Review in "Sequence Control Structures"

### Review Crossword Puzzle

1.



# Chapter 15

---

## 15.10 Review Questions: True/False

- |          |           |           |
|----------|-----------|-----------|
| 1. true  | 9. true   | 17. false |
| 2. false | 10. true  | 18. true  |
| 3. false | 11. true  | 19. true  |
| 4. false | 12. true  | 20. false |
| 5. false | 13. true  | 21. true  |
| 6. false | 14. true  | 22. true  |
| 7. false | 15. true  | 23. true  |
| 8. true  | 16. false |           |

## 15.11 Review Questions: Multiple Choice

- |      |      |      |
|------|------|------|
| 1. b | 3. a | 5. c |
| 2. a | 4. a | 6. d |

## 15.12 Review Exercises

### 1. Solution

---

- i. c, e, g
- ii. a, j
- iii. d, f
- iv. b, h, i

### 2. Solution

---

a	b	c	a != 1	b > a	c / 2 > 2 * a
3	-5	8	True	False	False
1	10	20	False	True	True
-4	-2	-9	True	True	True

### 3. Solution

---

Boolean Expression1 (BE1)	Boolean Expression2 (BE2)	BE1 or BE2	BE1 and BE2	not(BE2)
False	False	False	False	True
False	True	True	False	False
True	False	True	False	True
True	True	True	True	False

**4. Solution**

a	b	c	$a > 3 \text{ or } c > b \text{ and } c > 1$	$a > 3 \text{ and } c > b \text{ or } c > 1$
4	-6	2	True	True
-3	2	-4	False	False
2	5	5	False	True

**5. Solution**

Expression	Value
$(x + y) ^\star 3$	8
$(x + y) / (x ^\star 2 - 14)$	1.0
$x - 1 == y + 5$	True
$x > 2 \text{ and } y == 1$	False
$x == 1 \text{ or } y == -2 \text{ and } \text{not}(flag == \text{False})$	True
$\text{not}(x \geq 3) \text{ and } (x \% 2 > 1)$	False

**6. Solution**

- i. False
- ii. True

**7. Solution**

- i.  $age < 12 \text{ and } age != 8$
- ii.  $6 \leq age \leq 9 \text{ or } age == 11$
- iii.  $age > 7 \text{ and } age != 10 \text{ and } age != 12$
- iv.  $age == 6 \text{ or } age == 9 \text{ or } age == 11$
- v.  $6 \leq age \leq 12 \text{ and } age != 8$
- vi.  $age != 7 \text{ and } age != 10$

**8. Solution**

- i.  $x != 4 \text{ or } y == 3$
- ii.  $x + 4 > 0$
- iii.  $\text{not}(x \leq 5) \text{ and } y != 4$
- iv.  $x == \text{False}$
- v.  $\text{not}(x < 4 \text{ and } z \leq 4)$
- vi.  $x == 2 \text{ or } x < -5$

**9. Solution**

- i.  $\text{not}(x < 4 \text{ or } y == 10)$
- ii.  $\text{not}(x - 2 < 9)$

- iii. `not(not(x < 2) and y == 4)`
- iv. `not(x == False and y != 3)`
- v. **First approach:** `not(not(x < 2 or y < 2))`  
**Second approach:** `x < 2 or y < 2`
- vi. `not(x == -2 or x > 2)`

# Chapter 16

---

## 16.2 Review Questions: True/False

- |          |          |
|----------|----------|
| 1. false | 6. false |
| 2. false | 7. true  |
| 3. true  | 8. false |
| 4. false | 9. true  |
| 5. false |          |

## 16.3 Review Questions: Multiple Choice

- |      |      |
|------|------|
| 1. b | 4. d |
| 2. c | 5. d |
| 3. d | 6. a |

## 16.4 Review Exercises

### 1. Solution

---

The corrections/additions are in red

```
x = float(input())

y = - 5
if x * y / 2 > 20:
    y *= 2
    x += 4 * x ** 2

print(x, y)
```

### 2. Solution

---

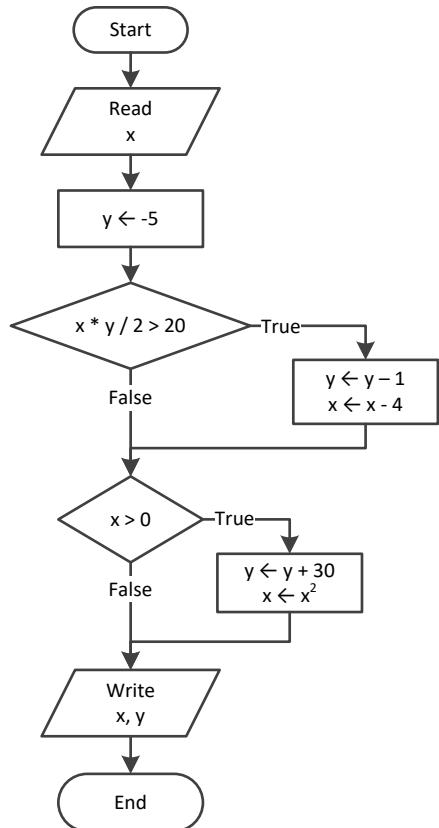
For the input value of 10

Step	Statement	x	y
1	x = float(input())	<b>10.0</b>	?
2	y = -5	10.0	<b>-5</b>
3	if x * y / 2 > 20:		False
4	if x > 0:		True
5	y += 30	10.0	<b>25</b>
6	x = x ** 2	<b>100.0</b>	25
7	print(x, ", ", y)	It displays: 100.0, 25	

For the input value of -10

Step	Statement	x	y
1	x = float(input())	<b>-10.0</b>	?
2	y = -5	-10.0	<b>-5</b>

<b>3</b>	if $x * y / 2 > 20$ :	True	
<b>4</b>	$y = 1$	-10.0	<b>-6</b>
<b>5</b>	$x = 4$	<b>-14.0</b>	-6
<b>6</b>	if $x > 0$ :	False	
<b>7</b>	print( $x, ", ", y$ )	It displays: -14.0, -6	



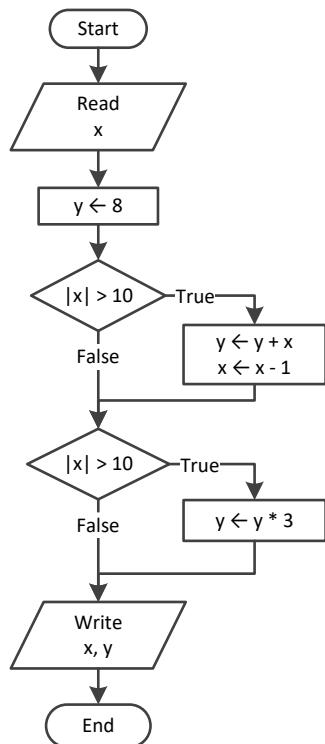
### 3. Solution

For the input value of -11

Step	Statement	x	y
<b>1</b>	$x = \text{int}(\text{input}())$	<b>-11</b>	?
<b>2</b>	$y = 8$	-11	<b>8</b>
<b>3</b>	if $\text{abs}(x) > 10$ :	True	
<b>4</b>	$y += x$	-11	<b>-3</b>
<b>5</b>	$x -= 1$	<b>-12</b>	-3
<b>6</b>	if $\text{abs}(x) > 10$ :	True	
<b>7</b>	$y *= 3$	-12	<b>-9</b>
<b>8</b>	print( $x, ", ", y$ )	It displays: -12, -9	

For the input value of 11

Step	Statement	x	y
1	<code>x = int(input())</code>	<b>11</b>	?
2	<code>y = 8</code>	11	<b>8</b>
3	<code>if abs(x) &gt; 10:</code>		True
4	<code>y += x</code>	11	<b>19</b>
5	<code>x -= 1</code>	<b>10</b>	19
6	<code>if abs(x) &gt; 10:</code>		False
7	<code>print(x, ", ", y)</code>	It displays: 10, 19	



#### 4. Solution

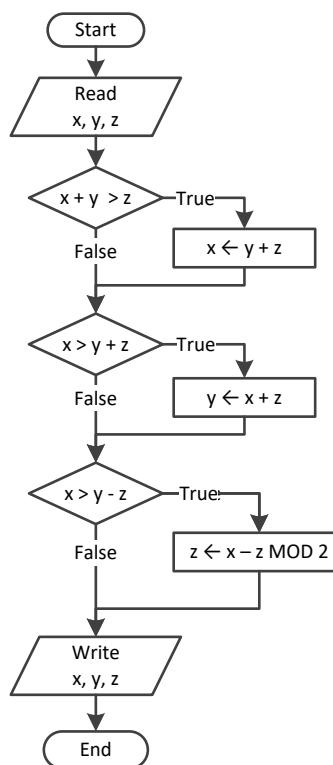
For input values of 1, 2 and 3

Step	Statement	x	y	z
1	<code>x = int(input())</code>	<b>1</b>	?	?
2	<code>y = int(input())</code>	1	<b>2</b>	?
3	<code>z = int(input())</code>	1	<b>2</b>	<b>3</b>
4	<code>if x + y &gt; z:</code>			False
5	<code>if x &gt; y + z:</code>			False
6	<code>if x &gt; y - z:</code>			True
7	<code>z = x - z % 2</code>	1	2	<b>0</b>

8	<code>print(x, ",", y, ",", z)</code>	It displays: 1, 2, 0		
---	---------------------------------------	----------------------	--	--

For input values of 4, 2 and 1

Step	Statement	x	y	z
1	<code>x = int(input())</code>	<b>4</b>	?	?
2	<code>y = int(input())</code>	4	<b>2</b>	?
3	<code>z = int(input())</code>	4	<b>2</b>	<b>1</b>
4	<code>if x + y &gt; z:</code>			True
5	<code>x = y + z</code>	<b>3</b>	2	1
6	<code>if x &gt; y + z:</code>			False
7	<code>if x &gt; y - z:</code>			True
8	<code>z = x - z % 2</code>	3	2	<b>2</b>
9	<code>print(x, ",", y, ",", z)</code>	It displays: 3, 2, 2		



## 5. Solution

```

x = float(input("Enter a number: "))
if x > 0:
    print("Positive")
  
```

## 6. Solution

```

x = float(input("Enter a number: "))
y = float(input("Enter a second number"))
  
```

```
if x > 0 and y > 0:  
    print("Positive")
```

### 7. Solution

---

```
x = int(input("Enter your age: "))  
  
if x > 14:  
    print("You can drive a car in Kansas (USA)")
```

### 8. Solution

---

```
s = input("Enter a string: ")  
  
if s == s.upper():  
    print("Uppercase")
```

### 9. Solution

---

```
s = input("Enter a string: ")  
  
if len(s) > 20:  
    print("Many characters")
```

### 10. Solution

---

```
n1 = float(input("Enter 1st number: "))  
n2 = float(input("Enter 2nd number: "))  
n3 = float(input("Enter 3rd number: "))  
n4 = float(input("Enter 4th number: "))  
  
if n1 < 0 or n2 < 0 or n3 < 0 or n4 < 0:  
    print("Among the given numbers, there is a negative one!")
```

### 11. Solution

---

```
a = float(input("Enter 1st number: "))  
b = float(input("Enter 2nd number: "))  
  
if a > b:  
    c = a          # Or you can do the following:  
    a = b          # a, b = b, a  
    b = c          #  
  
print(a, b)
```

### 12. Solution

---

```
t1 = float(input("Enter 1st temperature: "))  
t2 = float(input("Enter 2nd temperature: "))
```

```
t3 = float(input("Enter 3rd temperature: "))

average = (t1 + t2 + t3) / 3

if average > 60:
    print("Heat Wave")
```

# Chapter 17

---

## 17.2 Review Questions: True/False

- |          |          |
|----------|----------|
| 1. false | 4. false |
| 2. true  | 5. false |
| 3. true  | 6. false |

## 17.3 Review Questions: Multiple Choice

- |      |      |
|------|------|
| 1. b | 4. b |
| 2. c | 5. d |
| 3. c | 6. a |

## 17.4 Review Exercises

### 1. Solution

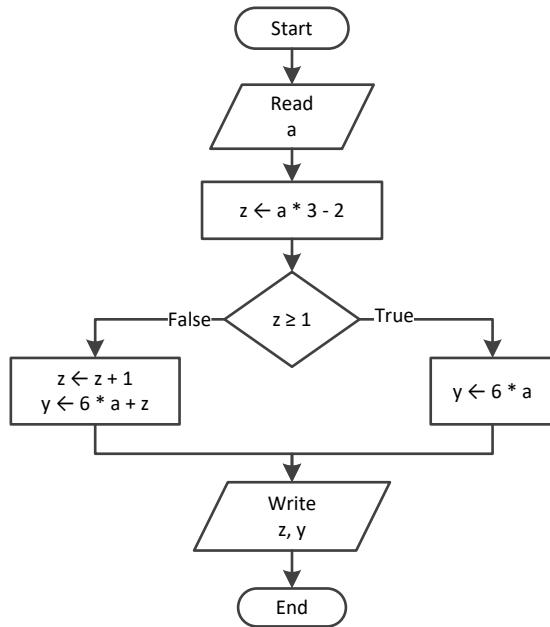
---

For input value of 3

Step	Statement	a	y	z
1	a = float(input())	<b>3.0</b>	?	?
2	z = a * 3 - 2	3.0	?	<b>7.0</b>
3	if z >= 1:		True	
4	y = 6 * a	3.0	<b>18.0</b>	7.0
5	print(z, ", ", y)	It displays: 7.0, 18.0		

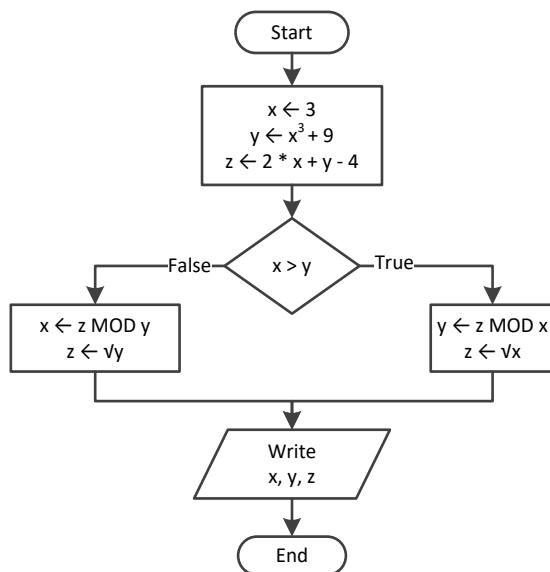
For input value of 0.5

Step	Statement	a	y	z
1	a = float(input())	<b>0.5</b>	?	?
2	z = a * 3 - 2	0.5	?	<b>-0.5</b>
3	if z >= 1:		False	
4	z += 1	0.5	?	<b>0.5</b>
5	y = 6 * a + z	0.5	<b>3.5</b>	0.5
6	print(z, ", ", y)	It displays: 0.5, 3.5		



## 2. Solution

Step	Statement	x	y	z
1	$x = 3$	3	?	?
2	$y = x^{**} 3 + 9$	3	<b>36</b>	?
3	$z = 2 * x + y - 4$	3	36	<b>38</b>
4	if $x > y$ :			False
5	$x = z \% y$	2	36	38
6	$z = \text{math.sqrt}(y)$	2	36	<b>6</b>
7	<code>print(x, ", ", y, ", ", z)</code>	It displays: 2, 36, 6		



### 3. Solution

```

x = float(input())
w = x * 3 - 15
z = (w + 7) * (x + 4) - 10
if w > x and z > x:
    x += 1
    y = x / 2 + 4
else:
    y = x / 4 + 2
print(y)

```

For input value of 10

Step	Statement	x	y	w	z
1	x = float(input())	<b>10.0</b>	?	?	?
2	w = x * 3 - 15	10.0	?	<b>15.0</b>	?
3	z = (w + 7) * (x + 4) - 10	10.0	?	15.0	<b>298.0</b>
4	if w > x and z > x:		True		
5	x += 1	<b>11.0</b>	?	15.0	298.0
6	y = x / 2 + 4	11.0	<b>9.5</b>	15.0	298.0
7	print(y)		It displays: 9.5		

For input value of 2

Step	Statement	x	y	w	z
1	x = float(input())	<b>2.0</b>	?	?	?
2	w = x * 3 - 15	2.0	?	<b>-9.0</b>	?
3	z = (w + 7) * (x + 4) - 10	2.0	?	-9.0	<b>-22.0</b>
4	if w > x and z > x:		False		
5	y = x / 4 + 2	2.0	<b>2.5</b>	-9.0	-22.0
6	print(y)		It displays: 2.5		

### 4. Solution

```

name1 = input("Enter team name 1: ")
name2 = input("Enter team name 2: ")
goals1 = int(input("Enter goals " + name1 + " scored: "))
goals2 = int(input("Enter goals " + name2 + " scored: "))

if goals1 > goals2:
    print("Winner:", name1)
else:
    print("Winner:", name2)

```

### 5. Solution

---

```
x = int(input())
if x % 6 == 0:
    print(x, "is a multiple of 6")
else:
    print(x, "is not a multiple of 6")
```

### 6. Solution

---

```
x = int(input())
if x % 6 == 0 or x % 7 == 0:
    print(x, "is a multiple of 6 or a multiple of 7")
else:
    print(x, "is neither a multiple of 6 nor a multiple of 7")
```

### 7. Solution

---

```
x = int(input())

y = x % 4

if y == 0:
    print(x, "is a multiple of 4")
else:
    print(x, "is not a multiple of 4")

print("The structure is:", x, "=", (x // 4), "x 4 +", y)
```

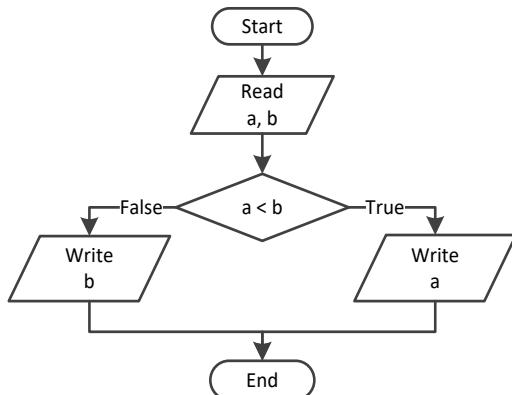
### 8. Solution

---

```
x = int(input())

if 1000 <= x <= 9999:
    print(x, "is a four-digit integer")
else:
    print(x, "is not a four-digit integer")
```

### 9. Solution



```

a = float(input())
b = float(input())

if a < b:
    print(a)
else:
    print(b)
  
```

### 10. Solution

```

a = float(input())
b = float(input())
c = float(input())

if a < b + c and b < a + c and c < a + b:
    print("Given numbers can be lengths of the three sides of a triangle")
else:
    print("Given numbers cannot be lengths of the three sides of a triangle")
  
```

### 11. Solution

```

a = float(input())
b = float(input())
c = float(input())

if a ** 2 == b ** 2 + c ** 2 or b ** 2 == a ** 2 + c ** 2 or c ** 2 == a ** 2 + b ** 2:
    print("Given numbers can be lengths of the three sides of a right triangle")
else:
    print("Given numbers cannot be lengths of the three sides of a right triangle")
  
```

### 12. Solution

```

a = float(input("Enter 1st jump in meters: "))
b = float(input("Enter 2nd jump in meters: "))
c = float(input("Enter 3rd jump in meters: "))
  
```

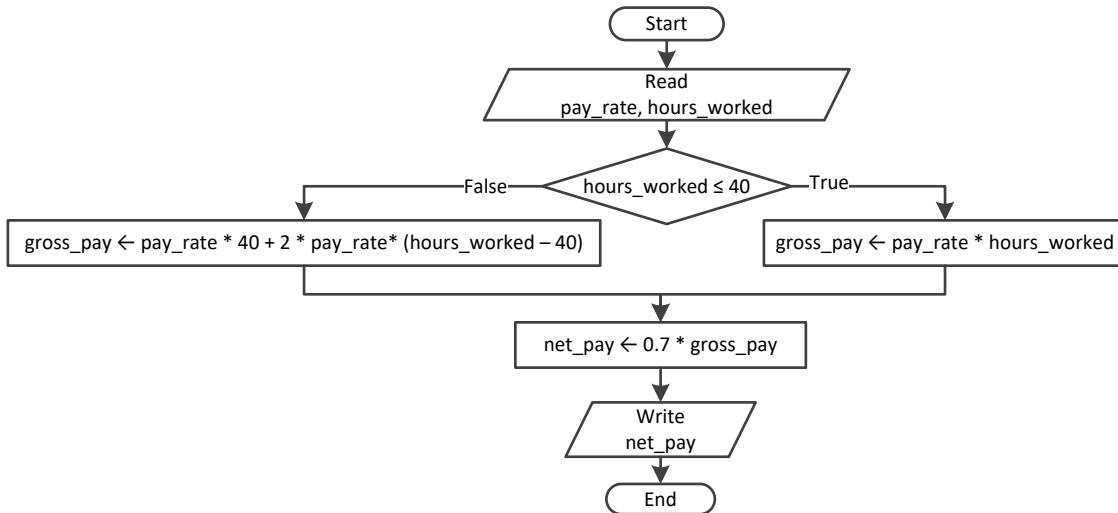
```

average = (a + b + c) / 3

if average >= 8:
    print("Qualified")
else:
    print("Disqualified")

```

### 13. Solution



```

pay_rate = float(input())
hours_worked = int(input())

if hours_worked <= 40:
    gross_pay = pay_rate * hours_worked
else:
    gross_pay = pay_rate * 40 + 2 * pay_rate * (hours_worked - 40)

net_pay = 0.7 * gross_pay
print(net_pay)

```

### 14. Solution

```

miles = int(input("Enter miles traveled: "))

r = miles % 12000

if r > 6000:
    miles_left = 12000 - r
    print("Your car needs a major service in", miles_left, "miles")
else:
    miles_left = 6000 - r
    print("Your car needs a minor service in", miles_left, "miles")

```

### 15. Solution

---

```
t = float(input("Enter the time the two cars traveled: "))
a1 = float(input("Enter the acceleration for car A: "))
a2 = float(input("Enter the acceleration for car B: "))

s1 = 0.5 * a1 * t ** 2
s2 = 0.5 * a2 * t ** 2

print("Distance between them:", abs(s1 - s2), "meters")

if s1 > s2:
    print("Car A is first")
else:
    print("Car B is first")
```

# Chapter 18

---

## 18.2 Review Questions: True/False

- |          |          |
|----------|----------|
| 1. true  | 5. false |
| 2. false | 6. true  |
| 3. false | 7. false |
| 4. false | 8. true  |

## 18.3 Review Exercises

### 1. Solution

---

For input value of 5

Step	Statement	q	b
1	q = int(input())	5	?
2	if 0 < q <= 50:		True
3	b = 1	5	1
4	print(b)		It displays: 1

For input value of 150

Step	Statement	q	b
1	q = int(input())	150	?
2	if 0 < q <= 50:		False
3	elif 50 < q <= 100:		False
4	elif 100 < q <= 200:		True
5	b = 3	150	3
6	print(b)		It displays: 3

For input value of 250

Step	Statement	q	b
1	q = int(input())	250	?
2	if 0 < q <= 50:		False
3	elif 50 < q <= 100:		False
4	elif 100 < q <= 200:		False
5	b = 4	250	4
6	print(b)		It displays: 4

For input value of -1

Step	Statement	q	b
1	q = int(input())	-1	?
2	if 0 < q <= 50:		False

<b>3</b>	elif 50 < q <= 100:	False	
<b>4</b>	elif 100 < q <= 200:	False	
<b>5</b>	b = 4	-1	<b>4</b>
<b>6</b>	print(b)	It displays: 4	

## 2. Solution

For input value of 5

Step	Statement	amount	discount	payment
<b>1</b>	amount = float(input())	<b>5.0</b>	?	?
<b>2</b>	discount = 0	5.0	<b>0</b>	?
<b>3</b>	if amount < 20:	True		
<b>4</b>	discount = 0	5.0	<b>0</b>	?
<b>5</b>	payment = amount - amount * discount / 100	5.0	0	<b>5.0</b>
<b>6</b>	print(discount, ", ", payment)	It displays: 0, 5.0		

For input value of 150

Step	Statement	amount	discount	payment
<b>1</b>	amount = float(input())	<b>150.0</b>	?	?
<b>2</b>	discount = 0	150.0	<b>0</b>	?
<b>3</b>	if amount < 20:	False		
<b>4</b>	elif 20 <= amount < 60:	False		
<b>5</b>	elif 60 <= amount < 100:	False		
<b>6</b>	elif amount >= 100:	True		
<b>7</b>	discount = 15	150.0	<b>15</b>	?
<b>8</b>	payment = amount - amount * discount / 100	150.0	15	<b>127.5</b>
<b>9</b>	print(discount, ", ", payment)	It displays: 15, 127.5		

For input value of -1

Step	Statement	amount	discount	payment
<b>1</b>	amount = float(input())	<b>-1.0</b>	?	?
<b>2</b>	discount = 0	-1.0	<b>0</b>	?
<b>3</b>	if amount < 20:	True		
<b>4</b>	discount = 0	-1.0	<b>0</b>	?
<b>5</b>	payment = amount - amount * discount / 100	-1.0	0	<b>-1.0</b>
<b>6</b>	print(discount, ", ", payment)	It displays: 0, -1.0		

### 3. Solution

---

For input value of 1

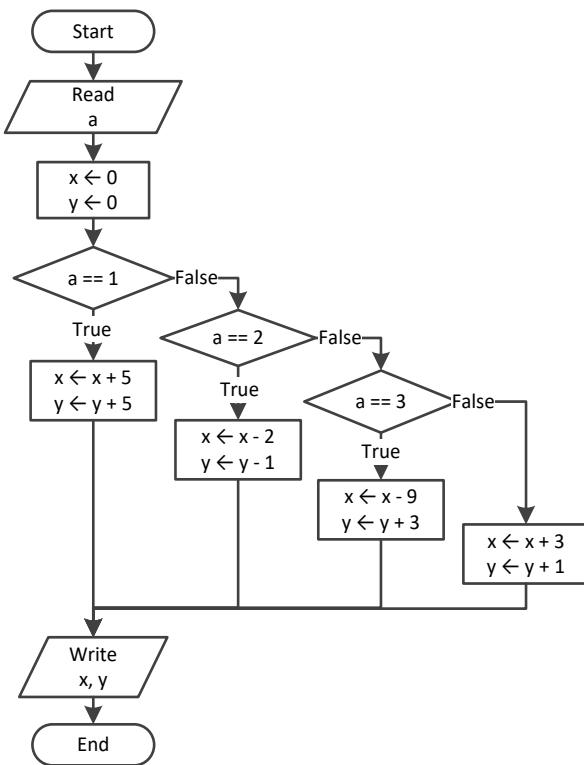
Step	Statement	a	x	y
1	a = int(input())	1	?	?
2	x = 0	1	0	?
3	y = 0	1	0	0
4	if a == 1:		True	
5	x = x + 5	1	5	0
6	y = y + 5	1	5	5
7	print(x, ", ", y)		It displays: 5, 5	

For input value of 3

Step	Statement	a	x	y
1	a = int(input())	3	?	?
2	x = 0	3	0	?
3	y = 0	3	0	0
4	if a == 1:		False	
5	elif a == 2:		False	
6	elif a == 3:		True	
7	x = x - 9	3	-9	0
8	y = y + 3	3	-9	3
9	print(x, ", ", y)		It displays: -9, 3	

For input value of 250

Step	Statement	a	x	y
1	a = int(input())	250	?	?
2	x = 0	250	0	?
3	y = 0	250	0	0
4	if a == 1:		False	
5	elif a == 2:		False	
6	elif a == 3:		False	
7	x = x + 3	250	3	0
8	y += 1	250	3	1
9	print(x, ", ", y)		It displays: 3, 1	



#### 4. Solution

For input values of 10, 2, 5

Step	Statement	a	x	y
1	a = int(input())	10	?	?
2	x = int(input())	10	2	?
3	y = float(input())	10	2	5.0
4	if a == 10:		True	
5	x = x % 2	10	0	5.0
6	y = y ** 2	10	0	25.0
7	print(x, ", ", y)	It displays: 0, 25.0		

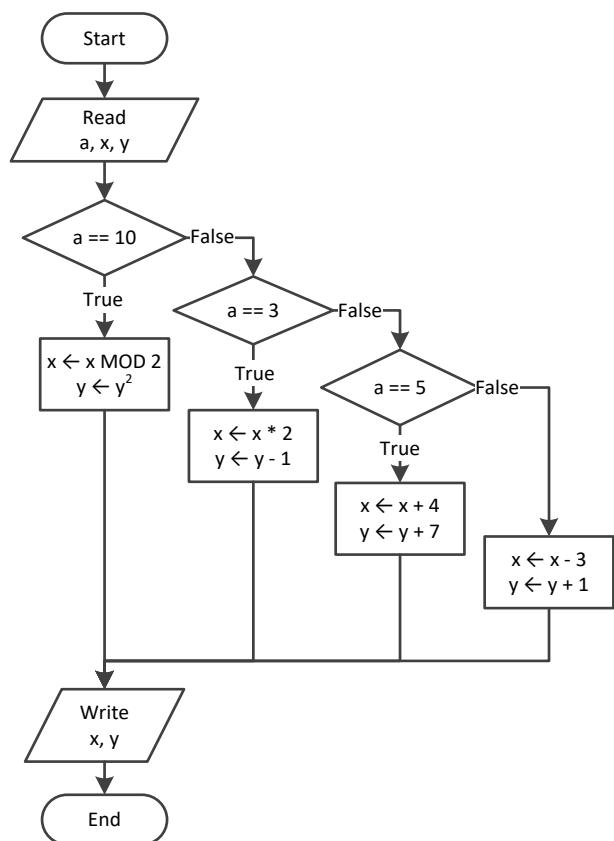
For input values of 5, 2, 3

Step	Statement	a	x	y
1	a = int(input())	5	?	?
2	x = int(input())	5	2	?
3	y = float(input())	5	2	3.0
4	if a == 10:		False	
5	elif a == 3:		False	
6	elif a == 5:		True	

<b>7</b>	<code>x = x + 4</code>	5	<b>6</b>	3.0
<b>8</b>	<code>y += 7</code>	5	6	<b>10.0</b>
<b>9</b>	<code>print(x, ", ", y)</code>	It displays: 6, 10.0		

For input values of 4, 6, 2

Step	Statement	a	x	y
<b>1</b>	<code>a = int(input())</code>	<b>4</b>	?	?
<b>2</b>	<code>x = int(input())</code>	4	<b>6</b>	?
<b>3</b>	<code>y = float(input())</code>	4	6	<b>2.0</b>
<b>4</b>	<code>if a == 10:</code>			False
<b>5</b>	<code>elif a == 3:</code>			False
<b>6</b>	<code>elif a == 5:</code>			False
<b>7</b>	<code>x -= 3</code>	4	<b>3</b>	2.0
<b>8</b>	<code>y += 1</code>	4	3	<b>3.0</b>
<b>9</b>	<code>print(x, ", ", y)</code>	It displays: 3, 3.0		



## 5. Solution

```

a = float(input())
if a < 1:
    y = 5 + a
  
```

```
    print(y)
elif a < 5:
    y = 23 / a
    print(y)
elif a < 10:
    y = 5 * a
    print(y)
else:
    print("Error!")
```

## 6. Solution

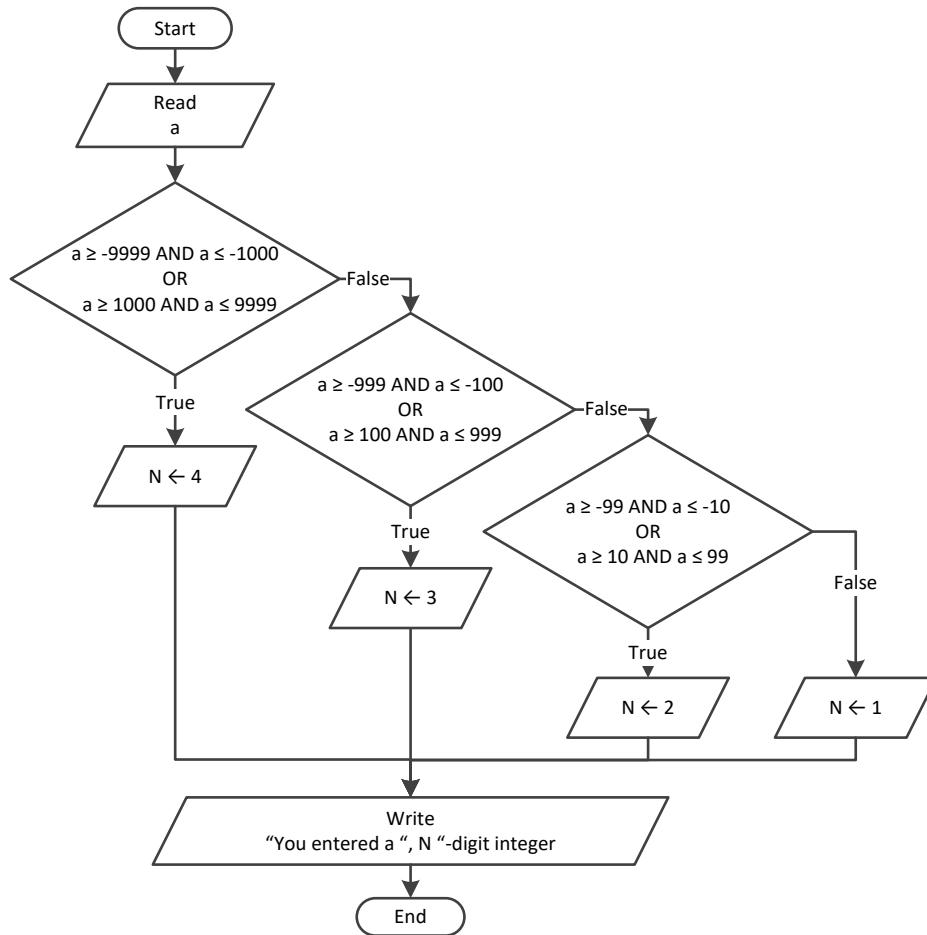
---

```
name1 = input("Enter team name 1: ")
name2 = input("Enter team name 2: ")
goals1 = int(input("Enter goals " + name1 + " scored: "))
goals2 = int(input("Enter goals " + name2 + " scored: "))

if goals1 > goals2:
    print("Winner:", name1)
elif goals2 > goals1:
    print("Winner:", name2)
else:
    print("It's a tie!")
```

## 7. Solution

### First approach



```

a = int(input())

if -9999 <= a <= -1000 or 1000 <= a <= 9999:
    n = 4
elif -999 <= a <= -100 or 100 <= a <= 999:
    n = 3
elif -99 <= a <= -10 or 10 <= a <= 99:
    n = 2
else:
    n = 1

print("You entered a ", n, "-digit integer", sep="")
  
```

### Second approach

```

a = int(input())
a_string = str(abs(a))
print("You entered a ", len(a_string), "-digit integer", sep="")
  
```

## 8. Solution

---

### First approach

```
a = int(input())

if -9999 <= a <= -1000 or 1000 <= a <= 9999:
    print("You entered a 4-digit integer", sep = "")
elif -999 <= a <= -100 or 100 <= a <= 999:
    print("You entered a 3-digit integer", sep = "")
elif -99 <= a <= -10 or 10 <= a <= 99:
    print("You entered a 2-digit integer", sep = "")
elif -9 <= a <= 9: #Include the value of zero
    print("You entered a 1-digit integer", sep = "")
else:
    print("Error: Invalid value!")
```

### Second approach

```
a = int(input())

if -9999 <= a <= 9999:
    a_string = str(abs(a))
    print("You entered a ", len(a_string), "-digit integer", sep = "")
else:
    print("Error: Invalid value!")
```

## 9. Solution

---

```
print("1. Convert USD to Euro (EUR)")
print("2. Convert USD to British Pound Sterling (GBP)")
print("3. Convert USD to Japanese Yen (JPY)")
print("4. Convert USD to Canadian Dollar (CAD)")
ch = int(input("Enter a choice: "))

usd = float(input("Enter an amount in US dollars: "))

if ch == 1:
    eur = usd * 0.87
    print("$", usd, " = ", eur, " EUR", sep = "")
elif ch == 2:
    gbp = usd * 0.78
    print("$", usd, " = ", gbp, " GBP", sep = "")
elif ch == 3:
    jpy = usd * 108.55
    print("$", usd, " = ", jpy, " JPY", sep = "")
else:
    cad = usd * 1.33
    print("$", usd, " = ", cad, " CAD", sep = "")
```

### 10. Solution

---

```
m = int(input("Enter the number of a month between 1 and 12: "))

if m <= 2 or m == 12:
    print("Winter")
elif m <= 5:
    print("Spring")
elif m <= 8:
    print("Summer")
else:
    print("Fall (Autumn)")
```

### 11. Solution

---

```
m = int(input("Enter the number of a month between 1 and 12: "))

if m < 1 or m > 12:
    print("Error: Invalid value!")
elif m <= 2 or m == 12:
    print("Winter")
elif m <= 5:
    print("Spring")
elif m <= 8:
    print("Summer")
else:
    print("Fall (Autumn)")
```

### 12. Solution

---

```
name = input("Enter the name of a month: ")

if name == "January":
    print(1)
elif name == "February":
    print(2)
elif name == "March":
    print(3)
elif name == "April":
    print(4)
elif name == "May":
    print(5)
elif name == "June":
    print(6)
elif name == "July":
    print(7)
elif name == "August":
    print(8)
elif name == "September":
```

```
    print(9)
elif name == "October":
    print(10)
elif name == "November":
    print(11)
elif name == "December":
    print(12)
else:
    print("Error")
```

### 13. Solution

---

```
n = float(input("Enter a number between 1.0 and 4.9: "))

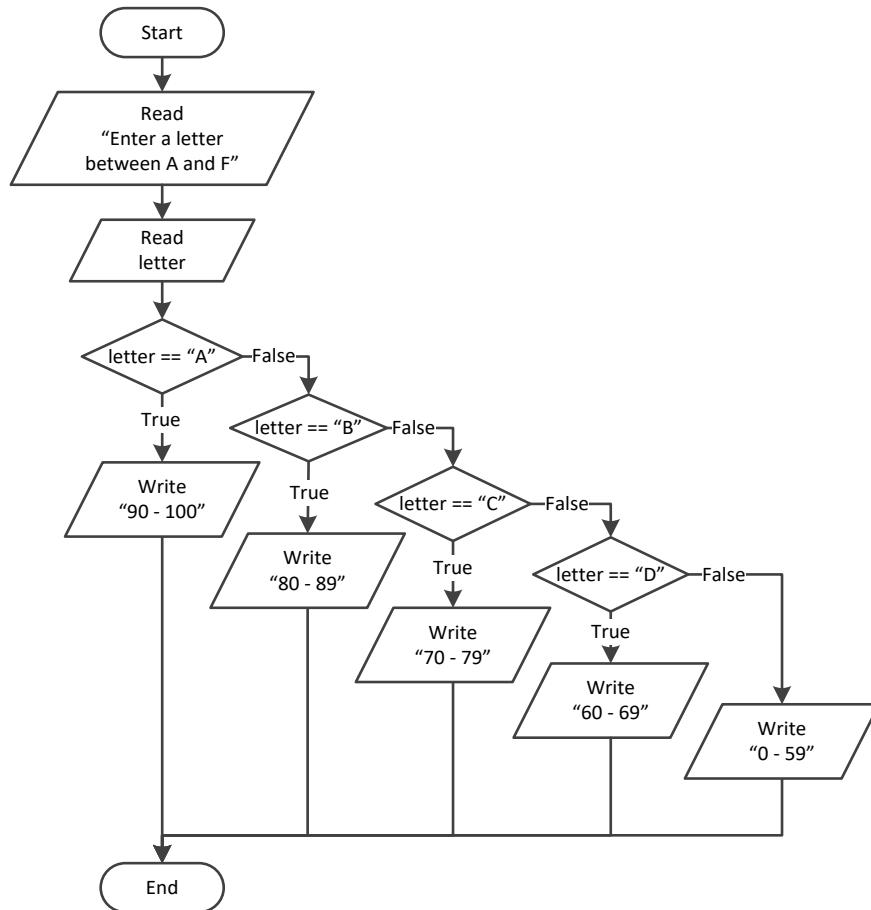
x = int(n)
y = int(n * 10) % 10

if x == 1:
    print("One", end = "")
elif x == 2:
    print("Two", end = "")
elif x == 3:
    print("Three", end = "")
elif x == 4:
    print("Four", end = "")

print(" point ", end = "")

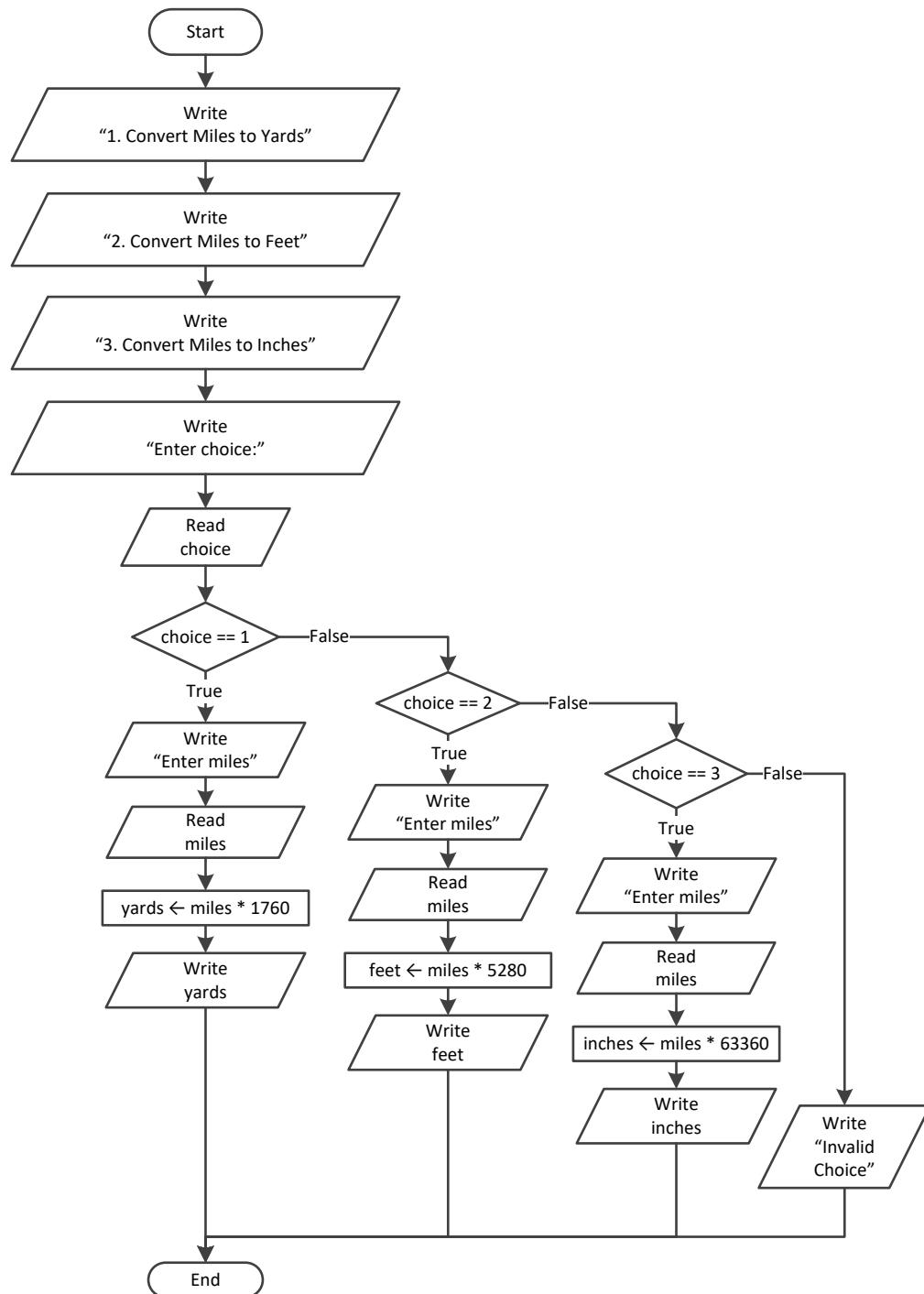
if y == 1:
    print("one")
elif y == 2:
    print("two")
elif y == 3:
    print("three")
elif y == 4:
    print("four")
elif y == 5:
    print("five")
elif y == 6:
    print("six")
elif y == 7:
    print("seven")
elif y == 8:
    print("eight")
elif y == 9:
    print("nine")
elif y == 0:
    print("zero")
```

#### 14. Solution



```
letter = input("Enter a letter between A and F: ")

if letter == "A":
    print("90 - 100")
elif letter == "B":
    print("80 - 89")
elif letter == "C":
    print("70 - 79")
elif letter == "D":
    print("60 - 69")
else:
    print("0 - 59")
```

**15. Solution**

```
print("1. Convert Miles to Yards")
print("2. Convert Miles to Feet")
print("3. Convert Miles to Inches")

choice = int(input("Enter a choice: "))
```

```
if choice == 1:  
    miles = float(input("Enter miles: "))  
    yards = miles * 1760  
    print(miles, "miles =", yards, "yards")  
elif choice == 2:  
    miles = float(input("Enter miles: "))  
    feet = miles * 5280  
    print(miles, "miles =", feet, "feet")  
elif choice == 3:  
    miles = float(input("Enter miles: "))  
    inches = miles * 63360  
    print(miles, "miles =", inches, "inches")  
else:  
    print("Invalid choice!")
```

## 16. Solution

---

```
roman = input("Enter a Roman numeral between I and X: ")  
  
if roman == "I":  
    print(1)  
elif roman == "II":  
    print(2)  
elif roman == "III":  
    print(3)  
elif roman == "IV":  
    print(4)  
elif roman == "V":  
    print(5)  
elif roman == "VI":  
    print(6)  
elif roman == "VII":  
    print(7)  
elif roman == "VIII":  
    print(8)  
elif roman == "IX":  
    print(9)  
elif roman == "X":  
    print(10)  
else:  
    print("Error")
```

## 17. Solution

---

```
total = int(input("Enter the total number of CDs purchased in a month: "))  
  
if total == 1:  
    print("You are awarded 3 points")  
elif total == 2:  
    print("You are awarded 10 points")
```

```
elif total == 3:  
    print("You are awarded 20 points")  
else:  
    print("You are awarded 45 points")
```

### 18. Solution

---

```
import random  
  
name = input("Enter your name: ")  
  
i = random.randrange(3)  
  
if i == 0:  
    print("Good morning", name)  
elif i == 1:  
    print("Good evening", name)  
elif i == 2:  
    print("Good night", name)
```

### 19. Solution

---

```
num = input()  
  
if num == "zero":  
    print(0)  
elif num == "one":  
    print(1)  
elif num == "two":  
    print(2)  
elif num == "three":  
    print(3)  
elif num == "four":  
    print(4)  
elif num == "five":  
    print(5)  
elif num == "six":  
    print(6)  
elif num == "seven":  
    print(7)  
elif num == "eight":  
    print(8)  
elif num == "nine":  
    print(9)  
else:  
    print("I don't know this number!")
```

### 20. Solution

---

```
b = int(input("Enter Beaufort number: "))
```

```
if b == 0:
    print("Calm")
elif b == 1:
    print("Light Air")
elif b == 2:
    print("Light breeze")
elif b == 3:
    print("Gentle breeze")
elif b == 4:
    print("Moderate breeze")
elif b == 5:
    print("Fresh breeze")
elif b == 6:
    print("Strong breeze")
elif b == 7:
    print("Moderate gale")
elif b == 8:
    print("Gale")
elif b == 9:
    print("Strong gale")
elif b == 10:
    print("Storm")
elif b == 11:
    print("Violent storm")
elif b == 12:
    print("Hurricane force")
else:
    print("Invalid Beaufort number!")
```

# Chapter 19

---

## 19.3 Review Questions: True/False

- |          |          |
|----------|----------|
| 1. true  | 4. false |
| 2. true  | 5. true  |
| 3. false |          |

## 19.4 Review Exercises

### 1. Solution

---

For input values of 20, 1

Step	Statement	x	y
1	x = int(input())	<b>20</b>	?
2	y = int(input())	20	<b>1</b>
3	if x < 30:		True
4	if y == 1:		True
5	x = x % 3	<b>2</b>	1
6	y = 5	2	<b>5</b>
7	print(x, ", ", y)	It displays: 2, 5	

For input values of 20, 3

Step	Statement	x	y
1	x = int(input())	<b>20</b>	?
2	y = int(input())	20	<b>3</b>
3	if x < 30:		True
4	if y == 1:		False
5	elif y == 2:		False
6	elif y == 3:		True
7	x = x + 5	<b>25</b>	3
8	y += 3	25	<b>6</b>
9	print(x, ", ", y)	It displays: 25, 6	

For input values of 12, 8

Step	Statement	x	y
1	x = int(input())	<b>12</b>	?
2	y = int(input())	12	<b>8</b>
3	if x < 30:		True
4	if y == 1:		False
5	elif y == 2:		False

<b>6</b>	elif y == 3:	False	
<b>7</b>	x -= 2	<b>10</b>	8
<b>8</b>	y += 1	10	<b>9</b>
<b>9</b>	print(x, ", ", y)	It displays: 10, 9	

For input values of 50, 0

Step	Statement	x	y
<b>1</b>	x = int(input())	<b>50</b>	?
<b>2</b>	y = int(input())	50	<b>0</b>
<b>3</b>	if x < 30:	False	
<b>4</b>	y += 1	50	<b>1</b>
<b>5</b>	print(x, ", ", y)	It displays: 50, 1	

## 2. Solution

---

For input values of 60, 25

Step	Statement	x	y
<b>1</b>	x = int(input())	<b>60</b>	?
<b>2</b>	y = int(input())	60	25
<b>3</b>	if (x + y) / 2 <= 20:	False	
<b>4</b>	if y < 15:	False	
<b>5</b>	elif y < 23:	False	
<b>6</b>	x = 2 * x + 5	<b>125</b>	25
<b>7</b>	y += 1	125	<b>26</b>
<b>8</b>	print(x, ", ", y)	It displays: 125, 26	

For input values of 50, 8

Step	Statement	x	y
<b>1</b>	x = int(input())	<b>50</b>	?
<b>2</b>	y = int(input())	50	8
<b>3</b>	if (x + y) / 2 <= 20:	False	
<b>4</b>	if y < 15:	True	
<b>5</b>	x = x % 4	<b>2</b>	8
<b>6</b>	y = 2	2	<b>2</b>
<b>7</b>	print(x, ", ", y)	It displays: 2, 2	

For input values of 20, 15

Step	Statement	x	y
<b>1</b>	x = int(input())	<b>20</b>	?
<b>2</b>	y = int(input())	20	15

<b>3</b>	if (x + y) / 2 <= 20:	True	
<b>4</b>	if y < 10:	False	
<b>5</b>	elif y < 20:	True	
<b>6</b>	x = x * 5	<b>100</b>	15
<b>7</b>	y += 2	100	<b>17</b>
<b>8</b>	print(x, ", ", y)	It displays: 100, 17	

For input values of 10, 30

Step	Statement	x	y
<b>1</b>	x = int(input())	<b>10</b>	?
<b>2</b>	y = int(input())	10	30
<b>3</b>	if (x + y) / 2 <= 20:	True	
<b>4</b>	if y < 10:	False	
<b>5</b>	elif y < 20:	False	
<b>6</b>	x = x - 2	<b>8</b>	30
<b>7</b>	y += 3	8	<b>33</b>
<b>8</b>	print(x, ", ", y)	It displays: 8, 33	

### 3. Solution

```
a = int(input())
if a > 1000:
    print("Big Positive")
else:
    if a > 0:
        print("Positive")
    else:
        if a < -1000:
            print("Big Negative")
        else:
            if a < 0:
                print("Negative")
            else:
                print("Zero")
```

### 4. Solution

```
print("Enter the three sides of a triangle: ")
a = float(input())
b = float(input())
c = float(input())

if a >= b + c or b >= a + c or c >= a + b:
    print("Given numbers cannot be lengths of the three sides of a triangle")
else:
```

```

if a == b and b == c:
    print("Equilateral")
elif a ** 2 == b ** 2 + c ** 2 or b ** 2 == a ** 2 + c ** 2 or c ** 2 == a ** 2 + b ** 2:
    print("Right (or right-angled)")
else:
    print("not special")

```

## 5. Solution

---

```

pin = int(input("Enter your four-digit PIN : "))
if pin != 1234:
    pin = int(input("Wrong PIN. Enter your four-digit PIN : "))
    if pin != 1234:
        pin = int(input("Wrong PIN. Enter your four-digit PIN : "))

if pin != 1234:
    print("PIN locked!")
else:
    amount = int(input("Enter the amount of money (an integer value) that you want to withdraw: "))
    usd10 = amount // 10
    r = amount % 10
    usd5 = r // 5
    usd1 = r % 5
    print(usd10, "note(s) of $10", usd5, "note(s) of $5", "and", usd1, "note(s) of $1")

```

## 6. Solution

---

### First approach

```

t = float(input("Enter temperature (in Fahrenheit): "))
w = float(input("Enter wind speed (in miles/hour): "))

if t > 75:
    if w > 12:
        print("The day is hot and windy")
    else:
        print("The day is hot and not windy")
else:
    if w > 12:
        print("The day is cold and windy")
    else:
        print("The day is cold and not windy")

```

### Second approach

```

t = float(input("Enter temperature (in Fahrenheit): "))
w = float(input("Enter wind speed (in miles/hour): "))

if t > 75:
    message1 = "hot"
else:
    message1 = "cold"

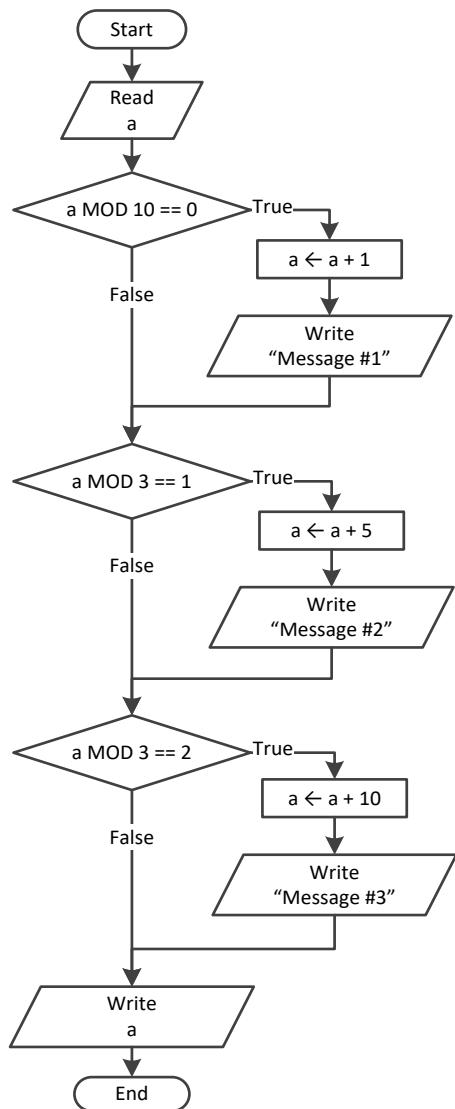
```

```
if w > 12:  
    message2 = "windy"  
else:  
    message2 = "not windy"  
  
print("The day is", message1, "and", message2)
```

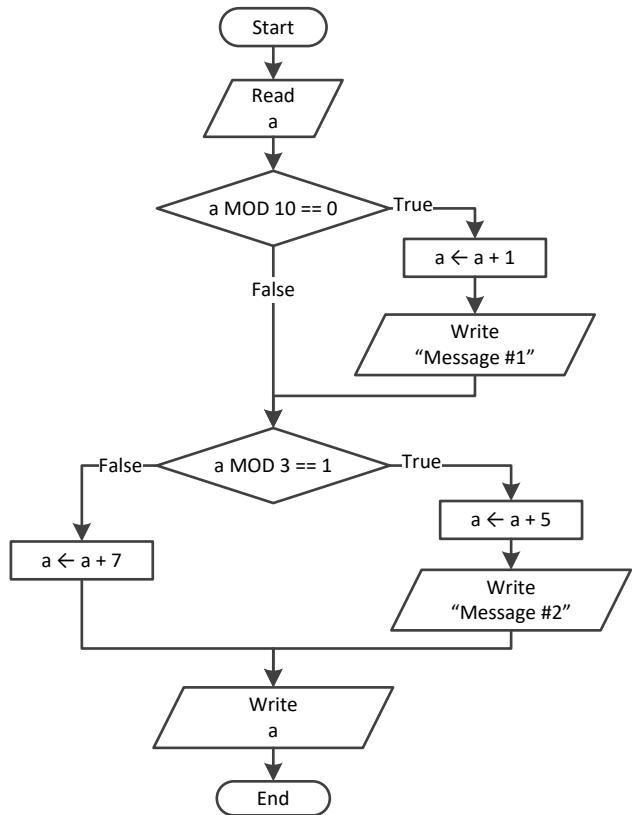
# Chapter 20

## 20.4 Review Exercises

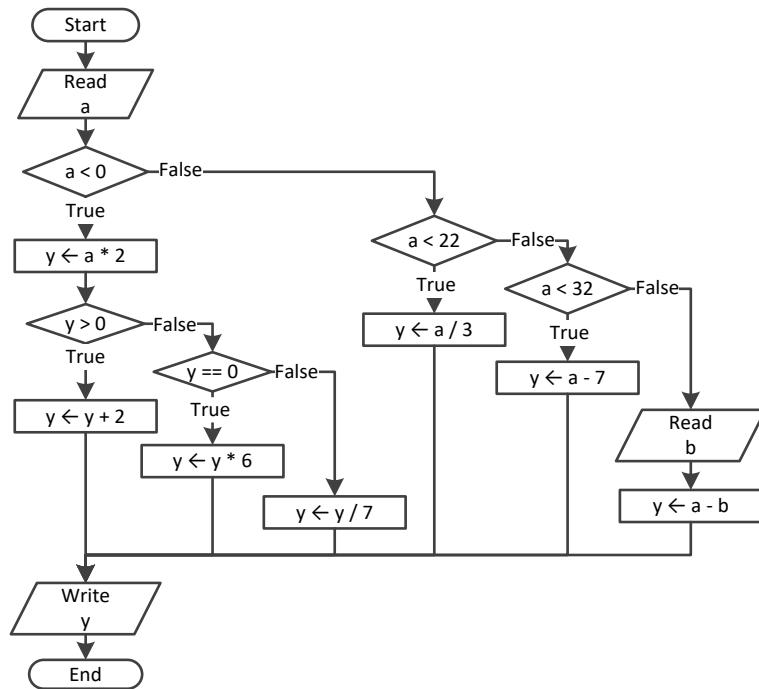
### 1. Solution



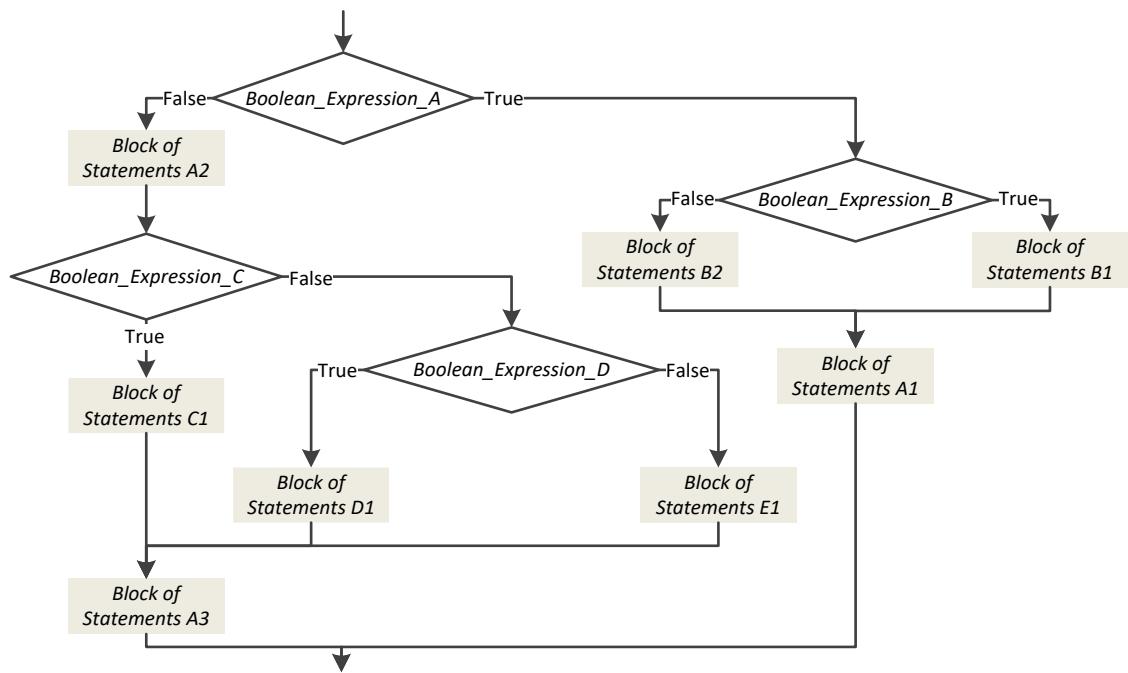
## 2. Solution



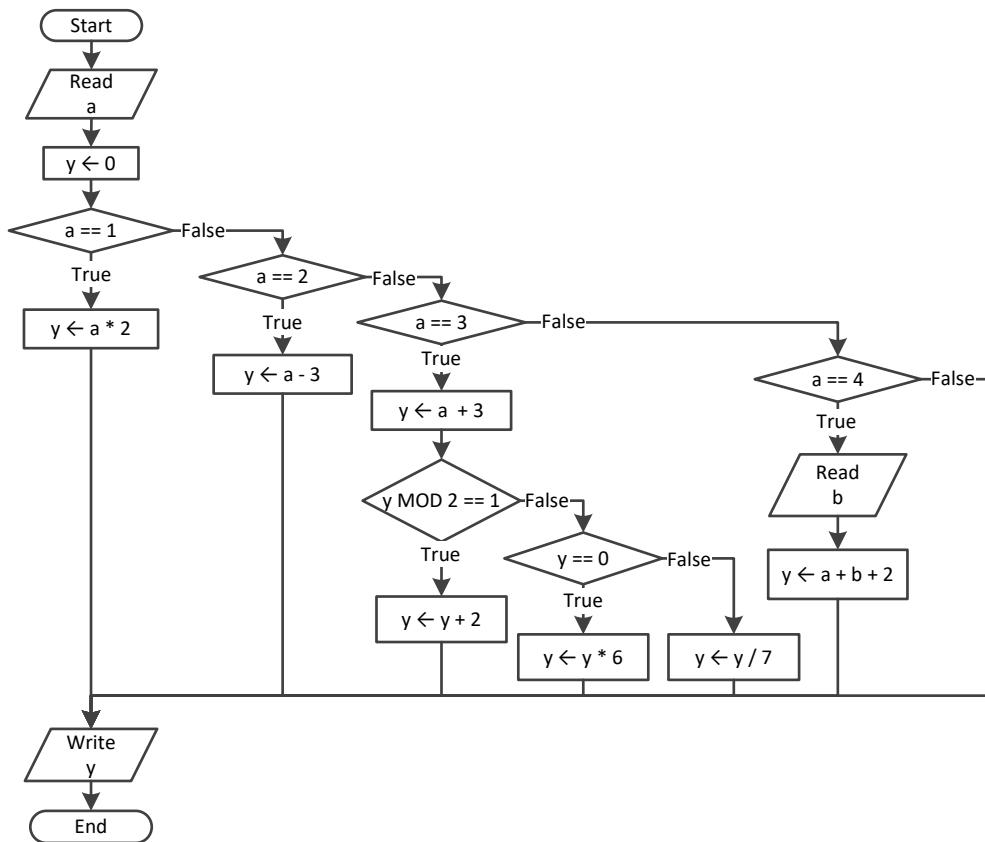
## 3. Solution



#### 4. Solution



## 5. Solution



## 6. Solution

```

x = float(input())
y = float(input())

if x != 100 or y <= 10:
    z = float(input())
    if z <= x + y:
        x -= 3
        y = x + 4
print(x, y)
  
```

## 7. Solution

```

x = int(input())

if x == 1:
    print("Good Morning")
    print("How Do you do?")
    print("Is everything okay?")
elif x == 2:
    print("Good Evening")
  
```

```

print("How Do you do?")
print("Is everything okay?")
elif x == 3:
    print("Good Afternoon")
    print("Is everything okay?")
else:
    print("Good Night")

```

### 8. Solution

---

```

a = int(input())
b = int(input())

c = a % 2
d = b // 5

if a >= b:
    y = 1
elif d > c and a > 2:
    y = 2
elif d * c > a / b:
    if d * c > 10:
        y = 4
    else:
        y = 3
else:
    y = 5

print(y)

```

### 9. Solution

---

```

x = int(input())
if x > 0:
    if x % 10 == 0:
        print("Last digit equal to 0")
    elif x % 10 == 1:
        print("Last digit equal to 1")
    else:
        print("None")
else:
    if x == -1:
        print("Bye")
    else:
        print("Invalid Number")

```

### 10. Solution

---

```

a = float(input())
b = float(input())

```

```
y = a * b

if y > 0:
    y -= 1
    y /= 2
else:
    y +=10
    if y > 0:
        y /= 2
    else:
        y *= 2
```

### 11. Solution

---

```
a = float(input())
b = float(input())
c = float(input())

c = a * b + c
if c > 0:
    c /= 2
    if a > b:
        a *= 2
        b *= 2
    else:
        c /= 20
        if c <= 10:
            b *= 2
else:
    c /= 3
    c /= 20
    if c <= 10:
        b *= 2
print(a, b, c)
```

# Chapter 21

---

## 21.8 Review Questions: True/False

- |          |          |
|----------|----------|
| 1. false | 4. true  |
| 2. true  | 5. true  |
| 3. false | 6. false |

## 21.9 Review Questions: Multiple Choice

- |      |      |
|------|------|
| 1. a | 3. a |
| 2. b |      |

## 21.10 Review Exercises

### 1. Solution

---

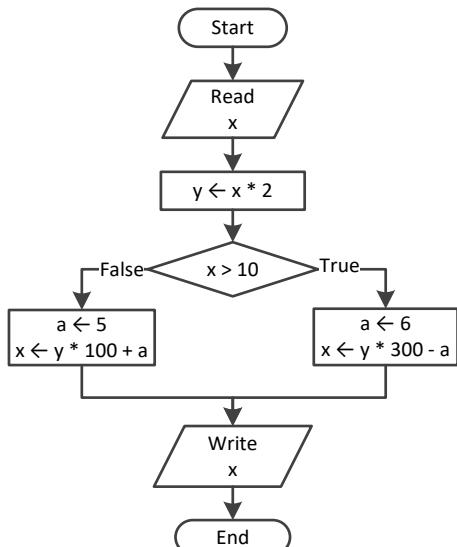
```
y = int(input())
x = int(input())

if y > 0:
    a = x * 4 * y + 1
else:
    a = x * 2 * y + 6

print(y)
print(a)
```

### 2. Solution

---



### 3. Solution

---

```
a = float(input())
```

```

if a >= 10:
    print("Error!")
else:
    if a < 1:
        y = 5 + a
    elif a < 5:
        y = 23 / a
    else:
        y = 5 * a
    print(y)

```

#### 4. Solution

---

```

day = int(input())
month = int(input())
name = input()

if day == 16 and month == 2 and name == "Loukia":
    print("Happy Birthday!!!!")
else:
    print("No match!")

```

#### 5. Solution

---

It does not operate the same way when variable `a` is less than or equal to 10. The correct program is

```

a = float(input())
b = float(input())
c = float(input())

if a > 10:
    if c < 2000:
        d = (a + b + c) / 12
        print("The result is:", d)
    else:
        print("Error!")
else:
    print("Error!")

```

#### 6. Solution

---

```

a = float(input())
b = float(input())
c = float(input())

if a > 10 and b < 2000 and c != 10:
    d = (a + b + c) / 12
    print("The result is:", d)

if a <= 10:
    print("Error!")

```

## 7. Solution

---

```
a = int(input())
b = int(input())

y = 3
if a > 0:
    y = y * a
    print("Hello Zeus")

print(y, b)
```

## 8. Solution

---

```
a = float(input())
b = float(input())

y = 0
if a > 0:
    y = y + 7
else:
    print("Hello Zeus")
    print(abs(a))
print(y)
```

## 9. Solution

---

```
os = input("What is your tablet's OS? ")

if os == "iOS":
    print("Apple")
elif os == "Android":
    print("Google")
elif os == "Windows":
    print("Microsoft")
```

# Chapter 22

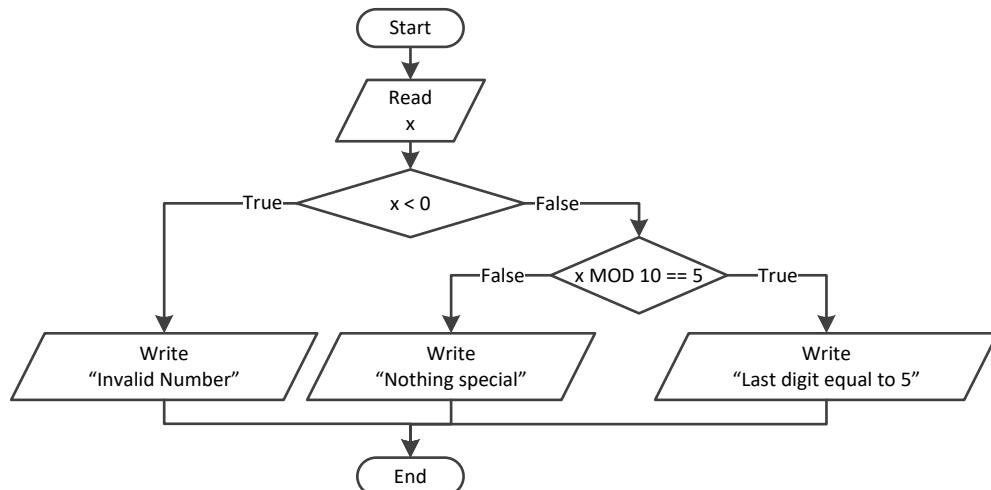
## 22.6 Review Exercises

### 1. Solution

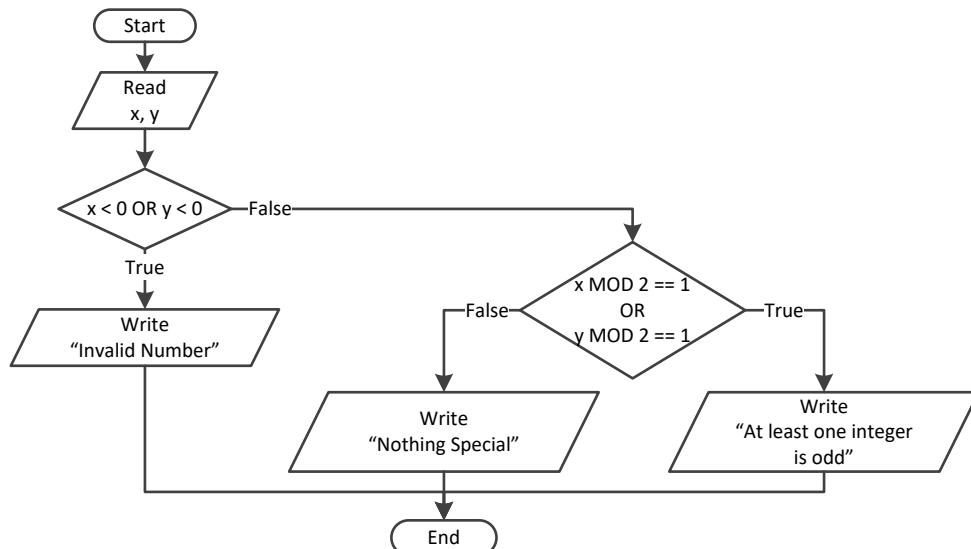
```
import math

x = float(input("Enter a non-negative number: "))
if x < 0:
    print("Error! You entered a negative value")
else:
    print("The square root of", x, "is", math.sqrt(x))
```

### 2. Solution



### 3. Solution

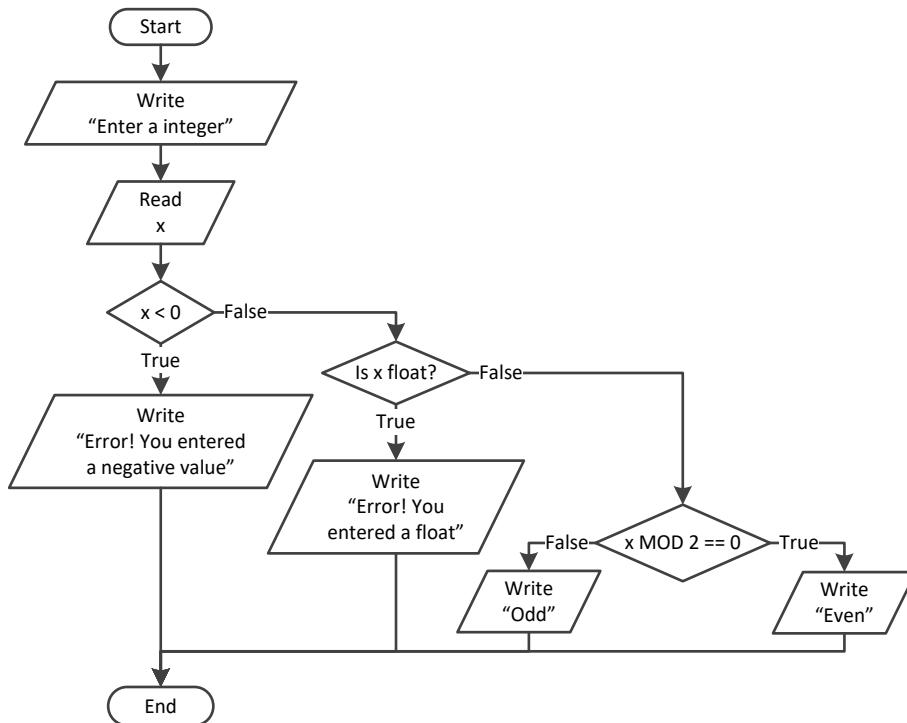


```

x = int(input())
y = int(input())
if x < 0 or y < 0:
    print("Invalid Number")
else:
    if x % 2 == 1 or y % 2 == 1:
        print("At least one integer is odd")
    else:
        print("Nothing Special")

```

#### 4. Solution

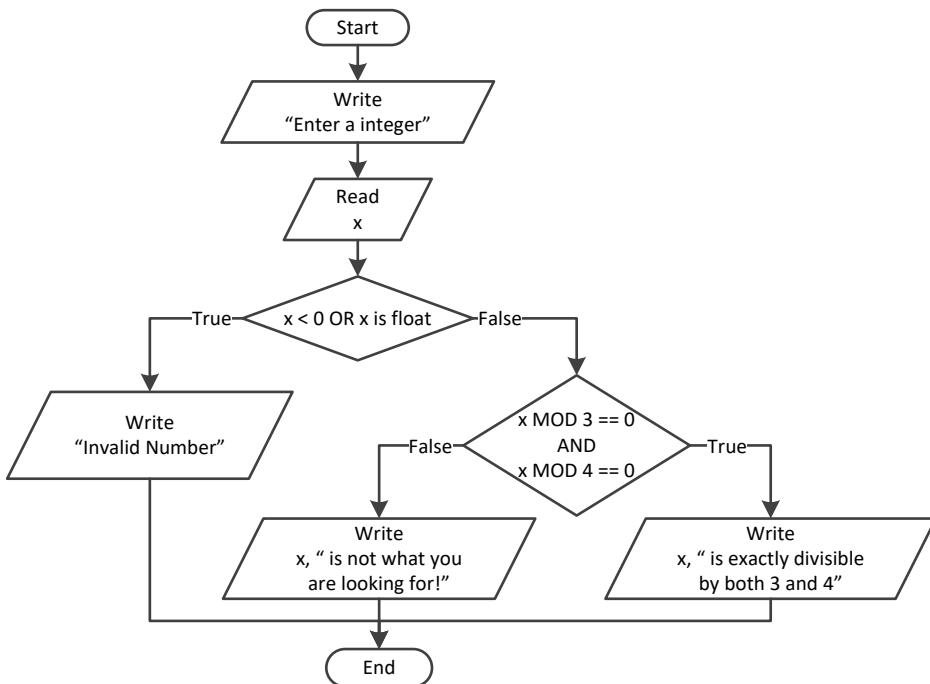


```

x = float(input("Enter a non-negative number: "))
if x < 0:
    print("Error! You entered a negative value")
elif x != int(x):
    print("Error! You entered a float")
elif x % 2 == 0:
    print("Even")
else:
    print("Odd")

```

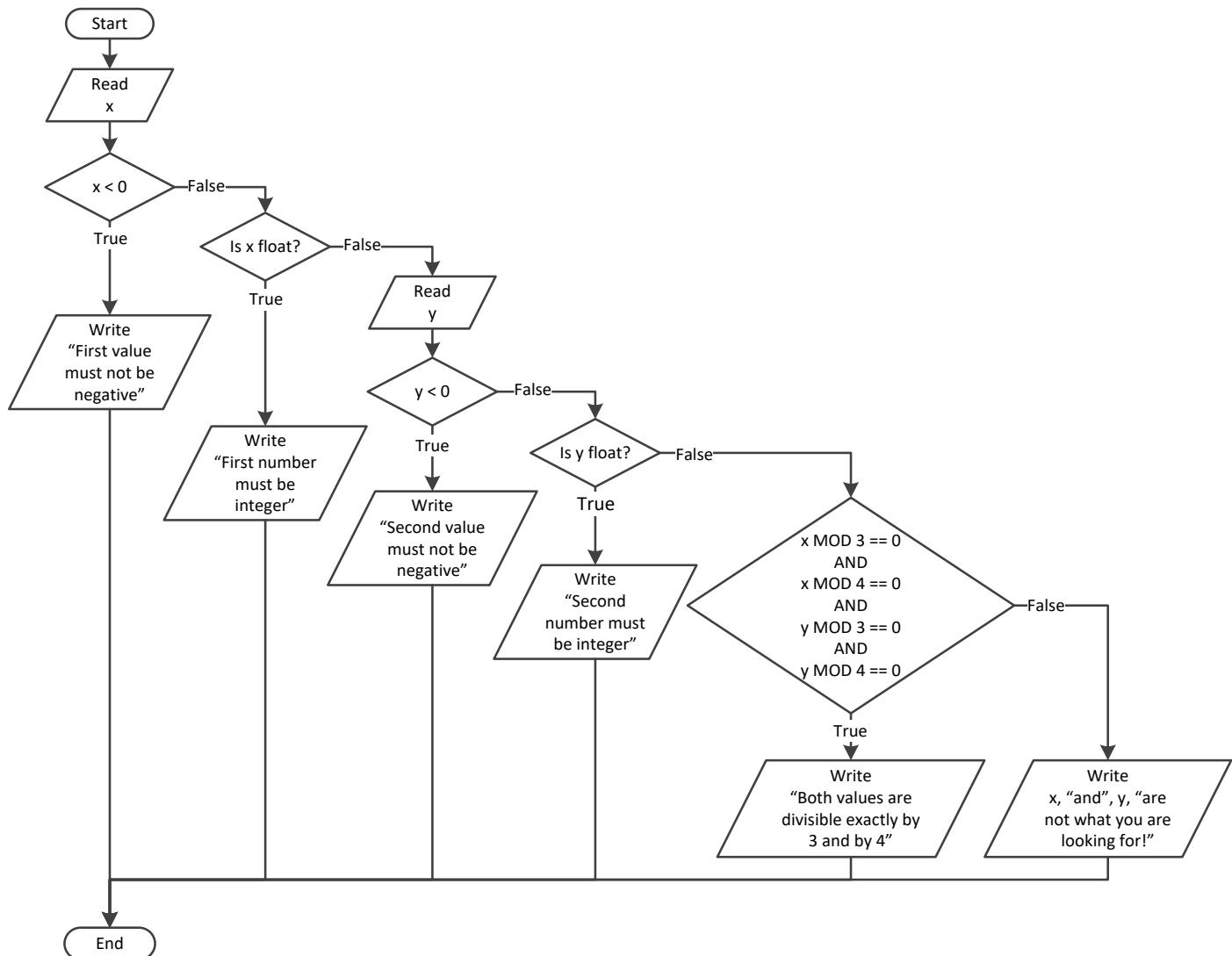
## 5. Solution



```
x = float(input("Enter an integer: "))

if x < 0 or x != int(x):
    print("Invalid Number")
elif x % 3 == 0 and x % 4 == 0:
    print(x, "is exactly divisible by both 3 and 4")
else:
    print(x, "is not what you are looking for!")
```

## 6. Solution



```

x = float(input())
if x < 0:
    print("First value must be not be negative")
else:
    if x != int(x):
        print("First number must be integer")
    else:
        y = float(input())
        if y < 0:
            print("Second value must be not be negative")
        else:
            if y != int(y):
                print("Second number must be integer")
            else:
                if x % 3 == 0 and x % 4 == 0 and y % 3 == 0 and y % 4 == 0:
                    print("Both values are divisible exactly by 3 and by 4")
                else:
                    print("x, \"and\", y, \"are not what you are looking for!\"")
  
```

```
        print("Both values are divisible exactly by 3 and by 4")
    else:
        print("nothing Special")
```

## 7. Solution

---

```
print("1. Convert Kelvin to Fahrenheit")
print("2. Convert Fahrenheit to Kelvin")
print("3. Convert Fahrenheit to Celsius")
print("4. Convert Celsius to Fahrenheit")

choice = int(input("Enter a choice: "))
t = float(input("Enter a temperature: "))

if choice < 1 or choice > 4:
    print("Wrong choice")
elif choice == 1:
    if t < 0: #Absolute zero in Kelvin
        print("Wrong temperature")
    else:
        print(1.8 * t - 459.67)
elif choice == 2:
    if t < -459.67: #Absolute zero in Fahrenheit
        print("Wrong temperature")
    else:
        print((t + 459.57) / 1.8)
elif choice == 3:
    if t < -459.67: #Absolute zero in Fahrenheit
        print("Wrong temperature")
    else:
        print(5 / 9 * (t - 32))
elif choice == 4:
    if t < -273.15: #Absolute zero in Celcius
        print("Wrong temperature")
    else:
        print(9 / 5 * t + 32)
```

## 8. Solution

---

```
a = int(input("Enter 1st integer: "))
op = input("Enter type of operation: ")
b = int(input("Enter 2nd integer: "))

if op == "+":
    print(a, b)
elif op == "-":
    print(a - b)
elif op == "*":
    print(a * b)
elif op == "/":
```

```
if b == 0:
    print("Error: Division by zero")
else:
    print(a / b)
elif op == "DIV":
    if b == 0:
        print("Error: Division by zero")
    else:
        print(a // b)
elif op == "MOD":
    if b == 0:
        print("Error: Division by zero")
    else:
        print(a % b)
elif op == "POWER":
    print(a ** b)
```

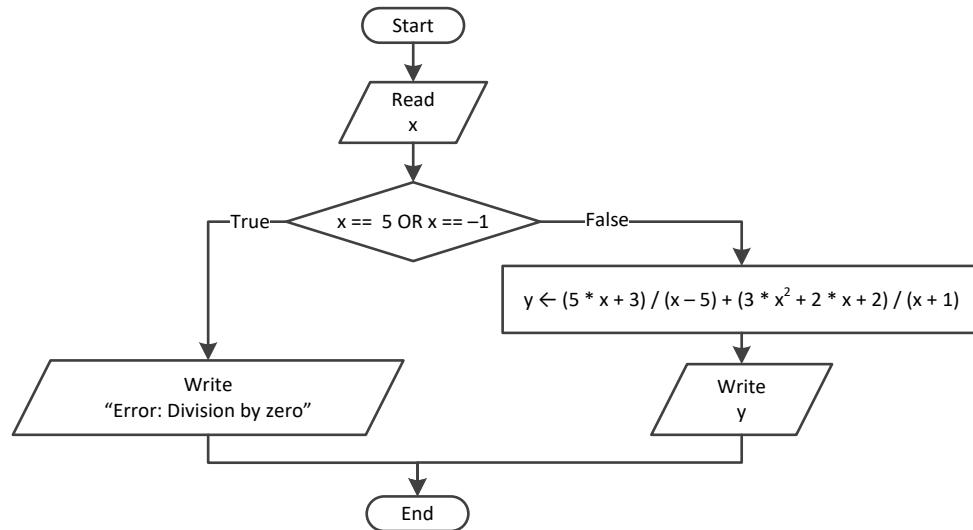
## 9. Solution

---

```
a = int(input("Enter 1st integer: "))
op = input("Enter type of operation: ")
b = int(input("Enter 2nd integer: "))

if op == "+":
    print(a, b)
elif op == "-":
    print(a - b)
elif op == "*":
    print(a * b)
elif op == "/":
    if b == 0:
        print("Error: Division by zero")
    else:
        print(a / b)
elif op == "DIV":
    if b == 0:
        print("Error: Division by zero")
    else:
        print(a // b)
elif op == "MOD":
    if b == 0:
        print("Error: Division by zero")
    else:
        print(a % b)
elif op == "POWER":
    print(a ** b)
else:
    print("Error: Invalid operator")
```

### 10. Solution

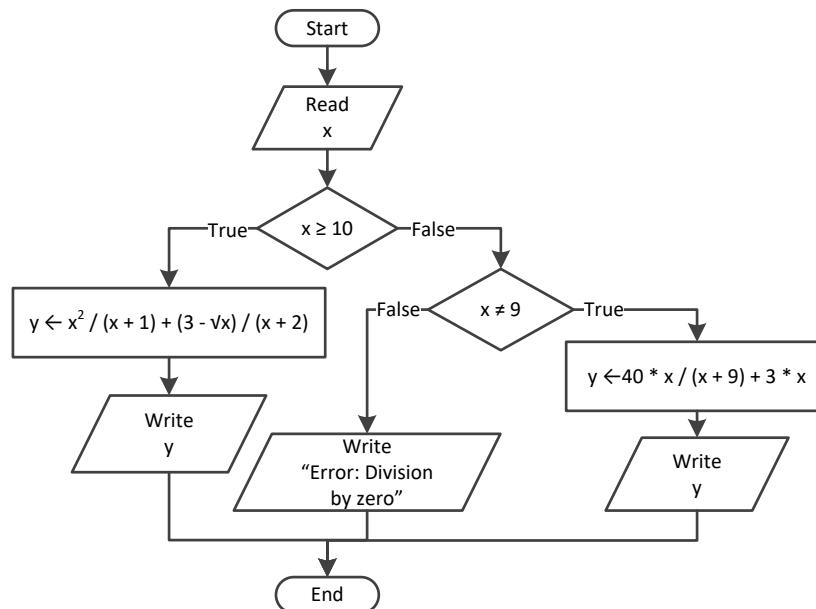


```

x = float(input())

if x == 5 or x == -1:
    print("Error: Division by zero")
else:
    y = (5 * x + 3) / (x - 5) + (3 * x ** 2 + 2 * x + 2) / (x + 1)
    print(y)
    
```

### 11. Solution



```

import math

x = float(input())
    
```

```

if x >= 10:
    y = x ** 2 / (x + 1) + (3 - math.sqrt(x)) / (x + 2)
    print(y)
elif x != 9:
    y = 40 * x / (x + 9) + 3 * x
    print(y)
else:
    print("Error: Division by zero")

```

## 12. Solution

---

```

import math

x = float(input())

if x <= -15 or x > 25:
    y = x - 1
    print(y)
elif x <= -10:
    y = x / math.sqrt(x + 30) + (8 + x) ** 2 / (x + 1)
    print(y)
elif x <= 0:
    y = abs(40 * x) / (x - 8)
    print(y)
else:
    if x == 9:
        print("Error: Division by zero")
    elif x < 9:
        print("Error: Invalid square root")
    else:
        y = 3 * x / math.sqrt(x - 9)
        print(y)

```

## 13. Solution

---

```

a1 = int(input("Enter the age of the first person: "))
n1 = input("Enter the name of the first person: ")
a2 = int(input("Enter the age of the second person: "))
n2 = input("Enter the name of the second person: ")
a3 = int(input("Enter the age of the third person: "))
n3 = input("Enter the name of the third person: ")

minimum = a1
min_name = n1
if a2 < minimum:
    minimum = a2
    min_name = n2
if a3 < minimum:
    minimum = a3
    min_name = n3

```

```
maximum = a1
max_name = n1
if a2 > maximum:
    maximum = a2
    max_name = n2
if a3 > maximum:
    maximum = a3
    max_name = n3

print(min_name , max_name)
```

#### 14. Solution

---

```
age1 = int(input("Enter age for person No1:"))
age2 = int(input("Enter age for person No2:"))
age3 = int(input("Enter age for person No3:"))

minimum = age1
if age2 < minimum:
    minimum = age2
if age3 < minimum:
    minimum = age3
maximum = age1
if age2 > maximum:
    maximum = age2
if age3 > maximum:
    maximum = age3

middle = age1 + age2 + age3 - minimum - maximum
print(middle)
```

#### 15. Solution

---

```
a1 = int(input("Enter the age of the first person: "))
n1 = input("Enter the name of the first person: ")
a2 = int(input("Enter the age of the second person: "))
n2 = input("Enter the name of the second person: ")
a3 = int(input("Enter the age of the third person: "))
n3 = input("Enter the name of the third person: ")

minimum = a1
min_name = n1
if a2 < minimum:
    minimum = a2
    min_name = n2
if a3 < minimum:
    minimum = a3
    min_name = n3
```

```

maximum = a1
max_name = n1
if a2 > maximum:
    maximum = a2
    max_name = n2
if a3 > maximum:
    maximum = a3
    max_name = n3

middle = a1 + a2 + a3 - minimum - maximum

if abs(maximum - middle) < abs(minimum - middle):
    print(max_name)
else:
    print(min_name)

```

**16. Solution**

```

x = float(input("Enter a three-digit integer: "))

if x != int(x):
    print("Error! You must enter an integer")
elif x < 100 or x > 999:
    print("Entered integer is not a three-digit integer")
else:
    digit1, r = divmod(x, 100)
    digit2, digit3 = divmod(r, 10)

    total = digit1 ** 3 + digit2 ** 3 + digit3 ** 3

    if total == x:
        print("You entered an Armstrong number!")
    else:
        print("You entered a non-Armstrong number!")

```

**17. Solution**

```

d = int(input("Enter day 1 - 31: "))
m = int(input("Enter month 1 - 12: "))
y = int(input("Enter year: "))

if m == 2:
    if y % 4 == 0 and y % 100 != 0 or y % 400 == 0:
        print(29 - d)
    else:
        print(28 - d)
elif m == 4 or m == 6 or m == 9 or m == 11:
    print(30 - d)
else:
    print(31 - d)

```

### 18. Solution

---

```
word = input()

word1 = word[0].upper() + \
        word[1].lower() + \
        word[2].upper() + \
        word[3].lower() + \
        word[4].upper() + \
        word[5].lower()

word2 = word[0].lower() + \
        word[1].upper() + \
        word[2].lower() + \
        word[3].upper() + \
        word[4].lower() + \
        word[5].upper()

if word == word1 or word == word2:
    print("Word is okay!")
else:
    print("Word is not okay")
```

### 19. Solution

---

```
q = int(input("Enter quantity: "))

if q < 3:
    discount = 0
elif q < 6:
    discount = 10
elif q < 10:
    discount = 15
elif q < 14:
    discount = 20
elif q < 20:
    discount = 27
else:
    discount = 30

payment = q * 10 - q * 10 * discount / 100.0

print("You got a discount of ", discount, "%", sep = "")
print("You must pay $", payment, sep = "")
```

### 20. Solution

---

```
VAT = 0.19
```

```
amount = float(input("Enter a before-tax amount: "))

if amount < 0:
    print("Error! You entered a negative value")
else:
    if amount < 50:
        discount = 0
    elif amount < 100:
        discount = 1
    elif amount < 250:
        discount = 2
    else:
        discount = 3

amount = amount - amount * discount / 100
payment = amount + amount * VAT

print("You got a discount of ", discount, "%", sep="")
print("You must pay $", payment, sep="")
```

## 21. Solution

---

```
a = int(input("Enter age: "))
if a < 18:
    print("Invalid age")
else:
    w = int(input("Enter weight in pounds: "))
    h = int(input("Enter height in inches: "))

bmi = w * 703 / h ** 2

if bmi < 15:
    print("Very severely underweight")
elif bmi < 16:
    print("Severely underweight")
elif bmi < 18.5:
    print("Underweight")
elif bmi < 25:
    print("Normal")
elif bmi < 30:
    print("Overweight")
elif bmi < 35:
    print("Severely overweight")
else:
    print("Very severely overweight")
```

## 22. Solution

---

```
TAX_RATE = 0.10
```

```
water = int(input("Enter water consumption (in cubic feet): "))

if water < 0:
    print("Error! You entered a negative value")
else:
    if water <= 10:
        total = water * 3
    elif water <= 20:
        total = 10 * 3 + (water - 10) * 5
    elif water <= 35:
        total = 10 * 3 + 10 * 5 + (water - 20) * 7
    else:
        total = 10 * 3 + 10 * 5 + 15 * 7 + (water - 35) * 9

    total = total + total * TAX_RATE
    print("Total amount to pay (taxes included):", total)
```

### 23. Solution

---

```
income = float(input("Enter taxable income: "))
children = int(input("Enter number of children: "))

if income <= 8000:
    tax = income * 0.10
elif income <= 30000:
    tax = 8000 * 0.10 + (income - 8000) * 0.15
elif income <= 70000:
    tax = 8000 * 0.10 + 22000 * 0.15 + (income - 30000) * 0.25
else:
    tax = 8000 * 0.10 + 22000 * 0.15 + 40000 * 0.25 + (income - 70000) * 0.30

if children > 0:
    tax = tax - tax * 0.02

print("Tax:", tax)
```

### 24. Solution

---

```
wind = float(input("Enter wind speed (in miles/hour): "))

if wind < 0:
    print("Error! You entered a negative value ")
else:
    if wind < 1:
        print("Beaufort: 0\nCalm")
    elif wind < 4:
        print("Beaufort: 1\nLight air")
    elif wind < 8:
        print("Beaufort: 2\nLight breeze")
    elif wind < 13:
```

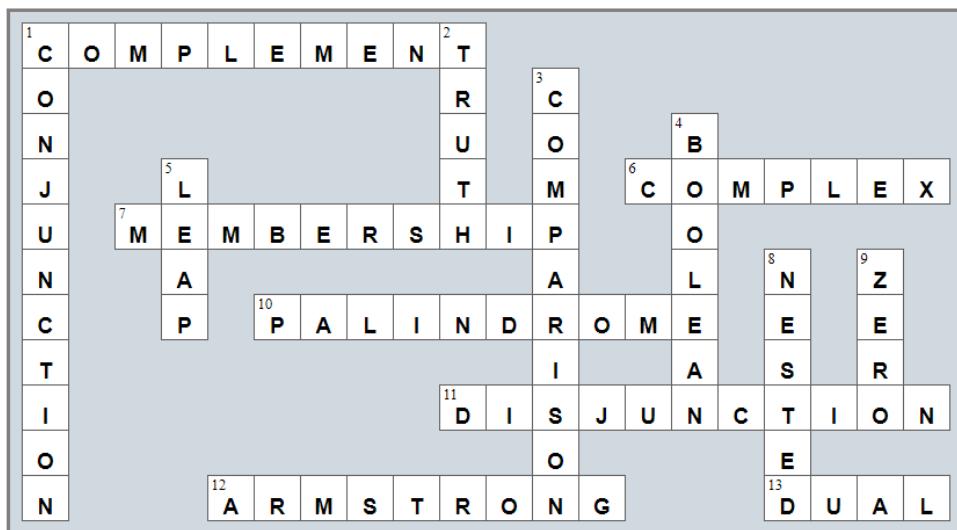
```
    print("Beaufort: 3\nGentle breeze")
elif wind < 18:
    print("Beaufort: 4\nModerate breeze")
elif wind < 25:
    print("Beaufort: 5\nFresh breeze")
elif wind < 31:
    print("Beaufort: 6\nStrong breeze")
elif wind < 39:
    print("Beaufort: 7\nModerate gale")
elif wind < 47:
    print("Beaufort: 8\nGale")
elif wind < 55:
    print("Beaufort: 9\nStrong gale")
elif wind < 64:
    print("Beaufort: 10\nStorm")
elif wind < 74:
    print("Beaufort: 11\nViolent storm")
else:
    print("Beaufort: 12\nHurricane force")

if wind < 13:
    print("It's Fishing Day!!!")
```

## Review in "Decision Control Structures"

### Review Crossword Puzzle

1.



# Chapter 23

---

## 23.3 Review Questions: True/False

- |          |          |
|----------|----------|
| 1. true  | 4. false |
| 2. true  | 5. true  |
| 3. false |          |

# Chapter 24

---

## 24.4 Review Questions: True/False

- |          |           |
|----------|-----------|
| 1. true  | 9. false  |
| 2. false | 10. false |
| 3. false | 11. false |
| 4. false | 12. true  |
| 5. false | 13. false |
| 6. false | 14. false |
| 7. true  | 15. true  |
| 8. true  | 16. false |

## 24.5 Review Questions: Multiple Choice

- |      |       |
|------|-------|
| 1. c | 7. c  |
| 2. c | 8. b  |
| 3. a | 9. b  |
| 4. b | 10. d |
| 5. d | 11. a |
| 6. b | 12. d |

## 24.6 Review Exercises

### 1. Solution

---

```
i = 3
while True:
    print(i)
    i -= 1
    if i == 0: break
print("The end")
```

### 2. Solution

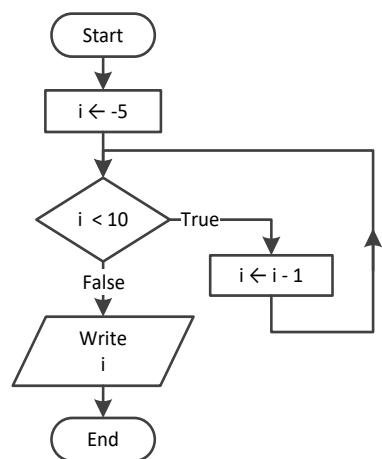
---

Step	Statement	i	x
1	i = 3	3	?
2	x = 0	3	0
3	while i >= 0:	True	
4	i -= 1	2	0
5	x += i	2	2
6	while i >= 0:	True	
7	i -= 1	1	2
8	x += i	1	3
9	while i >= 0:	True	

<b>10</b>	$i = -1$	<b>0</b>	3
<b>11</b>	$x += i$	0	<b>3</b>
<b>12</b>	while $i \geq 0$ :	True	
<b>13</b>	$i = -1$	<b>-1</b>	3
<b>14</b>	$x += i$	-1	<b>2</b>
<b>15</b>	while $i \geq 0$ :	False	
<b>16</b>	print(x)	It displays: 2	

It performs 4 iterations

### 3. Solution



Step	Statement	Notes	i
<b>1</b>	$i = -5$		<b>-5</b>
<b>2</b>	while $i < 10$ :	True	
<b>3</b>	$i = -1$		<b>-6</b>
<b>4</b>	while $i < 10$ :	True	
<b>5</b>	$i = -1$		<b>-7</b>
<b>6</b>	while $i < 10$ :	True	
<b>7</b>	$i = -1$		<b>-8</b>
<b>8</b>	...	...	...
<b>9</b>	...	...	...

It performs an infinite number of iterations

### 4. Solution

Step	Statement	a	b	c	d
<b>1</b>	$a = 2$	<b>2</b>	?	?	?
<b>2</b>	while $a \leq 10$ :	True			

<b>3</b>	b = a + 1	2	<b>3</b>	?	?
<b>4</b>	c = b * 2	2	3	<b>6</b>	?
<b>5</b>	d = c - b + 1	2	3	6	<b>4</b>
<b>6</b>	if d == 4:		True		
<b>7</b>	print(b, ", ", c)		It displays: 3, 6		
<b>8</b>	a += 4	<b>6</b>	3	6	4
<b>9</b>	while a <= 10:		True		
<b>10</b>	b = a + 1	6	<b>7</b>	6	4
<b>11</b>	c = b * 2	6	7	<b>14</b>	4
<b>12</b>	d = c - b + 1	6	7	14	<b>8</b>
<b>13</b>	if d == 4:		False		
<b>14</b>	elif d == 5:		False		
<b>15</b>	elif d == 8:		True		
<b>16</b>	print(a, ", ", b)		It displays: 6, 7		
<b>17</b>	a += 4	<b>10</b>	7	14	8
<b>18</b>	while a <= 10:		True		
<b>19</b>	b = a + 1	10	<b>11</b>	14	8
<b>20</b>	c = b * 2	10	11	<b>22</b>	8
<b>21</b>	d = c - b + 1	10	11	22	<b>12</b>
<b>22</b>	if d == 4:		False		
<b>23</b>	elif d == 5:		False		
<b>24</b>	elif d == 8:		False		
<b>25</b>	print(a, ", ", b, ", ", d)		It displays: 10, 11, 12		
<b>26</b>	a += 4	<b>14</b>	11	22	12
<b>27</b>	while a <= 10:		False		

## 5. Solution

Step	Statement	a	b	c	d	x
<b>1</b>	a = 1	<b>1</b>	?	?	?	?
<b>2</b>	b = 1	1	<b>1</b>	?	?	?
<b>3</b>	c = 0	1	1	<b>0</b>	?	?
<b>4</b>	d = 0	1	1	0	<b>0</b>	?
<b>5</b>	while b < 2:		True			
<b>6</b>	x = a + b	1	1	0	0	<b>2</b>
<b>7</b>	if x % 2 != 0:		False			
<b>8</b>	d = d + 1	1	1	0	<b>1</b>	2

<b>9</b>	a = b	<b>1</b>	1	0	1	2
<b>10</b>	b = c	1	<b>0</b>	0	1	2
<b>11</b>	c = d	1	0	<b>1</b>	1	2
<b>12</b>	while b < 2:			True		
<b>13</b>	x = a + b	1	0	1	1	<b>1</b>
<b>14</b>	if x % 2 != 0:			True		
<b>15</b>	c = c + 1	1	0	<b>2</b>	1	1
<b>16</b>	a = b	<b>0</b>	0	2	1	1
<b>17</b>	b = c	0	<b>2</b>	2	1	1
<b>18</b>	c = d	0	2	<b>1</b>	1	1
<b>19</b>	while b < 2:			False		

### 6. Solution

---

- i. -1
- ii. 9
- iii. 0.25
- iv. -7
- v. Any value between 17 and 32
- vi. 1.4

### 7. Solution

---

Step	Statement	x	y
<b>1</b>	y = 5	?	<b>5</b>
<b>2</b>	x = 38	<b>38</b>	5
<b>3</b>	y *= 2	38	<b>10</b>
<b>4</b>	x += 1	<b>39</b>	10
<b>5</b>	print(y)	It displays: 10	
<b>6</b>	if y >= x: break	False	
<b>7</b>	y *= 2	39	<b>20</b>
<b>8</b>	x += 1	<b>40</b>	20
<b>9</b>	print(y)	It displays: 20	
<b>10</b>	if y >= x: break	False	
<b>11</b>	y *= 2	40	<b>40</b>
<b>12</b>	x += 1	<b>41</b>	40
<b>13</b>	print(y)	It displays: 40	
<b>14</b>	if y >= x: break	False	
<b>15</b>	y *= 2	41	<b>80</b>

<b>16</b>	x += 1	<b>42</b>	80
<b>17</b>	print(y)		It displays: 80
<b>18</b>	if y >= x: break		True

**8. Solution**

Step	Statement	Notes	x
<b>1</b>	x = 1		<b>1</b>
<b>2</b>	if x % 2 == 0:	False	
<b>3</b>	x += 3		<b>4</b>
<b>4</b>	print(x)	It displays: 4	
<b>5</b>	if x >= 12: break	False	
<b>6</b>	if x % 2 == 0:	True	
<b>7</b>	x += 1		<b>5</b>
<b>8</b>	print(x)	It displays: 5	
<b>9</b>	if x >= 12: break	False	
<b>10</b>	if x % 2 == 0:	False	
<b>11</b>	x += 3		<b>8</b>
<b>12</b>	print(x)	It displays: 8	
<b>13</b>	if x >= 12: break	False	
<b>14</b>	if x % 2 == 0:	True	
<b>15</b>	x += 1		<b>9</b>
<b>16</b>	print(x)	It displays: 9	
<b>17</b>	if x >= 12: break	False	
<b>18</b>	if x % 2 == 0:	False	
<b>19</b>	x += 3		<b>12</b>
<b>20</b>	print(x)	It displays: 12	
<b>21</b>	if x >= 12: break	True	

**9. Solution**

Step	Statement	x	y
<b>1</b>	y = 2	?	<b>2</b>
<b>2</b>	x = 0	<b>0</b>	2
<b>3</b>	y = y ** 2	0	<b>4</b>
<b>4</b>	if x < 256:		True
<b>5</b>	x = x + y	<b>4</b>	
<b>6</b>	print(x, ", ", y)		It displays: 4, 4

<b>7</b>	if y >= 65535: break	False				
<b>8</b>	y = y ** 2	4	<b>16</b>			
<b>9</b>	if x < 256:	True				
<b>10</b>	x = x + y	<b>20</b>		16		
<b>11</b>	print(x, ", ", y)	It displays: 20, 16				
<b>12</b>	if y >= 65535: break	False				
<b>13</b>	y = y ** 2	20	<b>256</b>			
<b>14</b>	if x < 256:	True				
<b>15</b>	x = x + y	<b>276</b>	256			
<b>16</b>	print(x, ", ", y)	It displays: 276, 256				
<b>17</b>	if y >= 65535: break	False				
<b>18</b>	y = y ** 2	276	<b>65536</b>			
<b>19</b>	if x < 256:	False				
<b>20</b>	print(x, ", ", y)	It displays: 276, 65536				
<b>21</b>	if y >= 65535: break	True				

### 10. Solution

---

Step	Statement	a	b	c	d	x
<b>1</b>	a = 2	<b>2</b>	?	?	?	?
<b>2</b>	b = 4	2	<b>4</b>	?	?	?
<b>3</b>	c = 0	2	4	<b>0</b>	?	?
<b>4</b>	d = 0	2	4	0	<b>0</b>	?
<b>5</b>	x = a + b	2	4	0	0	<b>6</b>
<b>6</b>	if x % 2 != 0:	False				
<b>7</b>	elif d % 2 == 0:	True				
<b>8</b>	d = d + 5	2	4	0	<b>5</b>	6
<b>9</b>	a = b	<b>4</b>	4	0	5	6
<b>10</b>	b = d	4	<b>5</b>	0	5	6
<b>11</b>	if c >= 11: break	False				
<b>12</b>	x = a + b	4	5	0	5	<b>9</b>
<b>13</b>	if x % 2 != 0:	True				
<b>14</b>	c = c + 5	4	5	<b>5</b>	5	9
<b>15</b>	a = b	<b>b</b>	5	5	5	9

<b>16</b>	b = d	5	5	5	5	9
<b>17</b>	if c >= 11: break			False		
<b>18</b>	x = a + b	5	5	5	5	<b>10</b>
<b>19</b>	if x % 2 != 0:			False		
<b>20</b>	elif d % 2 == 0:			False		
<b>21</b>	c = c + 3	5	5	<b>8</b>	5	10
<b>22</b>	a = b	<b>5</b>	5	8	5	10
<b>23</b>	b = d	5	<b>5</b>	8	5	10
<b>24</b>	if c >= 11: break			False		
<b>25</b>	x = a + b	5	5	8	5	<b>10</b>
<b>26</b>	if x % 2 != 0:			False		
<b>27</b>	elif d % 2 == 0:			False		
<b>28</b>	c = c + 3	5	5	<b>11</b>	5	10
<b>29</b>	a = b	<b>5</b>	5	11	5	10
<b>30</b>	b = d	5	<b>5</b>	11	5	10
<b>31</b>	if c >= 11: break			True		

**11. Solution**

- i. -1
- ii. 18
- iii. 0.5
- iv. -20
- v. 128
- vi. 11.25

**12. Solution**

- i. 4
- ii. -2
- iii. 2
- iv. 10

**13. Solution**

```
n = int(input())
total = 0

i = 1
```

```
while i <= n:  
    a = float(input())  
    total = total + a  
    i += 1  
  
print(total)  
if n > 0:  
    print(total / n)
```

#### 14. Solution

---

```
count = 0  
  
n = int(input())  
p = 1  
  
i = 1  
while i <= n:  
    a = int(input())  
    if a % 2 == 0:  
        p = p * a  
        count += 1  
    i += 1  
  
if count > 0:  
    print(p)  
else:  
    print("You entered no even integers")
```

#### 15. Solution

---

```
total = 0  
  
i = 1  
while i <= 100:  
    a = int(input())  
    if a % 10 == 0:  
        total = total + a  
    i += 1  
print(total)
```

#### 16. Solution

---

```
total = 0  
  
i = 1  
while i <= 20:  
    a = int(input())  
    if 100 <= a <= 999:  
        total = total + a
```

```
i += 1  
print(total)
```

### 17. Solution

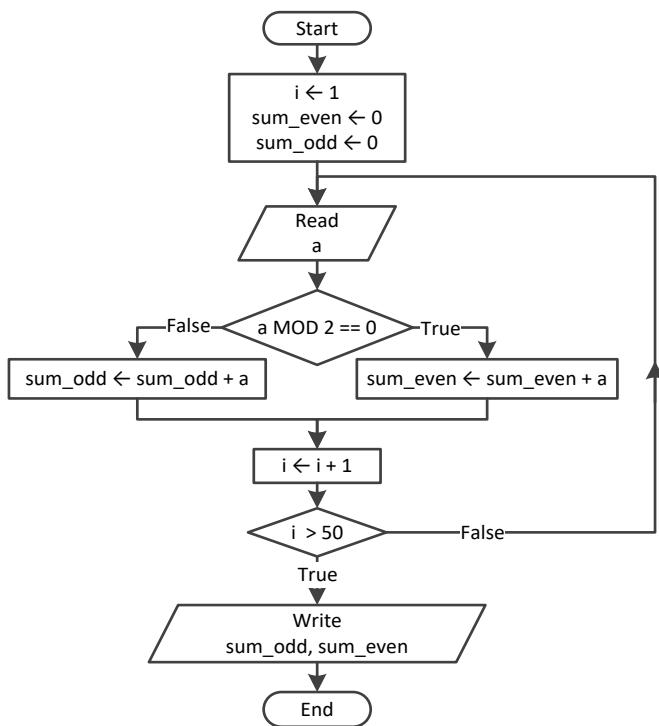
```
p = 1  
  
a = float(input())  
while a != 0:  
    p = p * a  
    a = float(input())  
print(p)
```

Step	Statement	a	p
1	p = 1	?	<b>1</b>
2	a = float(input())	<b>3.0</b>	1
3	while a != 0:	True	
4	p = p * a	3.0	<b>3</b>
5	a = float(input())	<b>2.0</b>	3
6	while a != 0:	True	
7	p = p * a	2.0	<b>6</b>
8	a = float(input())	<b>9.0</b>	6
9	while a != 0:	True	
10	p = p * a	9.0	<b>54</b>
11	a = float(input())	<b>0.0</b>	54
12	while a != 0:	False	
13	print(p)	It displays: 54	

### 18. Solution

```
population = 30000  
  
years = 0  
while population <= 100000:  
    population += population * 0.03  
    years += 1  
  
print(years)
```

### 19. Solution



```

i = 1
sum_even = 0
sum_odd = 0
while True:
    a = int(input())
    if a % 2 == 0:
        sum_even += a
    else:
        sum_odd += a
    i += 1
    if i > 50: break
print(sum_odd, sum_even)

```

### 20. Solution

```

n = int(input())
i = 1
p = 1
while True:
    a = int(input())
    if a < 0:
        p *= a
    i += 1
    if i > n: break
print(abs(p))

```

## 21. Solution

---

```
i = 1
p = 1
while True:
    a = int(input("Enter an integer: "))
    if 500 <= a <= 599:
        p *= a
        i += 1
    if i > 5: break

print(p)
```

## 22. Solution

---

```
population = 50000

years = 0
while True:
    population -= population * 0.10
    years += 1
    if population < 20000: break

print(years)
```

# Chapter 25

---

## 25.3 Review Questions: True/False

- |          |           |
|----------|-----------|
| 1. true  | 7. false  |
| 2. true  | 8. true   |
| 3. false | 9. false  |
| 4. false | 10. false |
| 5. false | 11. false |
| 6. true  | 12. false |

## 25.4 Review Questions: Multiple Choice

- |      |       |
|------|-------|
| 1. c | 8. b  |
| 2. d | 9. c  |
| 3. d | 10. b |
| 4. b | 11. d |
| 5. a | 12. d |
| 6. b | 13. d |
| 7. a | 14. c |

## 25.5 Review Exercises

### 1. Solution

---

Step	Statement	a	b	j
1	$a = 0$	<b>0</b>	?	?
2	$b = 0$	0	<b>0</b>	?
3	$j = 0$	0	0	<b>0</b>
4	<code>if j &lt; 5:</code>		True	
5	$b += 1$	0	<b>1</b>	0
6	$j = 2$	0	1	<b>2</b>
7	<code>if j &lt; 5:</code>		True	
8	$b += 1$	0	<b>2</b>	2
9	$j = 4$	0	2	<b>4</b>
10	<code>if j &lt; 5:</code>		True	
11	$b += 1$	0	<b>3</b>	4
12	$j = 6$	0	3	<b>6</b>
13	<code>if j &lt; 5:</code>		False	
14	$a += j - 1$	<b>5</b>	3	6
15	$j = 8$	5	3	<b>8</b>
16	<code>if j &lt; 5:</code>		False	
17	$a += j - 1$	<b>12</b>	3	8

<b>18</b>	<code>print(a, ", ", b)</code>	It displays: 12, 3
-----------	--------------------------------	--------------------

## 2. Solution

---

For input value of 10

Step	Statement	a	b	j
<b>1</b>	<code>a = int(input())</code>	<b>10</b>	?	?
<b>2</b>	<code>b = a</code>	10	<b>10</b>	?
<b>3</b>	<code>j = a - 5</code>	10	10	<b>5</b>
<b>4</b>	<code>if j % 2 != 0:</code>		True	
<b>5</b>	<code>b = a + j + 5</code>	10	<b>20</b>	5
<b>6</b>	<code>j = 7</code>	10	20	<b>7</b>
<b>7</b>	<code>if j % 2 != 0:</code>		True	
<b>8</b>	<code>b = a + j + 5</code>	10	<b>22</b>	7
<b>9</b>	<code>j = 9</code>	10	22	<b>9</b>
<b>10</b>	<code>if j % 2 != 0:</code>		True	
<b>11</b>	<code>b = a + j + 5</code>	10	<b>24</b>	9
<b>12</b>	<code>print(b)</code>	It displays: 24		

For input value of 21

Step	Statement	a	b	j
<b>1</b>	<code>a = int(input())</code>	<b>21</b>	?	?
<b>2</b>	<code>b = a</code>	21	<b>21</b>	?
<b>3</b>	<code>j = a - 5</code>	21	21	<b>16</b>
<b>4</b>	<code>if j % 2 != 0:</code>		False	
<b>5</b>	<code>b = a - j</code>	21	<b>5</b>	16
<b>6</b>	<code>j = 18</code>	21	5	<b>18</b>
<b>7</b>	<code>if j % 2 != 0:</code>		False	
<b>8</b>	<code>b = a - j</code>	21	<b>3</b>	18
<b>9</b>	<code>j = 20</code>	21	3	<b>20</b>
<b>10</b>	<code>if j % 2 != 0:</code>		False	
<b>11</b>	<code>b = a - j</code>	21	<b>1</b>	20
<b>12</b>	<code>print(b)</code>	It displays: 1		

## 3. Solution

---

For input value of 12

Step	Statement	a	x	y	j
<b>1</b>	<code>a = int(input())</code>	<b>12</b>	?	?	?

<b>2</b>	j = 2	12	?	?	<b>2</b>
<b>3</b>	x = j * 3 + 3	12	<b>9</b>	?	2
<b>4</b>	y = j * 2 + 10	12	9	<b>14</b>	2
<b>5</b>	if y - x > 0 or x > 30:		True		
<b>6</b>	y *= 2	12	9	<b>28</b>	2
<b>7</b>	x += 4	12	<b>13</b>	28	2
<b>8</b>	print(x, ", ", y)		It displays: 13, 28		
<b>9</b>	j = 5	12	13	28	<b>5</b>
<b>10</b>	x = j * 3 + 3	12	<b>18</b>	28	5
<b>11</b>	y = j * 2 + 10	12	18	<b>20</b>	5
<b>12</b>	if y - x > 0 or x > 30:		True		
<b>13</b>	y *= 2	12	18	<b>40</b>	5
<b>14</b>	x += 4	12	<b>22</b>	40	5
<b>15</b>	print(x, ", ", y)		It displays: 22, 40		
<b>16</b>	j = 8	12	22	40	<b>8</b>
<b>17</b>	x = j * 3 + 3	12	<b>27</b>	40	8
<b>18</b>	y = j * 2 + 10	12	27	<b>26</b>	8
<b>19</b>	if y - x > 0 or x > 30:		False		
<b>20</b>	x += 4	12	<b>31</b>	26	8
<b>21</b>	print(x, ", ", y)		It displays: 31, 26		
<b>22</b>	j = 11	12	31	26	<b>11</b>
<b>23</b>	x = j * 3 + 3	12	<b>36</b>	26	11
<b>24</b>	y = j * 2 + 10	12	36	<b>32</b>	11
<b>25</b>	if y - x > 0 or x > 30:		True		
<b>26</b>	y *= 2	12	36	<b>64</b>	11
<b>27</b>	x += 4	12	<b>40</b>	64	11
<b>28</b>	print(x, ", ", y)		It displays: 40, 64		

**4. Solution**

- i. 9
- ii. 20
- iii. -7 (or -8)
- iv. -1

**5. Solution**

It displays:

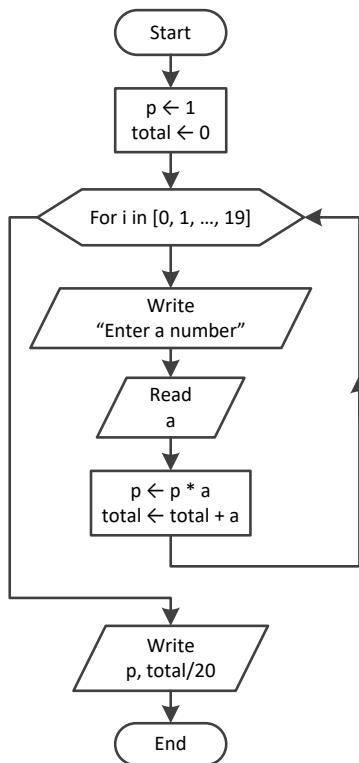
Z

Zee

Zeeuuu

Zeeuuussss

## 6. Solution



```

p = 1
total = 0
for i in range(20):
    a = float(input("Enter a number: "))
    p = p * a
    total = total + a
print(p, total / 20)
  
```

## 7. Solution

```

import math

i = 0
while i <= 360:
    print(math.sin(i * math.pi / 180))
    i += 0.5
  
```

## 8. Solution

```

import math

deg = int(input("Enter degrees: "))
  
```

```
for i in range(0, deg + 1):
    print(math.cos(i * math.pi / 180))
```

### 9. Solution

---

```
s = 0
for i in range(1, 101, 2):
    s += i
print(s)
```

### 10. Solution

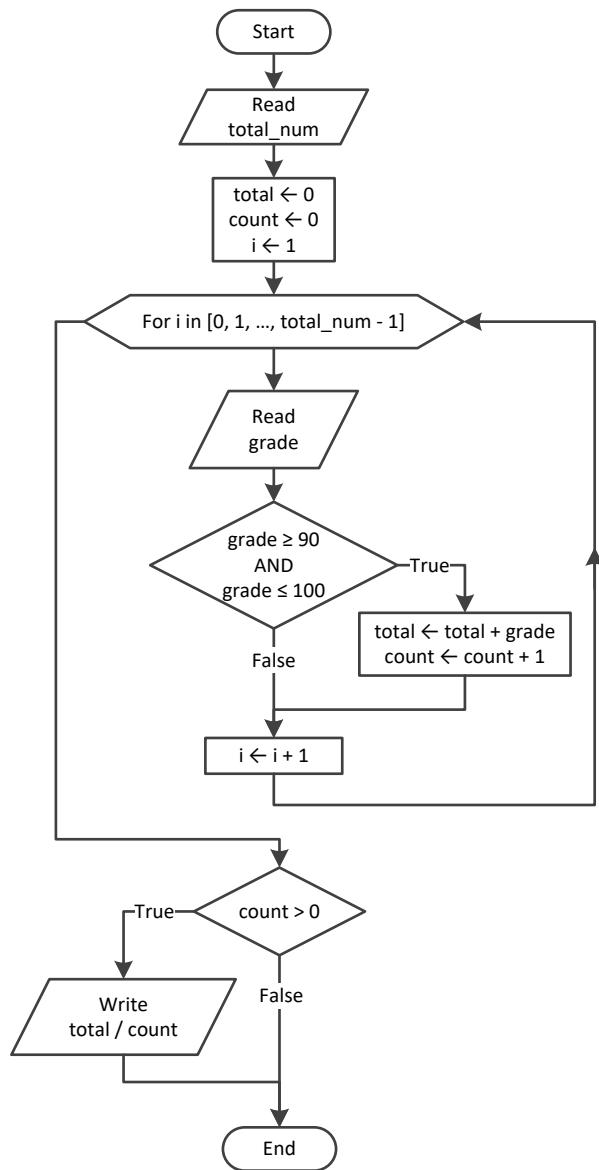
---

```
n = int(input())
p = 1
for i in range(2, 2 * n + 2, 2):
    p *= i ** (i - 1)
print(p)
```

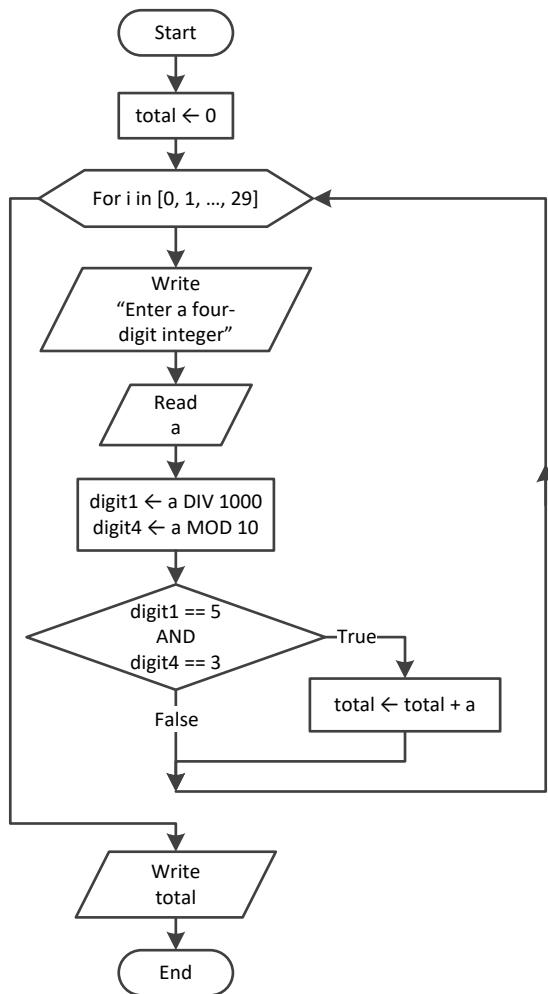
### 11. Solution

---

```
s = 0
i = 1
offset = 0
while i <= 191:
    s += i
    offset += 1
    i += offset
print(s)
```

**12. Solution**

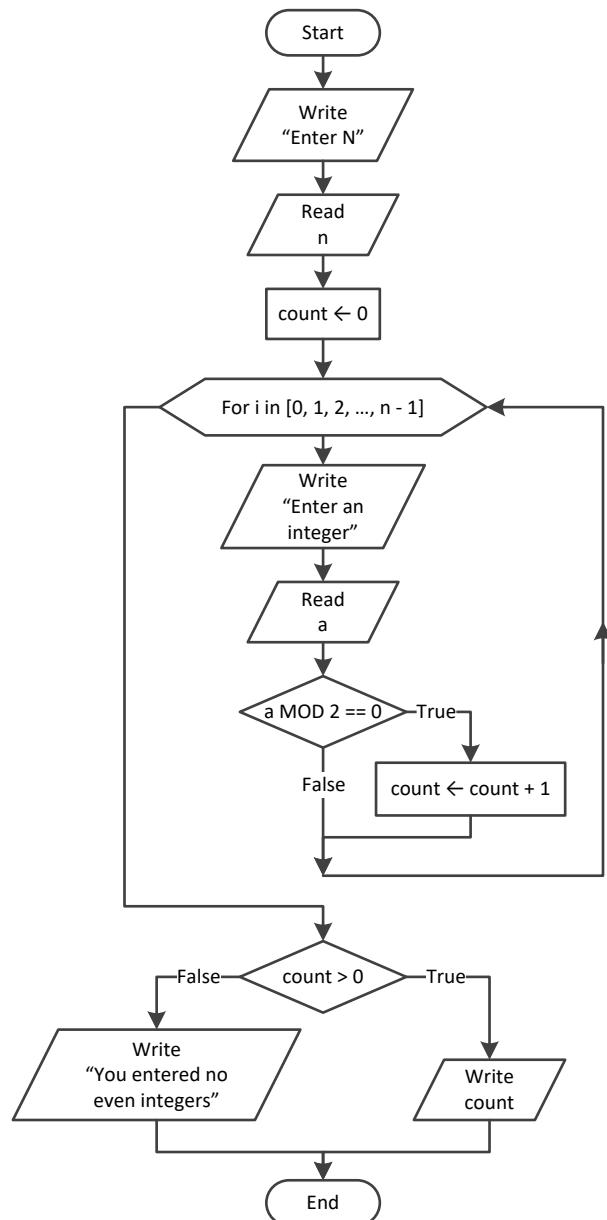
```
total_num = int(input())
total = 0
count = 0
for i in range(total_num):
    grade = int(input())
    if 90 <= grade <= 100:
        total += grade
        count += 1
if count > 0:
    print(total / count)
```

**13. Solution**

```
total = 0
for i in range(30):
    a = int(input("Enter a four-digit integer: "))
    digit1 = a // 1000
    digit4 = a % 10
    if digit1 == 5 and digit4 == 3:
        total += a

print(total)
```

### 14. Solution

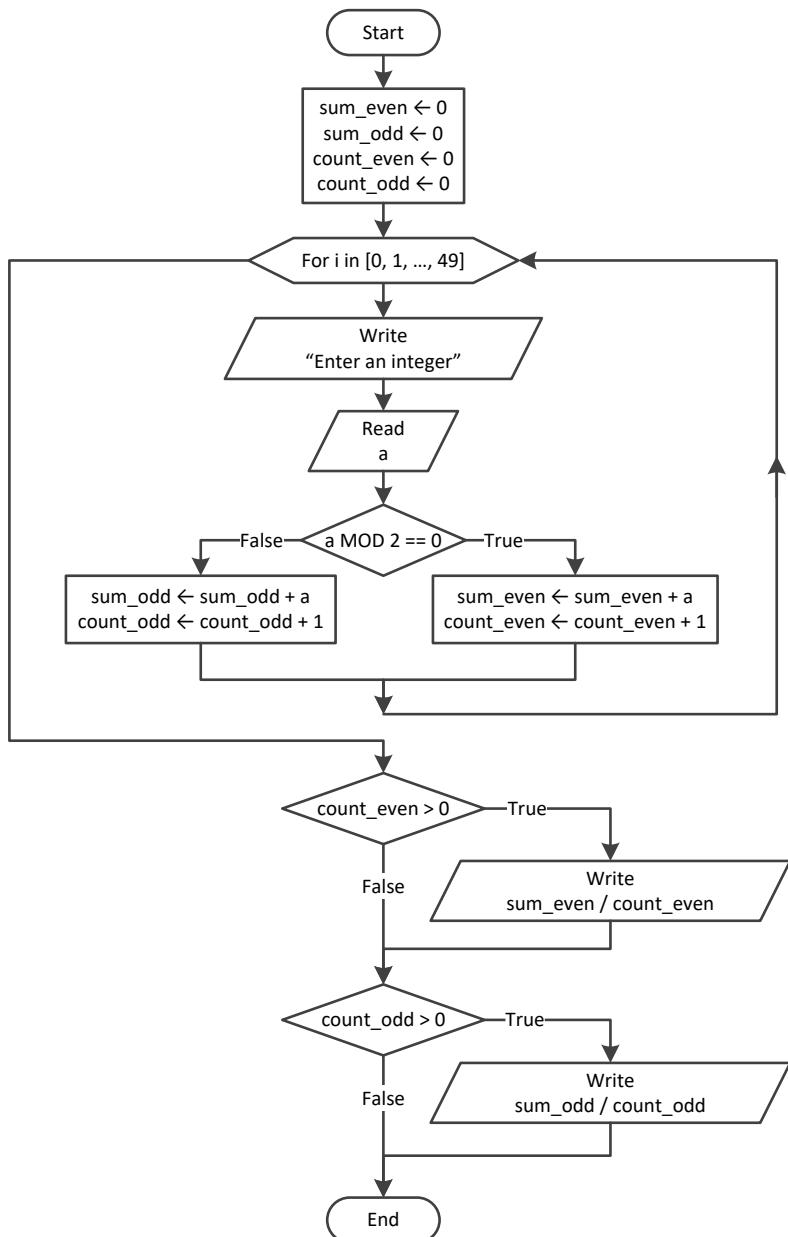


```

n = int(input("Enter N: "))
count = 0
for i in range(n):
    a = int(input("Enter an integer: "))
    if a % 2 == 0:
        count += 1

if count > 0:
    print(count)
else:
    print("You entered no even integers")
  
```

### 15. Solution



```

sum_even = 0
sum_odd = 0
count_even = 0
count_odd = 0
for i in range(50):
    a = int(input("Enter an integer: "))
    if a % 2 == 0:
        sum_even += a
        count_even += 1
    else:
        sum_odd += a
  
```

```

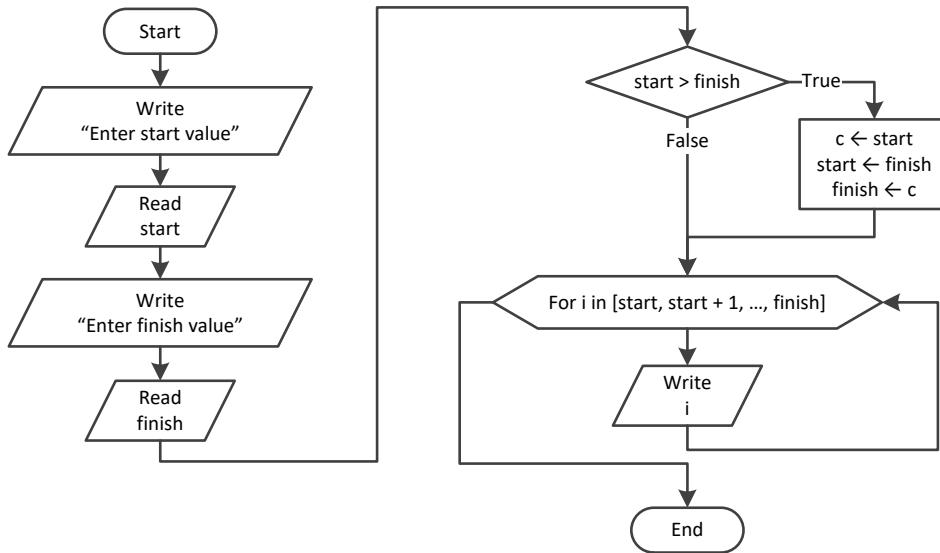
        count_odd += 1

if count_even > 0:
    print(sum_even / count_even)

if count_odd > 0:
    print(sum_odd / count_odd)

```

### 16. Solution



```

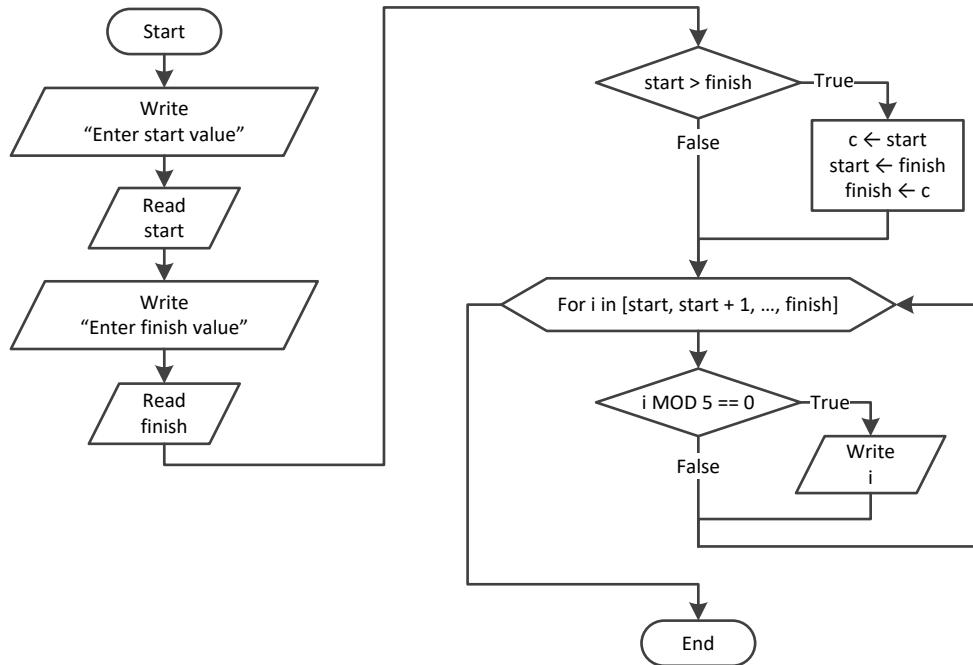
start = int(input("Enter start value: "))
finish = int(input("Enter finish value: "))

if start > finish:          # Or you can do the following:
    c = start                # start, finish = finish, start
    start = finish
    finish = c

for i in range(start, finish + 1):
    print(i)

```

### 17. Solution



```

start = int(input("Enter start value: "))
finish = int(input("Enter finish value: "))

if start > finish:
    c = start
    start = finish
    finish = c

for i in range(start, finish + 1):
    if i % 5 == 0:
        print(i)
    
```

### 18. Solution

#### First approach

```

b = float(input("Enter a value for base: "))
exp = int(input("Enter an integer for exponent: "))

p = 1
if exp >= 0:
    for i in range(exp):
        p *= b
else:
    for i in range(-exp):
        p *= 1 / b

print(p)
    
```

**Second approach**

```
b = float(input("Enter a value for base: "))
exp = int(input("Enter an integer for exponent: "))

p = 1
for i in range(abs(exp)):
    p *= b

if exp < 0:
    p = 1 / p

print(p)
```

**19. Solution**

---

```
msg = input("Enter a message: ")

characters = len(msg)
count = 0
for i in range(characters):
    if msg[i] == " ":
        count += 1

words = count + 1

print("The message entered contains", words, "words")
```

**20. Solution**

---

```
msg = input("Enter a message: ")

characters = len(msg)
count = 0
for i in range(characters):
    if msg[i] == " ":
        count += 1

words = count + 1

print("The average number of letters in each word is", (characters - count) / words)
```

**21. Solution**

---

```
consonants = "BCDFGHJKLMNPQRSTVWXYZ"

message = input("Enter an English message: ")

count = 0
for character in message:
    if character.upper() in consonants:
```

```
    count += 1  
  
print("Consonants:", count)
```

## 22. Solution

---

```
vowels = "AEIOU"  
consonants = "BCDFGHJKLMNPQRSTVWXYZ"  
digits = "0123456789"  
  
message = input("Enter an English message: ")  
  
countv = countc = countd = 0  
for character in message:  
    if character.upper() in vowels:  
        countv += 1  
    elif character.upper() in consonants:  
        countc += 1  
    elif character in digits: #No need to use the upper() method for digits  
        countd += 1  
  
print("Vowels:", countv)  
print("Consonants:", countc)  
print("Digits:", countd)
```

# Chapter 26

## 26.3 Review Questions: True/False

- |          |          |
|----------|----------|
| 1. true  | 6. false |
| 2. true  | 7. true  |
| 3. false | 8. true  |
| 4. true  | 9. true  |
| 5. true  | 10. true |

## 26.4 Review Questions: Multiple Choice

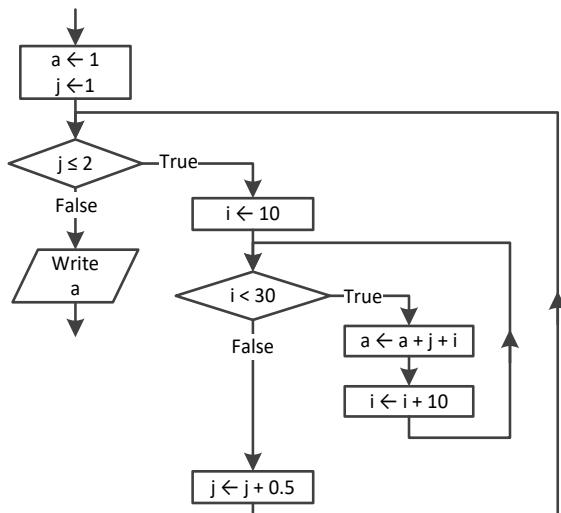
- |      |      |
|------|------|
| 1. b | 4. a |
| 2. a | 5. b |
| 3. c |      |

## 26.5 Review Exercises

### 1. Solution

- i. 10
- ii. 50
- iii. -7 (or -8)
- iv. 138 (or 137)

### 2. Solution



Step	Statement	a	i	j
1	$a = 1$	1	?	?
2	$j = 1$	1	?	1
3	$j \leq 2$	True		
4	$i = 10$	1	10	1

<b>5</b>	$i < 30$	True		
<b>6</b>	$a = a + j + i$	<b>12</b>	10	1
<b>7</b>	$i += 10$	12	<b>20</b>	1
<b>8</b>	$i < 30$	True		
<b>9</b>	$a = a * j + i$	<b>33</b>	20	1
<b>10</b>	$i += 10$	33	<b>30</b>	1
<b>11</b>	$i < 30$	False		
<b>12</b>	$j += 0.5$	33	30	<b>1.5</b>
<b>13</b>	$j \leq 2$	True		
<b>14</b>	$i = 10$	33	<b>10</b>	1.5
<b>15</b>	$i < 30$	True		
<b>16</b>	$a = a + j + i$	<b>44.5</b>	10	1.5
<b>17</b>	$i += 10$	44.5	<b>20</b>	1.5
<b>18</b>	$i < 30$	True		
<b>19</b>	$a = a * j + i$	<b>66</b>	20	1.5
<b>20</b>	$i += 10$	66	<b>30</b>	1.5
<b>21</b>	$i < 30$	False		
<b>22</b>	$j += 0.5$	66	30	<b>2</b>
<b>23</b>	$j \leq 2$	True		
<b>24</b>	$i = 10$	66	<b>10</b>	2
<b>25</b>	$i < 30$	True		
<b>26</b>	$a = a + j + i$	<b>78</b>	10	2
<b>27</b>	$i += 10$	78	<b>20</b>	2
<b>28</b>	$i < 30$	True		
<b>29</b>	$a = a * j + i$	<b>100</b>	20	2
<b>30</b>	$i += 10$	100	<b>30</b>	2
<b>31</b>	$i < 30$	False		
<b>32</b>	$j += 0.5$	100	30	<b>2.5</b>
<b>33</b>	$j \leq 2$	False		
<b>34</b>	<code>print(a)</code>	It displays: 100		

### 3. Solution

Step	Statement	s	i	j
<b>1</b>	$s = 0$	<b>0</b>	?	?
<b>2</b>	$i = 1$	0	<b>1</b>	?
<b>3</b>	$j = 3$	0	1	<b>3</b>

<b>4</b>	<code>s = s + i * j</code>	<b>3</b>	1	3
<b>5</b>	<code>j = 2</code>	3	1	<b>2</b>
<b>6</b>	<code>s = s + i * j</code>	<b>5</b>	1	2
<b>7</b>	<code>j = 1</code>	5	1	<b>1</b>
<b>8</b>	<code>s = s + i * j</code>	<b>6</b>	1	1
<b>9</b>	<code>i = 2</code>	6	<b>2</b>	1
<b>10</b>	<code>j = 3</code>	6	2	<b>3</b>
<b>11</b>	<code>s = s + i * j</code>	<b>12</b>	2	3
<b>12</b>	<code>j = 2</code>	12	2	<b>2</b>
<b>13</b>	<code>s = s + i * j</code>	<b>16</b>	2	2
<b>14</b>	<code>i = 3</code>	16	<b>3</b>	2
<b>15</b>	<code>j = 3</code>	16	3	<b>3</b>
<b>16</b>	<code>s = s + i * j</code>	<b>25</b>	3	3
<b>17</b>	<code>i = 4</code>	25	<b>4</b>	3
<b>18</b>	<code>print(s)</code>	It displays: 25		

The statement `s = s + i * j` is executed 6 times

#### 4. Solution

---

For input value of "NO"

Step	Statement	s	y	i	ans
<b>1</b>	<code>s = 1</code>	<b>1</b>	?	?	?
<b>2</b>	<code>y = 25</code>	1	<b>25</b>	?	?
<b>3</b>	<code>i = 1</code>	1	25	<b>1</b>	?
<b>4</b>	<code>s = s + y</code>	<b>26</b>	25	1	?
<b>5</b>	<code>y -= 5</code>	26	<b>20</b>	1	?
<b>6</b>	<code>i = 2</code>	26	20	<b>2</b>	?
<b>7</b>	<code>s = s + y</code>	<b>46</b>	20	2	?
<b>8</b>	<code>y -= 5</code>	46	<b>15</b>	2	?
<b>9</b>	<code>i = 3</code>	46	15	<b>3</b>	?
<b>10</b>	<code>s = s + y</code>	<b>61</b>	15	3	?
<b>11</b>	<code>y -= 5</code>	61	<b>10</b>	3	?
<b>12</b>	<code>ans = input()</code>	61	10	3	"NO"
<b>13</b>	<code>if ans != "YES": break</code>	True			
<b>14</b>	<code>print(s)</code>	It displays: 61			

For input values of "YES", "NO"

Step	Statement	s	y	i	ans
1	s = 1	1	?	?	?
2	y = 25	1	25	?	?
3	i = 1	1	25	1	?
4	s = s + y	26	25	1	?
5	y -= 5	26	20	1	?
6	i = 2	26	20	2	?
7	s = s + y	46	20	2	?
8	y -= 5	46	15	2	?
9	i = 3	46	15	3	?
10	s = s + y	61	15	3	?
11	y -= 5	61	10	3	?
12	ans = input()	61	10	3	"YES"
13	if ans != "YES": break				False
14	i = 1	61	10	1	"YES"
15	s = s + y	71	10	1	"YES"
16	y -= 5	71	5	1	"YES"
17	i = 2	71	5	2	"YES"
18	s = s + y	76	5	2	"YES"
19	y -= 5	76	0	2	"YES"
20	i = 3	76	0	3	"YES"
21	s = s + y	76	0	3	"YES"
22	y -= 5	76	-5	3	"YES"
23	ans = input()	76	-5	3	"NO"
24	if ans != "YES": break				True
25	print(s)				It displays: 76

For input values of "YES", "YES", "NO"

Step	Statement	s	y	i	ans
1	s = 1	1	?	?	?
2	y = 25	1	25	?	?
3	i = 1	1	25	1	?
4	s = s + y	26	25	1	?
5	y -= 5	26	20	1	?
6	i = 2	26	20	2	?
7	s = s + y	46	20	2	?

<b>8</b>	y -= 5	46	<b>15</b>	2	?
<b>9</b>	i = 3	46	15	<b>3</b>	?
<b>10</b>	s = s + y	<b>61</b>	15	3	?
<b>11</b>	y -= 5	61	<b>10</b>	3	?
<b>12</b>	ans = input()	61	10	3	"YES"
<b>13</b>	if ans != "YES": break		False		
<b>14</b>	i = 1	61	10	<b>1</b>	"YES"
<b>15</b>	s = s + y	<b>71</b>	10	1	"YES"
<b>16</b>	y -= 5	71	<b>5</b>	1	"YES"
<b>17</b>	i = 2	71	5	<b>2</b>	"YES"
<b>18</b>	s = s + y	<b>76</b>	5	2	"YES"
<b>19</b>	y -= 5	76	<b>0</b>	2	"YES"
<b>20</b>	i = 3	76	0	<b>3</b>	"YES"
<b>21</b>	s = s + y	<b>76</b>	0	3	"YES"
<b>22</b>	y -= 5	76	<b>-5</b>	3	"YES"
<b>23</b>	ans = input()	76	-5	3	"YES"
<b>24</b>	if ans != "YES": break		False		
<b>25</b>	i = 1	76	-5	<b>1</b>	"YES"
<b>26</b>	s = s + y	<b>71</b>	-5	1	"YES"
<b>27</b>	y -= 5	71	<b>-10</b>	1	"YES"
<b>28</b>	i = 2	71	-10	<b>2</b>	"YES"
<b>29</b>	s = s + y	<b>61</b>	-10	2	"YES"
<b>30</b>	y -= 5	61	<b>-15</b>	2	"YES"
<b>31</b>	i = 3	61	-15	<b>3</b>	"YES"
<b>32</b>	s = s + y	<b>46</b>	-15	3	"YES"
<b>33</b>	y -= 5	46	<b>-20</b>	3	"YES"
<b>34</b>	ans = input()	46	-20	3	"NO"
<b>35</b>	if ans != "YES": break		True		
<b>36</b>	print(s)		It displays: 46		

## 5. Solution

```
for hour in range(24):
    for minutes in range(60):
        print(hour, "\t", minutes)
```

## 6. Solution

```
for i in range(5, 0, -1):
```

```
for j in range(i):
    print(i, end = "")
print()
```

## 7. Solution

---

```
for i in range(6):
    for j in range(i + 1):
        print(j, end = "")
    print()
```

## 8. Solution

---

### First approach - Using nested loop control structures

```
for i in range(4):
    for j in range(10):
        print("* ", end = "")
    print()
```

### Second approach - Without using any loop control structures (The amateur way!!!)

```
print("* * * * * * * * * *")
print("* * * * * * * * * *")
print("* * * * * * * * * *")
print("* * * * * * * * * *")
```

### Third approach - Without using any loop control structures (The Pythonic way!!!)

```
print("* " * 10)
print("* " * 10)
print("* " * 10)
print("* " * 10)
```

### Fourth approach - Without using any loop control structures (The Pythonic way No 2!!!)

```
print(((* " " * 10) + "\n") * 4)
```

## 9. Solution

---

### First approach - Using nested loop control structures

```
y = int(input("Enter an integer between 3 and 20: "))

for i in range(y):
    for j in range(y):
        print("* ", end = "")
    print()
```

### Second approach - Using one single loop control structure

```
y = int(input("Enter an integer between 3 and 20: "))

for i in range(y):
    print("* " * y)
```

### Third approach - Without using any loop control structures (The Pythonic way!!!)

```
y = int(input("Enter an integer between 3 and 20: "))
```

```
print((( "*" * y) + "\n") * y)
```

## 10. Solution

---

### First approach - Using nested loop control structures

```
y = int(input("Enter an integer between 3 and 20: "))

for j in range(y):
    print("* ", end = "")
print()

for i in range(y - 2):
    print("* ", end = "")
    for j in range(y - 2):
        print(" ", end = "")
    print("* ")

for j in range(y):
    print("* ", end = "")
```

### Second approach - Without using any loop control structures (The Pythonic way!!!)

```
y = int(input("Enter an integer between 3 and 20: "))

print(( "*" * y) + "\n" + (( "*" + " " * (y - 2)) + "* \n") * (y - 2) + ("*" * y))
```

## 11. Solution

---

### First approach - Using nested loop control structures

```
for i in range(1, 5):
    for j in range(i):
        print("* ", end = "")
    print()

for i in range(5, 0, -1):
    for j in range(i):
        print("* ", end = "")
    print()
```

### Second approach - Using just one for-loop (The Pythonic way!!!)

```
for i in [1, 2, 3, 4, 5, 4, 3, 2, 1]:
    print("* " * i)
```

# Chapter 27

---

## 27.8 Review Questions: True/False

- |          |           |
|----------|-----------|
| 1. false | 8. false  |
| 2. false | 9. true   |
| 3. false | 10. true  |
| 4. true  | 11. false |
| 5. true  | 12. false |
| 6. false | 13. false |
| 7. false | 14. true  |

## 27.9 Review Questions: Multiple Choice

- |      |      |
|------|------|
| 1. c | 5. a |
| 2. d | 6. c |
| 3. b | 7. c |
| 4. a |      |

## 27.10 Review Exercises

### 1. Solution

---

```
count_names = 0
count_not_johns = 0

name = ""
name = input("Enter a name: ")
while name != "STOP":
    name = input("Enter a name: ")
    count_names += 1
    if name != "John":
        count_not_johns += 1
    name = input("Enter a name: ")

print(count_names, "names entered")
print("Names other than John entered", count_not_johns, "times")
```

### 2. Solution

---

#### First approach

```
text = input("Enter a text: ")

found = False
for character in text:
    if character == " ":
        found = True
        break

if found == False:
    print("One Single Word")
```

```
    else:  
        print("Complete Sentence")
```

### Second approach

```
text = input("Enter a text: ")  
  
if text.find(" ") == -1:  
    print("One Single Word")  
else:  
    print("Complete Sentence")
```

### Third approach

```
text = input("Enter a text: ")  
  
if " " not in text:  
    print("One Single Word")  
else:  
    print("Complete Sentence")
```

## 3. Solution

---

### First approach

```
sentence = input("Enter a sentence: ")  
  
found = False  
for character in sentence:  
    if character in "0123456789":  
        found = True  
        break  
  
if found:  
    print("The sentence contains a number")
```

### Second approach

```
sentence = input("Enter a sentence: ")  
  
found = False  
for digit in "0123456789":  
    if digit in sentence:  
        found = True  
        break  
  
if found:  
    print("The sentence contains a number")
```

## 4. Solution

---

```
print("Printing all integers from 1 to 100")  
i = 1  
while i < 101:  
    print(i)  
    i += 1
```

### 5. Solution

---

```
print("Printing odd integers from 1 to 99")
i = 1
while not(i > 100):
    print(i)
    i += 2
```

### 6. Solution

---

```
s = 0
for i in range(100):
    number = float(input())
    s = s + number
average = s / 100
print(average)
```

### 7. Solution

---

```
s = 0

denom = 1
for j in range(1, 101):
    denom *= j

for i in range(1, 101):
    s += i / denom
print(s)
```

### 8. Solution

---

```
for i in range(1, 5):
    for j in range(1, 5):
        print(i, "x", j, "=", (i * j))
```

### 9. Solution

---

```
print("\t|\t", end = "")
for i in range(1, 13):
    print(i, "\t", end = "")
print()

for i in range(1, 13):
    print("-----", end = "")
print()

for i in range(1, 13):
    print(i, "\t|\t", end = "")
    for j in range(1, 13):
        print(i * j, end = "\t")
    print()
```

**10. Solution**

```
n = int(input("Enter an integer: "))

print("\t|\t", end = "")
for i in range(1, n + 1):
    print(i, "\t", end = "")
print()

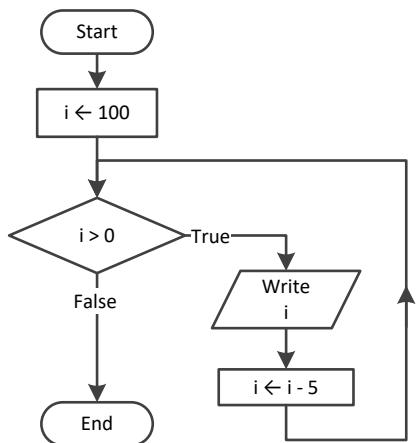
for i in range(n + 1):
    print("-----", end = "")
print()

for i in range(1, n + 1):
    print(i, "\t|\t", end = "")
    for j in range(1, n + 1):
        print(i * j, end = "\t")
    print()
```

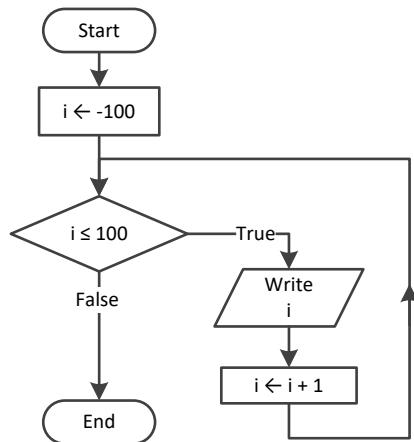
# Chapter 28

## 28.4 Review Exercises

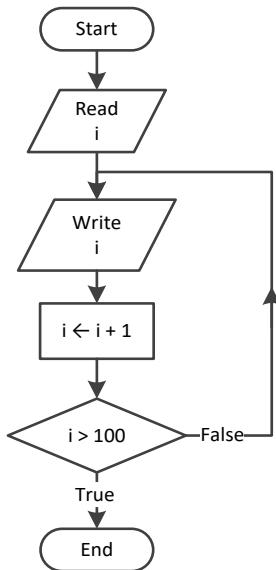
### 1. Solution



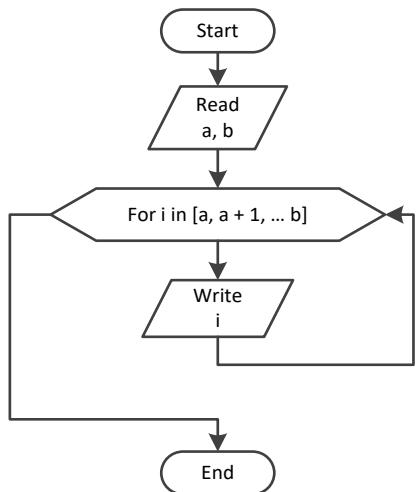
### 2. Solution



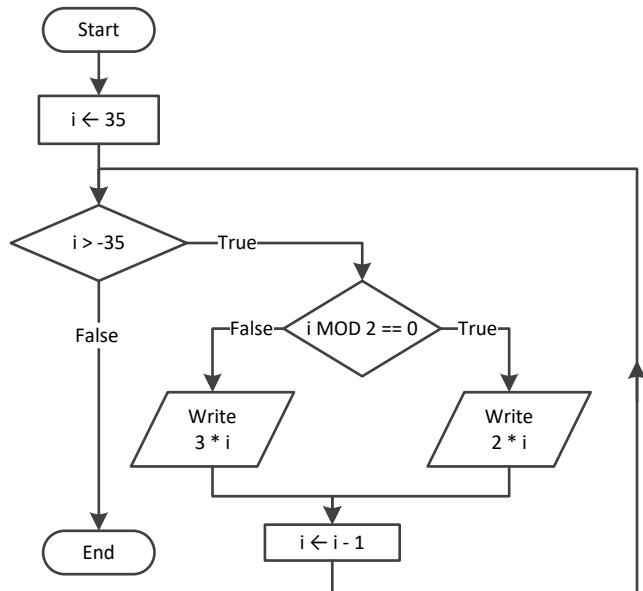
### 3. Solution



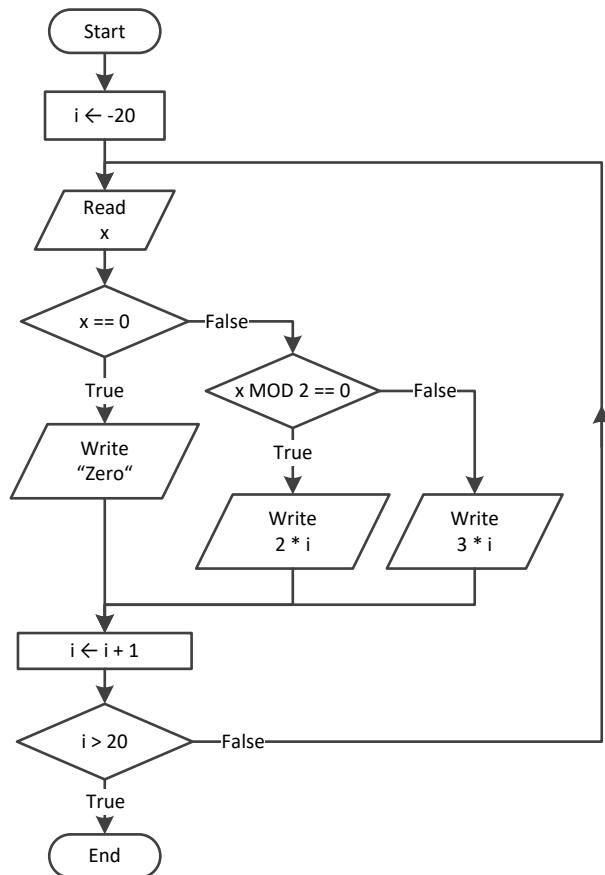
### 4. Solution



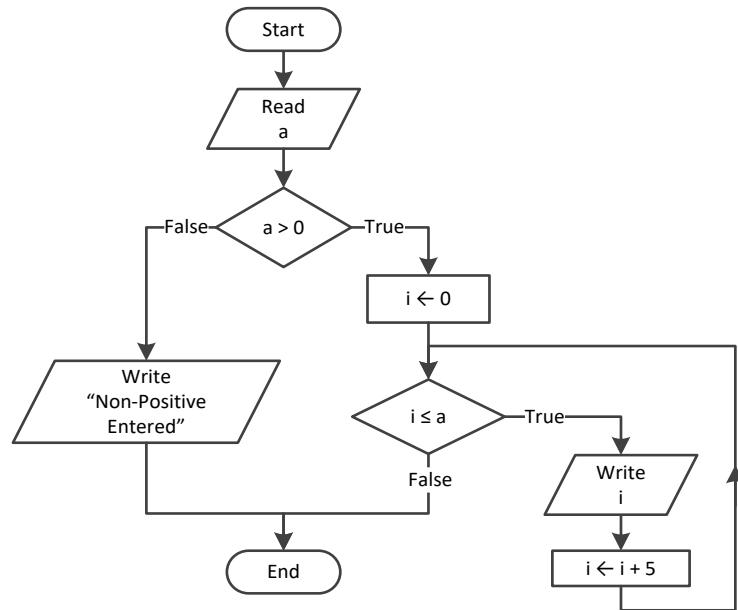
## 5. Solution



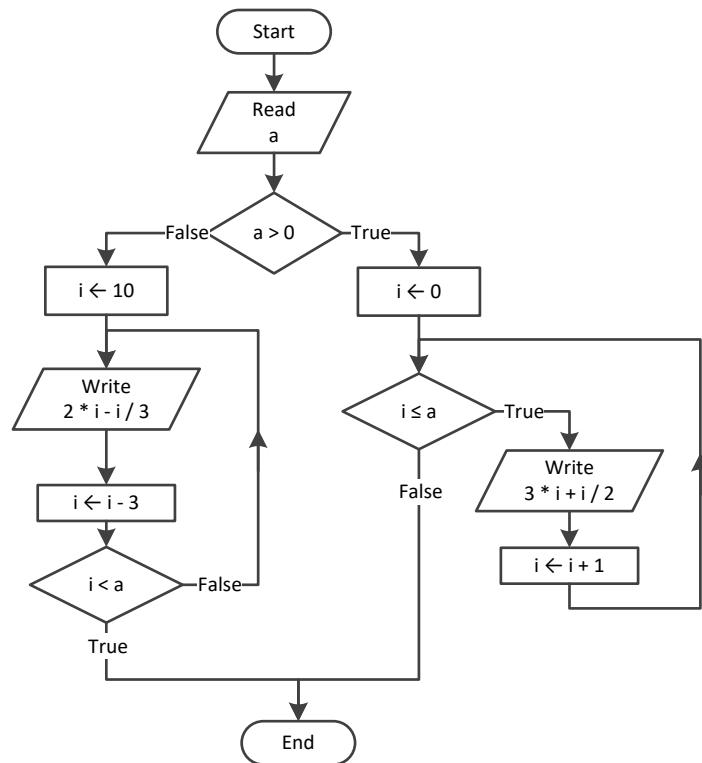
## 6. Solution

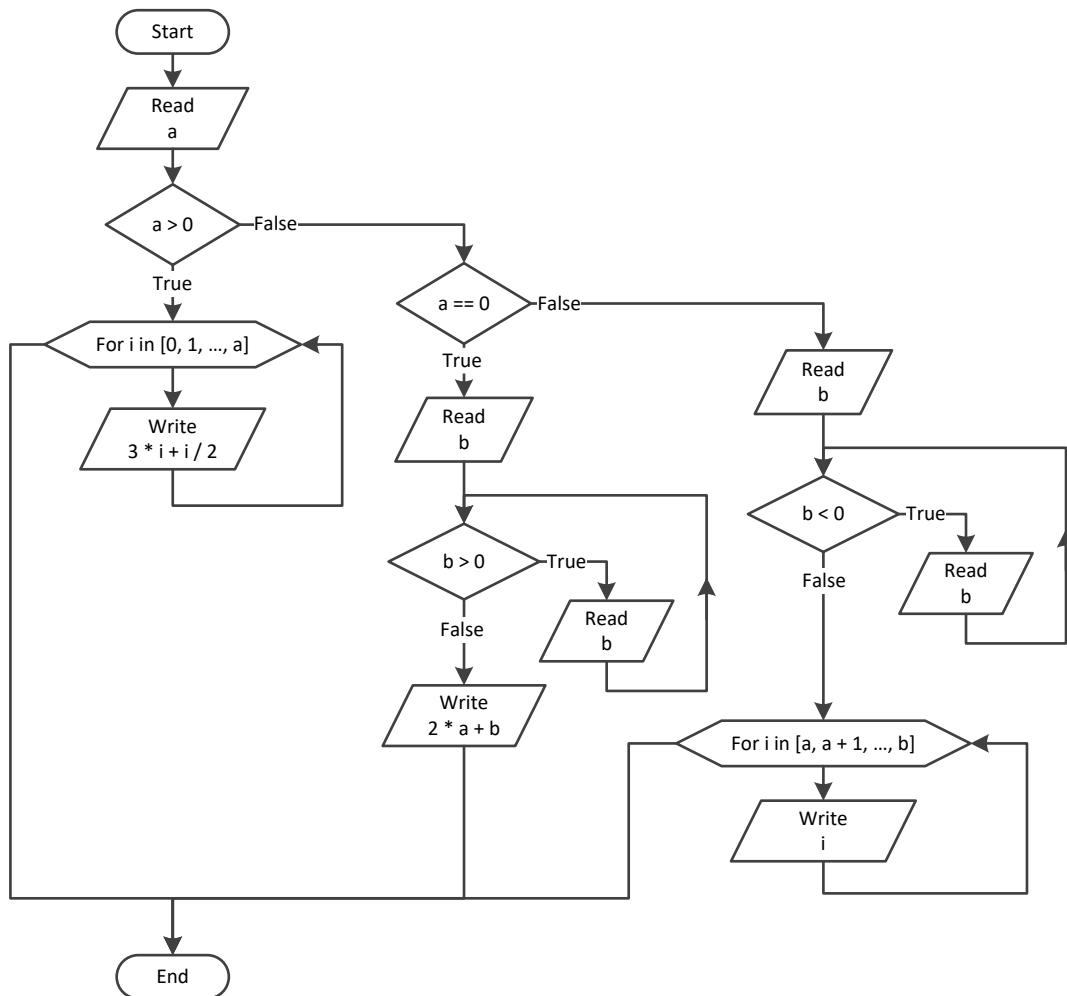


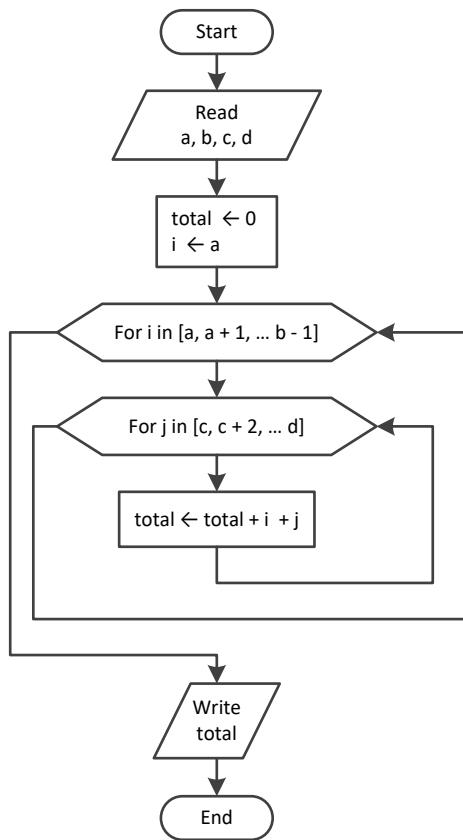
### 7. Solution

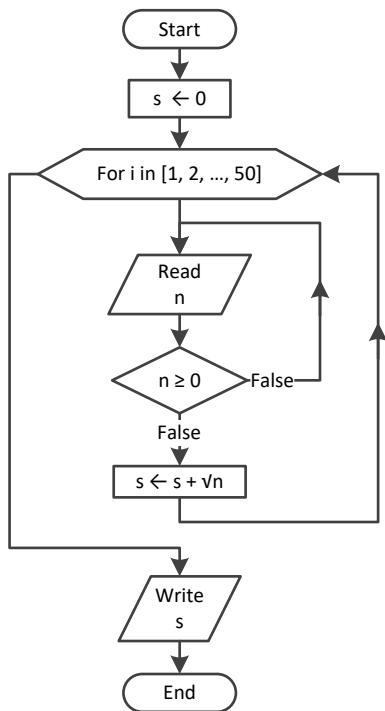
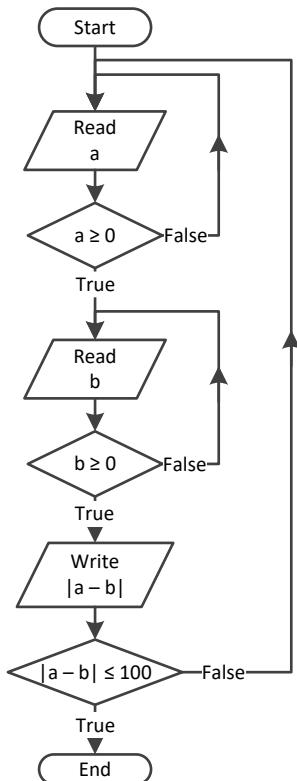


### 8. Solution

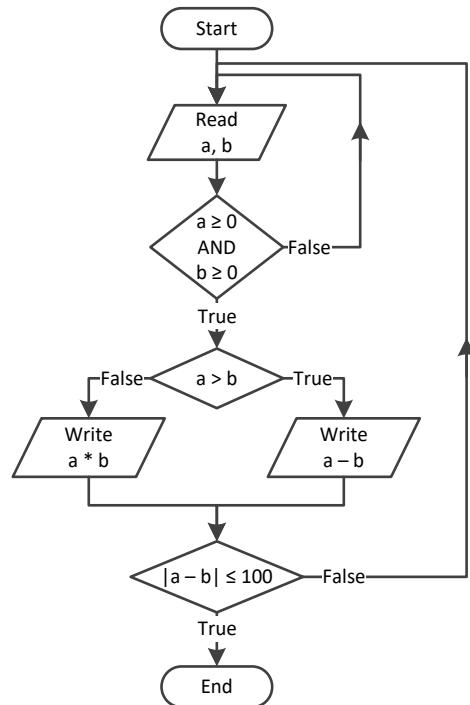


**9. Solution**

**10. Solution**

**11. Solution****12. Solution**

### 13. Solution



### 14. Solution

```

i = 1
while True:
    print(i)
    i += 5
    if i > 500: break
print("The End")
  
```

### 15. Solution

```

i = 0
a = int(input())
while True:
    if i % 2 != 0:
        print(i)
    i += 5
    if i >= a: break
  
```

### 16. Solution

```

a = int(input())
while a != -1:
    while True:
        b = int(input())
        if b > a: break
  
```

```
i = a
while i <= b:
    print(i)
    i += 1
a = int(input())
```

### 17. Solution

---

```
i = 1
S = 0
P = 1
a = 0
while True:
    if i < 45:
        S += a
    else:
        P *= a
    i += 1
    if i >= 90: break
    a = float(input())

print(S, P)
```

# Chapter 29

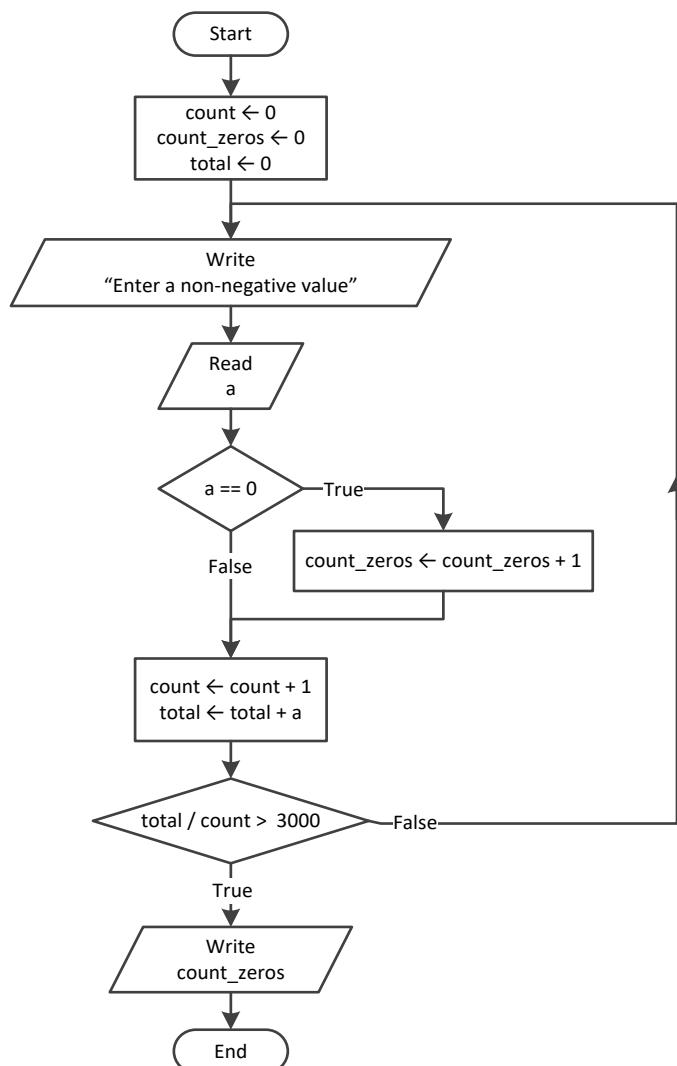
---

## 29.7 Review Questions: True/False

- |          |          |
|----------|----------|
| 1. true  | 6. false |
| 2. false | 7. false |
| 3. false | 8. false |
| 4. true  | 9. true  |
| 5. false |          |

## 29.8 Review Exercises

### 1. Solution



```
count = 0
count_zeros = 0
total = 0

while True:
    a = float(input("Enter a non-negative value: "))
    if a == 0:
        count_zeros += 1
    count += 1
    total += a
    if total / count > 3000: break

print(count_zeros)
```

## 2. Solution

---

### First approach

```
a = int(input("Enter an integer between 1 and 20: "))
for i in range(1000, 10000):
    d4 = i % 10
    r = i // 10
    d3 = r % 10
    r = r // 10
    d2 = r % 10
    d1 = r // 10
    if d1 + d2 + d3 + d4 < a:
        print(i)
```

However, using the `divmod()` function, it can become:

```
a = int(input("Enter an integer between 1 and 20: "))
for i in range(1000, 10000):
    r, d4 = divmod(i, 10)
    r, d3 = divmod(r, 10)
    d1, d2 = divmod(r, 10)

    if d1 + d2 + d3 + d4 < a:
        print(i)
```

### Second approach

```
a = int(input("Enter an integer between 1 and 20: "))
for d1 in range(1, 10):
    for d2 in range(10):
        for d3 in range(10):
            for d4 in range(10):
                if d1 + d2 + d3 + d4 < a:
                    print(d1 * 1000 + d2 * 100 + d3 * 10 + d4)
```

### Third approach

```
a = int(input("Enter an integer between 1 and 20: "))
for i in range(1000, 10000):
    d1, d2, d3, d4 = str(i)           #d1, d2, d3, d4 are strings
    if int(d1) + int(d2) + int(d3) + int(d4) < a: #In order to sum the digits, convert to integer
        print(i)
```

## 3. Solution

---

### First approach

```
for i in range(1000, 10000):
    d1 = i // 1000
    r = i % 1000
    d2 = r // 100
    r = r % 100
    d3 = r // 10
    d4 = r % 10
```

```

if d1 > d2 and d2 == d3 and d3 < d4:
    print(i)

```

However, using the `divmod()` function, it can become:

```

for i in range(1000, 10000):
    d1, r = divmod(i, 1000)
    d2, r = divmod(r, 100)
    d3, d4 = divmod(r, 10)
    if d1 > d2 and d2 == d3 and d3 < d4:
        print(i)

```

### Second approach

```

for d1 in range(1, 10):
    for d2 in range(10):
        for d3 in range(10):
            for d4 in range(10):
                if d1 > d2 and d2 == d3 and d3 < d4:
                    print(d1 * 1000 + d2 * 100 + d3 * 10 + d4)

```

### Third approach

```

for i in range(1000, 10000):
    d1, d2, d3, d4 = str(i)           #d1, d2, d3, d4 are strings
    if d1 > d2 and d2 == d3 and d3 < d4:   #No need to convert to integer. Compare them as strings
        print(i)

```

## 4. Solution

---

### First approach

```

x = int(input("Enter a number: "))
count = 0

while x != 0:
    count += 1
    x = x // 10

print(count)

```

### Second approach

```

x = int(input("Enter a number: "))
#Convert the absolute value of x to string and get its length
count = len(str(abs(x)))
print(count)

```

## 5. Solution

---

```

x = int(input())
while x != 1 and x != 0:
    print("Error")
    x = int(input())

```

## 6. Solution

---

```

while True:

```

```
gender = input()
if gender.upper() == "M" or gender.upper() == "F": break
```

## 7. Solution

---

```
import math

x = int(input("Enter a non-negative number: "))
count = 0
while x < 0:
    count += 1
    if count == 2: break

    print("Error: Invalid number!")
    x = int(input("Enter a non-negative number: "))

if count < 2:
    y = math.sqrt(x)
    print(y)
else:
    print("Dude, you are dumb!")
```

## 8. Solution

---

```
import math

while True:
    r = float(input("Enter the length of a radius: "))
    while r <= 0:
        r = float(input("Invalid radius. Enter the length of a radius: "))

    area = math.pi * r ** 2
    print("The area is:", area)

    answer = input("Would you like to repeat? ")
    if answer.upper() != "YES": break
```

## 9. Solution

---

```
for x in range(-100, 101):
    for y in range(-100, 101):
        if 5 * x + 3 * y ** 2 == 0:
            print(x, ",", y)
```

## 10. Solution

---

```
for x in range(-10, 11):
    for y in range(-10, 11):
        for z in range(-10, 11):
            if (x + y) / 2 + 3 * z ** 2 / (x + 3 * y + 45) == x / 3:
```

```
    print(x, ", ", y, ", ", z)
```

### 11. Solution

---

```
m1 = int(input())
m2 = int(input())
m3 = int(input())

s = 0
while m2 != 0:
    if m2 % 2 != 0:
        s += m1
    m1 *= 2
    m2 = m2 // 2

m1 = s
m2 = m3

s = 0
while m2 != 0:
    if m2 % 2 != 0:
        s += m1
    m1 *= 2
    m2 = m2 // 2

print(s)
```

### 12. Solution

---

```
x = int(input())
while x <= 0:
    print("Error! You must enter a positive integer")
    x = int(input())

number_of_divisors = 2
for i in range(2, x // 2 + 1):
    if x % i == 0:
        number_of_divisors += 1

print(number_of_divisors)
```

### 13. Solution

---

```
x = int(input("Enter an integer greater than 1: "))
while x <= 1:
    print("Error!")
    x = int(input("Enter an integer greater than 1: "))

number_of_divisors = 2
for i in range(2, x // 2 + 1):
```

```

if x % i == 0:
    number_of_divisors += 1
    break

if number_of_divisors == 2:
    print("Number", x, "is prime")

```

#### 14. Solution

---

```

a = int(input("Enter an integer greater than 1: "))
while a < 2:
    a = int(input("Wrong number. Please enter an integer greater than 1: "))

b = int(input("Enter a second integer greater than 1: "))
while b < 2:
    b = int(input("Wrong number. Please enter a second integer greater than 1: "))

if a > b:
    c = a          # Or you can do the following:
    a = b          # a, b = b, a
    b = c

for x in range(a, b + 1):
    number_of_divisors = 2
    i = 2
    while i <= x // 2 and number_of_divisors == 2:
        if x % i == 0:
            number_of_divisors += 1
        i += 1
    if number_of_divisors == 2:
        print("Number", x, "is prime")

```

#### 15. Solution

---

##### First approach

```

a = int(input("Enter a positive four-digit integer: "))
while a < 1000 or a > 9999:
    a = int(input("Wrong number. Please enter a positive four-digit integer: "))

b = int(input("Enter a second positive four-digit integer: "))
while b < 1000 or b > 9999:
    b = int(input("Wrong number. Please enter a second positive four-digit integer: "))

if a > b:
    c = a          # Or you can do the following:
    a = b          # a, b = b, a
    b = c

for x in range(a, b + 1):
    r, d4 = divmod(x, 10)

```

```

r, d3 = divmod(r, 10)
d1, d2 = divmod(r, 10)

if d1 == d4 and d2 == d3:
    print(x)

```

**Second approach**

```

a = int(input("Enter a positive four-digit integer: "))
while a < 1000 or a > 9999:
    a = int(input("Wrong number. Please enter a positive four-digit integer: "))

b = int(input("Enter a second positive four-digit integer: "))
while b < 1000 or b > 9999:
    b = int(input("Wrong number. Please enter a second positive four-digit integer: "))

if a > b:
    a, b = b, a

for x in range(a, b + 1):
    if str(x) == str(x)[::-1]:
        print(x)

```

**16. Solution**

```

for i in range(31):
    print(2 ** i)

```

**17. Solution**

```

offset = 10
i = 1
while i <= 401:
    print(i)
    i += offset
    offset += 2

```

**18. Solution**

```

for i in range(1, 101):
    print(-i, "\n", i)

```

**19. Solution****First approach**

```

value = 0
for i in range(8):
    offset = 10 ** i
    value += offset
    print(value)

```

**Second approach**

```

value = "1"

```

```
for i in range(8):
    print(value)
    value += "1"
```

## 20. Solution

---

### First approach

```
a = int(input())

fib_prev_prev = 0
fib_prev = 1
fib = 1
for i in range(a):
    print(fib)
    fib = fib_prev + fib_prev_prev
    fib_prev_prev = fib_prev
    fib_prev = fib
```

### Second approach

```
a = int(input())

fib_prev_prev, fib_prev, fib = 0, 1, 1
for i in range(a):
    print(fib)
    fib = fib_prev + fib_prev_prev
    fib_prev_prev, fib_prev = fib_prev, fib
```

## 21. Solution

---

### First approach

```
a = int(input())

fib_prev_prev = 0
fib_prev = 1
fib = 1
while fib < a:
    print(fib)
    fib = fib_prev + fib_prev_prev
    fib_prev_prev = fib_prev
    fib_prev = fib
```

### Second approach

```
a = int(input())

fib_prev_prev, fib_prev, fib = 0, 1, 1
while fib < a:
    print(fib)
    fib = fib_prev + fib_prev_prev
    fib_prev_prev, fib_prev = fib_prev, fib
```

## 22. Solution

---

```
n = int(input("Enter a positive integer: "))
while n <= 0:
    n = int(input("Wrong number. Please enter a positive integer: "))

nominator = 0
for i in range(2, 2 * n + 2, 2):
    nominator += i

denominator = 1
for i in range(1, n + 1):
    denominator *= i

y = nominator / denominator
print(y)
```

## 23. Solution

---

```
n = int(input("Enter a positive integer: "))
while n <= 0:
    n = int(input("Wrong number. Please enter a positive integer: "))

nominator = 0
sign = 1
for i in range(1, 2 * n + 1 + 2, 2):
    nominator += sign * i
    sign = -sign

y = nominator / n
print(y)
```

## 24. Solution

---

```
n = int(input("Enter a positive integer: "))
while n <= 0:
    n = int(input("Wrong number. Please enter a positive integer: "))

y = 0.5 #This is equal to the first two terms: 1 - 1 / 2

sign = 1
for i in range(3, n + 2, 2):
    y += sign / i
    sign = -sign

print(y)
```

## 25. Solution

---

```
n = int(input("Enter a positive integer: "))
```

```
while n <= 0:  
    n = int(input("Wrong number. Please enter a positive integer: "))  
  
y = 0  
for i in range(1, n + 1):  
    y += 1 / i ** (n - i + 1)  
  
print(y)
```

## 26. Solution

```
n = int(input("Enter a non-negative integer: "))  
  
factorial = 1  
for i in range(1, n + 1):  
    factorial *= i  
  
print(factorial)
```



Please note that this Python code operates properly for all non-negative integers, including zero.

## 27. Solution

### First approach

```
ACCURACY = 0.00001  
  
x = float(input())  
  
exponential = 0  
i = 0  
while True:  
    exponential_previous = exponential  
  
    factorial = 1  
    for j in range(1, i + 1):  
        factorial *= j  
  
    exponential += x ** i / factorial  
  
    i += 1  
    if abs(exponential - exponential_previous) <= ACCURACY: break  
  
print("e(", x, ") ~=", exponential)
```

### Second approach

```
ACCURACY = 0.00001  
  
x = float(input())  
  
exponential = 1
```

```
i = 1
factorial = 1
while True:
    exponential_previous = exponential

    factorial *= i

    exponential += x ** i / factorial

    i += 1
    if abs(exponential - exponential_previous) <= ACCURACY: break

print("e(", x, ") ~=", exponential)
```

## 28. Solution

---

### First approach

```
ACCURACY = 0.00001

x = float(input())

sign = 1
sinus = 0
i = 1
while True:
    sinus_previous = sinus

    factorial = 1
    for j in range(1, i + 1):
        factorial *= j

    sinus += sign * x ** i / factorial

    sign = -sign
    i += 2
    if abs(sinus - sinus_previous) <= ACCURACY: break

print("sin(", x, ") ~=", sinus)
```

### Second approach

```
ACCURACY = 0.00001

x = float(input())

sign = -1
sinus = x
i = 3
factorial = 1
while True:
    sinus_previous = sinus
```

```
factorial *= i * (i - 1)

sinus += sign * x ** i / factorial

sign = -sign
i += 2
if abs(sinus - sinus_previous) <= ACCURACY: break

print("sin(", x, ") ~=", sinus)
```

## 29. Solution

---

### First approach

```
ACCURACY = 0.00001

x = float(input())

sign = 1
cosinus = 0
i = 0
while True:
    cosinus_previous = cosinus

    factorial = 1
    for j in range(1, i + 1):
        factorial *= j

    cosinus += sign * x ** i / factorial

    sign = -sign
    i += 2
    if abs(cosinus - cosinus_previous) <= ACCURACY: break

print("cos(", x, ") ~=", cosinus)
```

### Second approach

```
ACCURACY = 0.00001

x = float(input())

sign = -1
cosinus = 1
i = 2
factorial = 1
while True:
    cosinus_previous = cosinus

    factorial *= i * (i - 1)
```

```
cosinus += sign * x ** i / factorial  
  
sign = -sign  
i += 2  
if abs(cosinus - cosinus_previous) <= ACCURACY: break  
  
print("cos(", x, ") ~=", cosinus)
```

### 30. Solution

---

```
maximum = -460  
total = 0  
for i in range(31):  
    t = float(input("Enter temperature for day " + str(i + 1) + ": "))  
    while t < -459.67:  
        print("Error! Wrong temperature.")  
        t = float(input("Enter temperature for day " + str(i + 1) + ": "))  
  
    total += t  
    if t > maximum:  
        maximum = t  
  
print(total / 31, maximum)
```

### 31. Solution

---

```
level = float(input())  
if level != 9999:  
    hour = int(input())  
    minutes = int(input())  
  
    maximum = level  
    max_hour = hour  
    max_minutes = minutes  
  
    minimum = level  
    min_hour = hour  
    min_minutes = minutes  
  
    level = float(input())  
    while level != 9999:  
        hour = int(input())  
        minutes = int(input())  
  
        if level > maximum:  
            maximum = level  
            max_hour = hour  
            max_minutes = minutes  
  
        if level < minimum:
```

```
    minimum = level
    min_hour = hour
    min_minutes = minutes

    level = float(input())

    print(maximum, max_hour, max_minutes, minimum, min_hour, min_minutes)
```

### 32. Solution

---

```
import string

alphabet = string.ascii_lowercase

while True:
    a = int(input("Enter an integer between 1 and 26: "))

    failure = False
    if a < 1:
        print("Please enter positive integers!")
        failure = True
    elif a > 26:
        print("Please enter a value less than or equal to 26!")
        failure = True
    if not failure: break

while True:
    b = int(input("Enter an integer between 1 and 26: "))

    failure = False
    if b < 1:
        print("Please enter positive integers!")
        failure = True
    elif b > 26:
        print("Please enter a value less than or equal to 26!")
        failure = True
    if not failure: break

if a > b:
    a, b = b, a

for i in range(a, b + 1):
    print(alphabet[i - 1])
```

### 33. Solution

---

```
import random

secret_number = random.randrange(1, 101)
```

```
attempts = 1
guess = int(input("Enter a guess: "))
while guess != secret_number:
    if guess > secret_number:
        print("Your guess is bigger than my secret number. Try again.")
    else:
        print("Your guess is smaller than my secret number. Try again.")
    attempts += 1
    guess = int(input("Enter a guess: "))

print("You found it!")
print("Attempts:", attempts)
```

### 34. Solution

---

```
import random

for i in range(2):
    secret_number = random.randrange(1, 101)

    attempts = 1
    guess = int(input("Enter a guess: "))
    while guess != secret_number:
        if guess > secret_number:
            print("Your guess is bigger than my secret number. Try again.")
        else:
            print("Your guess is smaller than my secret number. Try again.")
        attempts += 1
        guess = int(input("Enter a guess: "))

    print("You found it!")
    print("Attempts:", attempts)

if i == 0:
    first_player_attempts = attempts

if first_player_attempts < attempts:
    print("First player wins!")
elif first_player_attempts > attempts:
    print("Second player wins!")
else:
    print("It's a draw")
```

### 35. Solution

---

```
while True:
    print("1. 4/3 TV Screen")
    print("2. 16/9 TV Screen")
    print("3. Exit")
    choice = int(input("Enter a choice: "))
```

```
if choice == 3:  
    break  
elif choice == 1:  
    diagonal = int(input("Enter diagonal: "))  
    print("Width:", diagonal * 0.8)  
    print("Height:", diagonal * 0.6)  
elif choice == 2:  
    diagonal = int(input("Enter diagonal: "))  
    print("Width:", diagonal * 0.87)  
    print("Height:", diagonal * 0.49)
```

### 36. Solution

```
n = int(input("Enter total number of students: "))  
while n <= 0:  
    n = int(input("Wrong number. Please enter total number of students: "))  
  
total = 0  
total_a = 0  
count_a = 0  
total_b = 0  
count_b = 0  
total_a_boys = 0  
count_a_boys = 0  
count_cdef_girls = 0  
  
maximum = -1  
minimum = 101  
  
for i in range(n):  
    grade = int(input("Enter grade for student No" + str(i + 1) + ": "))  
    while grade < 0 or grade > 100:  
        grade = int(input("Wrong grade. Please enter grade for student No" + str(i + 1) + ": "))  
  
    gender = input("Enter gender for student No" + str(i + 1) + ": ").upper()  
    while gender != "M" and gender != "F":  
        gender = input("Wrong gender. Please enter gender for student No" + str(i + 1) + ": ").upper()  
  
    if 90 <= grade <= 100:  
        total_a += grade  
        count_a += 1  
        if gender == "M":  
            total_a_boys += grade  
            count_a_boys += 1  
    elif 80 <= grade <= 89:  
        total_b += grade  
        count_b += 1  
    else:  
        if gender == "F":
```

```

        count_cdef_girls += 1

    if grade > maximum:
        maximum = grade

    if grade < minimum:
        minimum = grade

    total += grade

if count_a > 0:
    print("The average value of those who got an 'A' is: ")
    print(total_a / count_a)
if count_b > 0:
    print("The average value of those who got a 'B' is: ")
    print(total_b / count_b)
if count_a_boys > 0:
    print("The average value of boys who got an 'A' is: ")
    print(total_a_boys / count_a_boys)

print("The total number of girls that got less than 'B' is:", count_cdef_girls)
print("The highest grade is:", maximum)
print("The lowest grade is:", minimum)
print("The average grade of the whole class is:", total / n)

```

### 37. Solution

---

```

while True:
    amount = float(input("Enter amount: "))
    while amount <= 0:
        amount = float(input("Wrong amount. Please enter amount: "))

    if amount < 20:
        discount = 0
    elif amount < 50:
        discount = 3
    elif amount < 100:
        discount = 5
    else:
        discount = 10

    print("Discount:", discount, "%", sep = "")
    print("Amount to pay (discount included):", (amount - amount * discount / 100))

    answer = input("Would you like to repeat? ")
    if answer.upper() != "YES": break

```

### 38. Solution

---

```
TAX_RATE = 0.25
```

```
kwh = int(input("Enter number of Kilowatt-hours consumed: "))
while kwh < 0 and kwh != -1:
    kwh = int(input("Wrong value. Please enter number of Kilowatt-hours consumed: "))

while kwh != -1:
    if kwh <= 400:
        t = kwh * 0.11
    elif kwh <= 1500:
        t = 400 * 0.11 + (kwh - 400) * 0.22
    elif kwh <= 3500:
        t = 400 * 0.11 + 1100 * 0.22 + (kwh - 1500) * 0.25
    else:
        t = 400 * 0.11 + 1100 * 0.22 + 2000 * 0.25 + (kwh - 3500) * 0.50

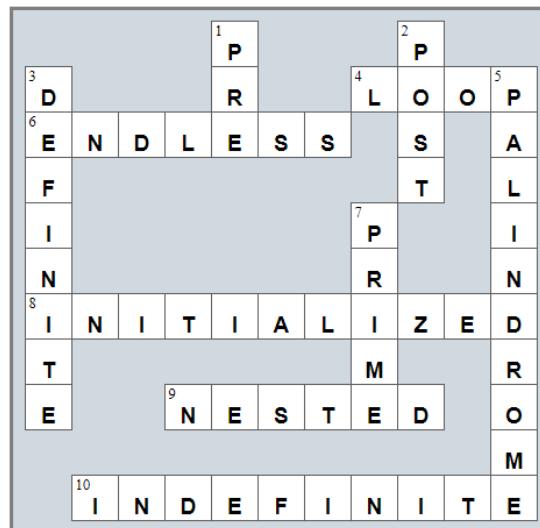
    t += t * TAX_RATE
    print("Total amount to pay (taxes included):", t)

kwh = int(input("Enter number of Kilowatt-hours consumed: "))
while kwh < 0 and kwh != -1:
    kwh = int(input("Wrong value. Please enter number of Kilowatt-hours consumed: "))
```

## Review in "Loop Control Structures"

### Review Crossword Puzzle

1.



# Chapter 30

---

## 30.15 Review Questions: True/False

- |           |           |
|-----------|-----------|
| 1. true   | 21. true  |
| 2. true   | 22. false |
| 3. false  | 23. true  |
| 4. false  | 24. false |
| 5. false  | 25. true  |
| 6. true   | 26. false |
| 7. false  | 27. false |
| 8. true   | 28. true  |
| 9. false  | 29. false |
| 10. true  | 30. true  |
| 11. true  | 31. true  |
| 12. true  | 32. false |
| 13. false | 33. false |
| 14. false | 34. true  |
| 15. false | 35. true  |
| 16. true  | 36. true  |
| 17. false | 37. false |
| 18. true  | 38. false |
| 19. true  | 39. true  |
| 20. false |           |

## 30.16 Review Questions: Multiple Choice

- |      |       |
|------|-------|
| 1. b | 8. d  |
| 2. a | 9. c  |
| 3. c | 10. a |
| 4. b | 11. b |
| 5. d | 12. a |
| 6. b | 13. b |
| 7. d | 14. b |

## 30.17 Review Exercises

### 1. Solution

---

Weights =

170	0	People
190	1	
193	2	
165	3	
200	4	

## 2. Solution

<b>Names =</b> <table border="1" style="border-collapse: collapse; width: 100%;"> <tr><td>John Thompson</td></tr> <tr><td>Chloe Brown</td></tr> <tr><td>Ryan Miller</td></tr> <tr><td>Antony Harris</td></tr> <tr><td>Alexander Lewis</td></tr> <tr><td>Samantha Clark</td></tr> <tr><td>Ava Parker</td></tr> </table>	John Thompson	Chloe Brown	Ryan Miller	Antony Harris	Alexander Lewis	Samantha Clark	Ava Parker	<b>Weights =</b> <table border="1" style="border-collapse: collapse; width: 100%;"> <tr><td>170</td></tr> <tr><td>190</td></tr> <tr><td>193</td></tr> <tr><td>165</td></tr> <tr><td>200</td></tr> <tr><td>170</td></tr> <tr><td>172</td></tr> </table>	170	190	193	165	200	170	172	<b>People</b> <table border="1" style="border-collapse: collapse; width: 100%; margin-left: 20px;"> <tr><td>0</td></tr> <tr><td>1</td></tr> <tr><td>2</td></tr> <tr><td>3</td></tr> <tr><td>4</td></tr> <tr><td>5</td></tr> <tr><td>6</td></tr> </table>	0	1	2	3	4	5	6
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Chloe Brown																							
Ryan Miller																							
Antony Harris																							
Alexander Lewis																							
Samantha Clark																							
Ava Parker																							
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193																							
165																							
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5																							
6																							

## 3. Solution

<b>Names =</b> <table border="1" style="border-collapse: collapse; width: 100%;"> <tr><td>Toba</td></tr> <tr><td>Issyk Kul</td></tr> <tr><td>Baikal</td></tr> <tr><td>Crater</td></tr> <tr><td>Karakul</td></tr> </table>	Toba	Issyk Kul	Baikal	Crater	Karakul	<b>Areas =</b> <table border="1" style="border-collapse: collapse; width: 100%;"> <tr><td>440</td><td>438</td><td>437</td></tr> <tr><td>2408</td><td>2405</td><td>2402</td></tr> <tr><td>12248</td><td>12247</td><td>12240</td></tr> <tr><td>21</td><td>20</td><td>18</td></tr> <tr><td>150</td><td>145</td><td>142</td></tr> </table>	440	438	437	2408	2405	2402	12248	12247	12240	21	20	18	150	145	142	<b>Months</b> <table border="1" style="border-collapse: collapse; width: 100%; margin-left: 20px;"> <tr><td>0</td></tr> <tr><td>1</td></tr> <tr><td>2</td></tr> </table>	0	1	2
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Baikal																									
Crater																									
Karakul																									
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2																									
3																									
4																									

June    July    August

## 4. Solution

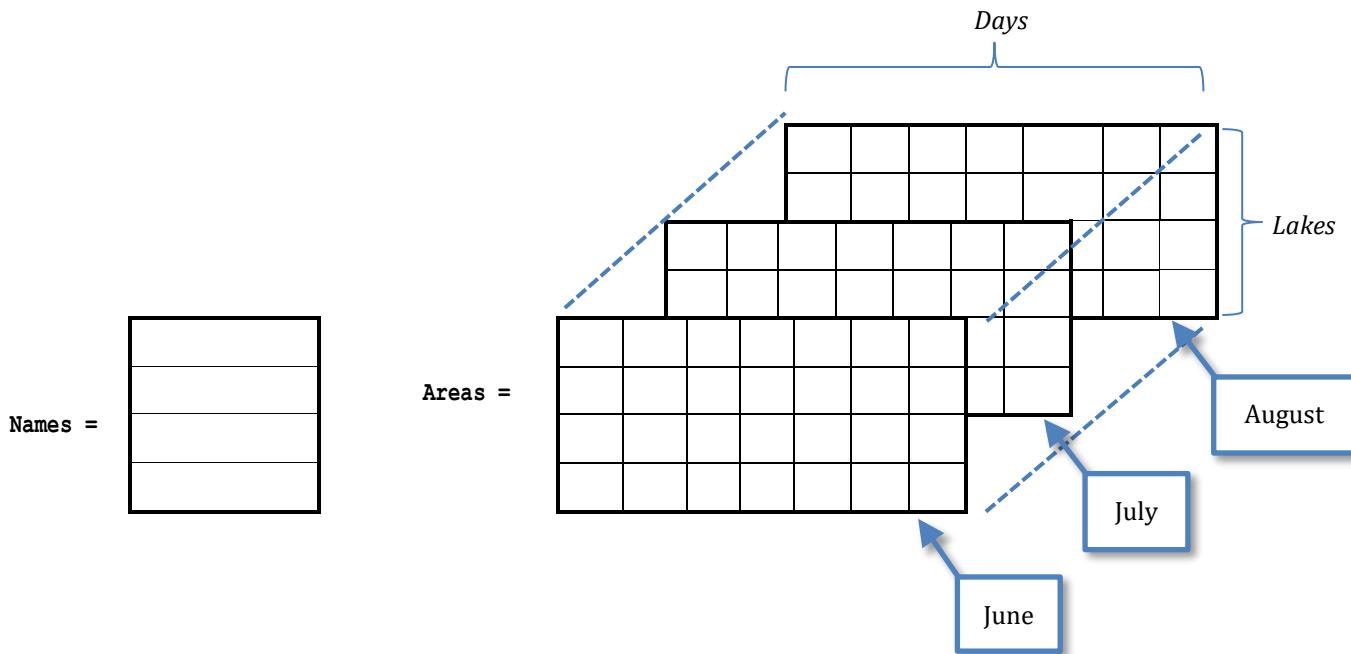
<b>Boxes =</b> <table border="1" style="border-collapse: collapse; width: 100%;"> <tr><td>10</td><td>31</td><td>15</td></tr> <tr><td>15</td><td>12</td><td>17</td></tr> <tr><td>22</td><td>10</td><td>18</td></tr> <tr><td>22</td><td>20</td><td>12</td></tr> <tr><td>26</td><td>25</td><td>14</td></tr> <tr><td>66</td><td>26</td><td>21</td></tr> <tr><td>54</td><td>34</td><td>24</td></tr> <tr><td>64</td><td>28</td><td>22</td></tr> <tr><td>34</td><td>12</td><td>18</td></tr> <tr><td>33</td><td>10</td><td>10</td></tr> </table>	10	31	15	15	12	17	22	10	18	22	20	12	26	25	14	66	26	21	54	34	24	64	28	22	34	12	18	33	10	10	<b>Dimensions</b> <table border="1" style="border-collapse: collapse; width: 100%;"> <tr><td>0</td><td>1</td><td>2</td></tr> </table>	0	1	2	<b>Boxes</b> <table border="1" style="border-collapse: collapse; width: 100%; margin-left: 20px;"> <tr><td>0</td></tr> <tr><td>1</td></tr> <tr><td>2</td></tr> <tr><td>3</td></tr> <tr><td>4</td></tr> <tr><td>5</td></tr> <tr><td>6</td></tr> <tr><td>7</td></tr> <tr><td>8</td></tr> <tr><td>9</td></tr> </table>	0	1	2	3	4	5	6	7	8	9
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15	12	17																																											
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66	26	21																																											
54	34	24																																											
64	28	22																																											
34	12	18																																											
33	10	10																																											
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### 5. Solution

<b>Names =</b>	<table border="1"> <tr><td>Toba</td></tr> <tr><td>Issyk Kul</td></tr> <tr><td>Baikal</td></tr> <tr><td>Crater</td></tr> <tr><td>Karakul</td></tr> <tr><td>Quesnel</td></tr> <tr><td>Urmia</td></tr> <tr><td>Albert</td></tr> </table>	Toba	Issyk Kul	Baikal	Crater	Karakul	Quesnel	Urmia	Albert	<b>Areas =</b>	<table border="1"> <tr><td>440</td></tr> <tr><td>2408</td></tr> <tr><td>12248</td></tr> <tr><td>21</td></tr> <tr><td>150</td></tr> <tr><td>103</td></tr> <tr><td>2317</td></tr> <tr><td>2045</td></tr> </table>	440	2408	12248	21	150	103	2317	2045	<b>Depths =</b>	<table border="1"> <tr><td>1660</td></tr> <tr><td>2192</td></tr> <tr><td>5380</td></tr> <tr><td>1950</td></tr> <tr><td>750</td></tr> <tr><td>2000</td></tr> <tr><td>52</td></tr> <tr><td>190</td></tr> </table>	1660	2192	5380	1950	750	2000	52	190	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>
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2192																																					
5380																																					
1950																																					
750																																					
2000																																					
52																																					
190																																					

*Lakes*

### 6. Solution



### 7. Solution

Step	Statement	x	a[0]	a[1]	a[2]
1	<code>a = [None] * 3</code>	?	?	?	?
2	<code>a[2] = 1</code>	?	?	?	<b>1</b>
3	<code>x = 0</code>	<b>0</b>	?	?	1
4	<code>a[x + a[2]] = 4</code>	0	?	<b>4</b>	1
5	<code>a[x] = a[x + 1] * 4</code>	0	<b>16</b>	4	1

### 8. Solution

Step	Statement	x	a[0]	a[1]	a[2]	a[3]	a[4]
1	a = [None] * 5	?	?	?	?	?	?
2	a[1] = 5	?	?	<b>5</b>	?	?	?
3	x = 0	<b>0</b>	?	5	?	?	?
4	a[x] = 4	0	<b>4</b>	5	?	?	?
5	a[a[0]] = a[x + 1] % 3	0	4	5	?	?	<b>2</b>
6	a[a[0] / 2] = 10	0	4	5	<b>10</b>	?	2
7	x += 2	<b>2</b>	4	5	10	?	2
8	a[x + 1] = a[x] + 9	2	4	5	10	<b>19</b>	2

### 9. Solution

For input value of 3

Step	Statement	x	a[0]	a[1]	a[2]	a[3]
1	a = [None] * 4	?	?	?	?	?
2	a[1] = int(input())	?	?	<b>3</b>	?	?
3	x = 0	<b>0</b>	?	3	?	?
4	a[x] = 3	0	<b>3</b>	3	?	?
5	a[a[0]] = a[x + 1] % 2	0	3	3	?	<b>1</b>
6	a[a[0] % 2] = 10	0	3	<b>10</b>	?	1
7	x += 1	<b>1</b>	3	10	?	1
8	a[x + 1] = a[x] + 9	1	3	10	<b>19</b>	1

For input value of 4

Step	Statement	x	a[0]	a[1]	a[2]	a[3]
1	a = [None] * 4	?	?	?	?	?
2	a[1] = int(input())	?	?	<b>4</b>	?	?
3	x = 0	<b>0</b>	?	4	?	?
4	a[x] = 3	0	<b>3</b>	4	?	?
5	a[a[0]] = a[x + 1] % 2	0	3	4	?	<b>0</b>
6	a[a[0] % 2] = 10	0	3	<b>10</b>	?	0
7	x += 1	<b>1</b>	3	10	?	0
8	a[x + 1] = a[x] + 9	1	3	10	<b>19</b>	0

For input value of 1

Step	Statement	x	a[0]	a[1]	a[2]	a[3]
1	a = [None] * 4	?	?	?	?	?
2	a[1] = int(input())	?	?	<b>1</b>	?	?
3	x = 0	<b>0</b>	?	1	?	?

<b>4</b>	$a[x] = 3$	0	<b>3</b>	1	?	?
<b>5</b>	$a[a[0]] = a[x + 1] \% 2$	0	3	1	?	<b>3</b>
<b>6</b>	$a[a[0] \% 2] = 10$	0	3	<b>10</b>	?	3
<b>7</b>	$x += 1$	<b>1</b>	3	10	?	3
<b>8</b>	$a[x + 1] = a[x] + 9$	1	3	10	<b>19</b>	3

**10. Solution**

For input value of 100

Step	Statement	x	a[0]	a[1]	a[2]	a[3]
<b>1</b>	$a = [None] * 4$	?	?	?	?	?
<b>2</b>	$a[1] = \text{int}(\text{input}())$	?	?	<b>100</b>	?	?
<b>3</b>	$x = 0$	<b>0</b>	?	100	?	?
<b>4</b>	$a[x] = 3$	0	<b>3</b>	100	?	?
<b>5</b>	$a[a[0]] = a[x + 1] \% 10$	0	3	100	?	<b>0</b>
<b>6</b>	$\text{if } a[3] > 5:$	False				
<b>7</b>	$a[2] = 3$	0	3	100	<b>3</b>	0

For input value of 108

Step	Statement	x	a[0]	a[1]	a[2]	a[3]
<b>1</b>	$a = [None] * 4$	?	?	?	?	?
<b>2</b>	$a[1] = \text{int}(\text{input}())$	?	?	<b>108</b>	?	?
<b>3</b>	$x = 0$	<b>0</b>	?	108	?	?
<b>4</b>	$a[x] = 3$	0	<b>3</b>	108	?	?
<b>5</b>	$a[a[0]] = a[x + 1] \% 10$	0	3	108	?	<b>8</b>
<b>6</b>	$\text{if } a[3] > 5:$	True				
<b>7</b>	$a[a[0] \% 2] = 9$	0	3	<b>9</b>	?	8
<b>8</b>	$x += 1$	<b>1</b>	3	9	?	8
<b>9</b>	$a[x + 1] = a[x] + 9$	1	3	9	<b>18</b>	8

For input value of 1

Step	Statement	x	a[0]	a[1]	a[2]	a[3]
<b>1</b>	$a = [None] * 4$	?	?	?	?	?
<b>2</b>	$a[1] = \text{int}(\text{input}())$	?	?	<b>1</b>	?	?
<b>3</b>	$x = 0$	<b>0</b>	?	1	?	?
<b>4</b>	$a[x] = 3$	0	<b>3</b>	1	?	?
<b>5</b>	$a[a[0]] = a[x + 1] \% 10$	0	3	1	?	<b>1</b>
<b>6</b>	$\text{if } a[3] > 5:$	False				
<b>7</b>	$a[2] = 3$	0	3	1	<b>3</b>	1

### 11. Solution

---

Step	Statement	x	y	a[0]	a[1]	a[2]
1	a = [None] * 3	?	?	?	?	?
2	x = 4	4	?	?	?	?
3	y = x - 1	4	3	?	?	?
4, 5	if x > y: a[0] = 1 else: a[0] = y	4	3	1	?	?
6	a[1] = x + 3	4	3	1	7	?
7	y = y - 1	4	2	1	7	?
8	a[y] = (x + 5) % 2	4	2	1	7	1

### 12. Solution

---

Step	Statement	i	a[0]	a[1]	a[2]	a[3]	a[4]	a[5]
1	a = [17, 12, 45, 12, 12, 49]	?	17	12	45	12	12	49
2	i = 0	0	17	12	45	12	12	49
3	if a[i] == 12:				False			
4	a[i] += 1	0	18	12	45	12	12	49
5	i = 1	1	18	12	45	12	12	49
6	if a[i] == 12:				True			
7	a[i] -= 1	1	18	11	45	12	12	49
8	i = 2	2	18	11	45	12	12	49
9	if a[i] == 12:				False			
10	a[i] += 1	2	18	11	46	12	12	49
11	i = 3	3	18	11	46	12	12	49
12	if a[i] == 12:				True			
13	a[i] -= 1	3	18	11	46	11	12	49
14	i = 4	4	18	11	46	11	12	49
15	if a[i] == 12:				True			
16	a[i] -= 1	4	18	11	46	11	11	49
17	i = 5	5	18	11	46	11	11	49
18	if a[i] == 12:				False			
19	a[i] += 1	5	18	11	46	11	11	50

### 13. Solution

Step	Statement	i	a[0]	a[1]	a[2]	a[3]	a[4]	a[5]
1	<code>a = [10, 15, 12, 23, 22, 19]</code>	?	<b>10</b>	<b>15</b>	<b>12</b>	<b>23</b>	<b>22</b>	<b>19</b>
2	<code>i = 1</code>	<b>1</b>	10	15	12	23	22	19
3	<code>a[i] = a[i + 1] + a[i - 1]</code>	1	10	<b>22</b>	12	23	22	19
4	<code>i = 2</code>	<b>2</b>	10	22	12	23	22	19
5	<code>a[i] = a[i + 1] + a[i - 1]</code>	2	10	22	<b>45</b>	23	22	19
6	<code>i = 3</code>	<b>3</b>	10	22	45	23	22	19
7	<code>a[i] = a[i + 1] + a[i - 1]</code>	3	10	22	45	<b>67</b>	22	19
8	<code>i = 4</code>	<b>4</b>	10	22	45	67	22	19
9	<code>a[i] = a[i + 1] + a[i - 1]</code>	4	10	22	45	67	<b>86</b>	19

### 14. Solution

It displays:

Navajo  
Cherokee  
Sioux

### 15. Solution

#### First approach

```
ELEMENTS = 100

a = [None] * ELEMENTS
for i in range(ELEMENTS):
    a[i] = float(input())

for i in range(ELEMENTS):
    print(a[i] ** 3)
```

#### Second approach

```
ELEMENTS = 100

a = []
for i in range(ELEMENTS):
    a.append(float(input()))

for element in a:
    print(element ** 3)
```

### 16. Solution

#### First approach

```
ELEMENTS = 80

a = [None] * ELEMENTS
for i in range(ELEMENTS):
```

```
a[i] = float(input())

for i in range(ELEMENTS):
    a[i] = a[i] ** 2

for i in range(ELEMENTS - 1, -1, -1):
    print(a[i])
```

**Second approach**

```
ELEMENTS = 80

a = []
for i in range(ELEMENTS):
    a.append(float(input()))

for i in range(ELEMENTS):
    a[i] = a[i] ** 2

for element in a[::-1]:
    print(element)
```

**17. Solution****First approach**

```
ELEMENTS = 90

a = [None] * ELEMENTS
for i in range(ELEMENTS):
    a[i] = int(input())

for i in range(ELEMENTS - 1, -1, -1):
    if a[i] % 5 == 0:
        print(a[i])
```

**Second approach**

```
ELEMENTS = 90

a = []
for i in range(ELEMENTS):
    a.append(int(input()))

for element in a[::-1]:
    if element % 5 == 0:
        print(element)
```

**18. Solution****First approach**

```
ELEMENTS = 50

a = [None] * ELEMENTS
for i in range(ELEMENTS):
    a[i] = int(input())
```

```
for i in range(ELEMENTS):
    if a[i] % 2 == 0 or a[i] > 10:
        print(a[i])
```

### Second approach

```
ELEMENTS = 50

a = []
for i in range(ELEMENTS):
    a.append(int(input()))

for element in a:
    if element % 2 == 0 or element > 10:
        print(element)
```

## 19. Solution

---

### First approach

```
ELEMENTS = 30

a = [None] * ELEMENTS
for i in range(ELEMENTS):
    a[i] = float(input())

total = 0
for i in range(ELEMENTS):
    if a[i] > 0:
        total += a[i]

print(total)
```

### Second approach

```
ELEMENTS = 30

a = []
for i in range(ELEMENTS):
    a.append(float(input()))

total = 0
for element in a:
    if element > 0:
        total += element

print(total)
```

## 20. Solution

---

### First approach

```
ELEMENTS = 50

a = [None] * ELEMENTS
for i in range(ELEMENTS):
```

```
a[i] = int(input())

total = 0
for i in range(ELEMENTS):
    if a[i] >= 10 and a[i] <= 99:
        total += a[i]

print(total)
```

**Second approach**

```
ELEMENTS = 50

a = []
for i in range(ELEMENTS):
    a.append(int(input()))

total = 0
for element in a:
    if 10 <= element <= 99:
        total += element

print(total)
```

**21. Solution****First approach**

```
ELEMENTS = 40

a = [None] * ELEMENTS
for i in range(ELEMENTS):
    a[i] = float(input())

sum_pos = 0
sum_neg = 0
for i in range(ELEMENTS):
    if a[i] > 0 :
        sum_pos += a[i]
    elif a[i] < 0:
        sum_neg += a[i]

print(sum_pos, sum_neg)
```

**Second approach**

```
ELEMENTS = 40

a = []
for i in range(ELEMENTS):
    a.append(float(input()))

sum_pos = sum_neg = 0
for element in a:
    if element > 0 :
        sum_pos += element
```

```
    elif element < 0:  
        sum_neg += element  
  
    print(sum_pos, sum_neg)
```

## 22. Solution

---

### First approach

```
ELEMENTS = 20  
  
a = [None] * ELEMENTS  
for i in range(ELEMENTS):  
    a[i] = float(input())  
  
total = 0  
for i in range(ELEMENTS):  
    total += a[i]  
  
print(total / ELEMENTS)
```

### Second approach

```
ELEMENTS = 20  
  
a = []  
for i in range(ELEMENTS):  
    a.append(float(input()))  
  
total = 0  
for element in a:  
    total += element  
  
print(total / ELEMENTS)
```

## 23. Solution

---

```
ELEMENTS = 50  
  
a = [None] * ELEMENTS  
for i in range(ELEMENTS):  
    a[i] = int(input("Enter an integer: "))  
  
for i in range(ELEMENTS):  
    if a[i] < 20:  
        print(i)
```

## 24. Solution

---

```
ELEMENTS = 60  
  
a = [None] * ELEMENTS  
for i in range(ELEMENTS):  
    a[i] = float(input("Enter a number: "))  
  
for i in range(0, ELEMENTS, 2):
```

```
    print(a[i])
```

### 25. Solution

```
ELEMENTS = 20

a = [None] * ELEMENTS
for i in range(ELEMENTS):
    a[i] = float(input("Enter a number: "))

total = 0
for i in range(0, ELEMENTS, 2):
    total += a[i]

print(total)
```

### 26. Solution

#### First approach

```
ELEMENTS = 100

a = [None] * ELEMENTS
for i in range(ELEMENTS):
    a[i] = i + 1
```

#### Second approach

```
ELEMENTS = 100

a = []
for i in range(ELEMENTS):
    a.append(i + 1)
```

### 27. Solution

```
a = []
for i in range(2, 202, 2):
    a.append(i)
```

### 28. Solution

#### First approach

```
n = int(input("Enter N: "))

a = [None] * n
for i in range(1, n + 1):
    a[i - 1] = i ** 2

for i in range(n):
    print(a[i])
```

#### Second approach

```
n = int(input("Enter N: "))

a = []
for i in range(1, n + 1):
    a.append(i ** 2)
```

```
for element in a:  
    print(element)
```

**29. Solution**

```
ELEMENTS = 10  
  
a = []  
for i in range(ELEMENTS):  
    a.append(float(input("Enter a number: ")))  
  
for i in range(ELEMENTS):  
    if a[i] == int(a[i]):  
        print(i)
```

**30. Solution**

```
ELEMENTS = 50  
  
a = []  
for i in range(ELEMENTS):  
    a.append(float(input("Enter a number: ")))  
  
count = 0  
for i in range(ELEMENTS):  
    if a[i] < 0:  
        count += 1  
  
print(count)
```

**31. Solution****First approach**

```
WORDS = 50  
  
a = [None] * WORDS  
for i in range(WORDDS):  
    a[i] = input()  
  
for i in range(WORDDS):  
    if len(a[i]) >= 10:  
        print(a[i])
```

**Second approach**

```
WORDS = 50  
  
a = []  
for i in range(WORDDS):  
    a.append(input())  
  
for element in a:  
    if len(element) >= 10:  
        print(element)
```

### 32. Solution

```
ELEMENTS = 30

words = []
for i in range(ELEMENTS):
    words.append(input())

length_limits = (0, 5, 10, 20)

for i in range(1, 4):
    for word in words:
        if len(word) >= length_limits[i - 1] and len(word) < length_limits[i]:
            print(word)
```

### 33. Solution

#### First approach

```
WORDS = 40

a = [None] * WORDS
for i in range(WORDS):
    a[i] = input("Enter a word: ")

for i in range(WORDS):
    count = 0
    for j in range(len(a[i])):
        if a[i][j] == "w":
            count += 1
    if count >= 2:
        print(a[i])
```

#### Second approach

```
WORDS = 40

a = []
for i in range(WORDS):
    a.append(input("Enter a word: "))

for word in a:
    count = 0
    for letter in word:
        if letter == "w":
            count += 1
    if count >= 2:
        print(word)
```

# Chapter 31

---

## 31.7 Review Questions: True/False

- |           |           |
|-----------|-----------|
| 1. false  | 15. true  |
| 2. true   | 16. true  |
| 3. false  | 17. true  |
| 4. false  | 18. true  |
| 5. false  | 19. false |
| 6. true   | 20. true  |
| 7. false  | 21. true  |
| 8. true   | 22. true  |
| 9. true   | 23. false |
| 10. true  | 24. true  |
| 11. true  | 25. true  |
| 12. true  | 26. true  |
| 13. false | 27. false |
| 14. true  |           |

## 31.8 Review Questions: Multiple Choice

- |      |       |
|------|-------|
| 1. b | 7. d  |
| 2. b | 8. c  |
| 3. c | 9. c  |
| 4. a | 10. c |
| 5. d | 11. b |
| 6. a |       |

## 31.9 Review Exercises

### 1. Solution

---

Step	Statement	x	a						
1	<code>a = [ [None] * 3 for i in range(2) ]</code>	?	<table border="1"> <tbody> <tr><td>?</td><td>?</td><td>?</td></tr> <tr><td>?</td><td>?</td><td>?</td></tr> </tbody> </table>	?	?	?	?	?	?
?	?	?							
?	?	?							
2	<code>a[0][2] = 1</code>	?	<table border="1"> <tbody> <tr><td>?</td><td>?</td><td><b>1</b></td></tr> <tr><td>?</td><td>?</td><td>?</td></tr> </tbody> </table>	?	?	<b>1</b>	?	?	?
?	?	<b>1</b>							
?	?	?							
3	<code>x = 0</code>	0	<table border="1"> <tbody> <tr><td>?</td><td>?</td><td>1</td></tr> <tr><td>?</td><td>?</td><td>?</td></tr> </tbody> </table>	?	?	1	?	?	?
?	?	1							
?	?	?							
4	<code>a[0][x] = 9</code>	0	<table border="1"> <tbody> <tr><td><b>9</b></td><td>?</td><td>1</td></tr> <tr><td>?</td><td>?</td><td>?</td></tr> </tbody> </table>	<b>9</b>	?	1	?	?	?
<b>9</b>	?	1							
?	?	?							

<b>5</b>	<code>a[0][x + a[0][2]] = 4</code>	0	<table border="1"> <tr><td>9</td><td>4</td><td>1</td></tr> <tr><td>?</td><td>?</td><td>?</td></tr> </table>	9	4	1	?	?	?
9	4	1							
?	?	?							
<b>6</b>	<code>a[a[0][2]][2] = 19</code>	0	<table border="1"> <tr><td>9</td><td>4</td><td>1</td></tr> <tr><td>?</td><td>?</td><td><b>19</b></td></tr> </table>	9	4	1	?	?	<b>19</b>
9	4	1							
?	?	<b>19</b>							
<b>7</b>	<code>a[a[0][2]][x + 1] = 13</code>	0	<table border="1"> <tr><td>9</td><td>4</td><td>1</td></tr> <tr><td>?</td><td><b>13</b></td><td>19</td></tr> </table>	9	4	1	?	<b>13</b>	19
9	4	1							
?	<b>13</b>	19							
<b>8</b>	<code>a[a[0][2]][x] = 15</code>	0	<table border="1"> <tr><td>9</td><td>4</td><td>1</td></tr> <tr><td><b>15</b></td><td>13</td><td>19</td></tr> </table>	9	4	1	<b>15</b>	13	19
9	4	1							
<b>15</b>	13	19							

## 2. Solution

Step	Statement	i	j	a						
<b>1</b>	<code>a = [ [None] * 3 for i in range(2) ]</code>	?	?	<table border="1"> <tr><td>?</td><td>?</td><td>?</td></tr> <tr><td>?</td><td>?</td><td>?</td></tr> </table>	?	?	?	?	?	?
?	?	?								
?	?	?								
<b>2</b>	<code>i = 0</code>	<b>0</b>	?	<table border="1"> <tr><td>?</td><td>?</td><td>?</td></tr> <tr><td>?</td><td>?</td><td>?</td></tr> </table>	?	?	?	?	?	?
?	?	?								
?	?	?								
<b>3</b>	<code>j = 0</code>	0	<b>0</b>	<table border="1"> <tr><td>?</td><td>?</td><td>?</td></tr> <tr><td>?</td><td>?</td><td>?</td></tr> </table>	?	?	?	?	?	?
?	?	?								
?	?	?								
<b>4</b>	<code>a[i][j] = [i + 1] * 5 + j</code>	0	0	<table border="1"> <tr><td><b>5</b></td><td>?</td><td>?</td></tr> <tr><td>?</td><td>?</td><td>?</td></tr> </table>	<b>5</b>	?	?	?	?	?
<b>5</b>	?	?								
?	?	?								
<b>5</b>	<code>j = 1</code>	0	<b>1</b>	<table border="1"> <tr><td>5</td><td>?</td><td>?</td></tr> <tr><td>?</td><td>?</td><td>?</td></tr> </table>	5	?	?	?	?	?
5	?	?								
?	?	?								
<b>6</b>	<code>a[i][j] = [i + 1] * 5 + j</code>	0	1	<table border="1"> <tr><td>5</td><td><b>6</b></td><td>?</td></tr> <tr><td>?</td><td>?</td><td>?</td></tr> </table>	5	<b>6</b>	?	?	?	?
5	<b>6</b>	?								
?	?	?								
<b>7</b>	<code>j = 2</code>	0	<b>2</b>	<table border="1"> <tr><td>5</td><td>6</td><td>?</td></tr> <tr><td>?</td><td>?</td><td>?</td></tr> </table>	5	6	?	?	?	?
5	6	?								
?	?	?								
<b>8</b>	<code>a[i][j] = [i + 1] * 5 + j</code>	0	2	<table border="1"> <tr><td>5</td><td>6</td><td><b>7</b></td></tr> <tr><td>?</td><td>?</td><td>?</td></tr> </table>	5	6	<b>7</b>	?	?	?
5	6	<b>7</b>								
?	?	?								
<b>9</b>	<code>i = 1</code>	<b>1</b>	2	<table border="1"> <tr><td>5</td><td>6</td><td>7</td></tr> <tr><td>?</td><td>?</td><td>?</td></tr> </table>	5	6	7	?	?	?
5	6	7								
?	?	?								

<b>10</b>	j = 0	1	<b>0</b>	<table border="1"> <tr><td>5</td><td>6</td><td>7</td></tr> <tr><td>?</td><td>?</td><td>?</td></tr> </table>	5	6	7	?	?	?
5	6	7								
?	?	?								
<b>11</b>	a[i][j] = [i + 1] * 5 + j	1	0	<table border="1"> <tr><td>5</td><td>6</td><td>7</td></tr> <tr><td><b>10</b></td><td>?</td><td>?</td></tr> </table>	5	6	7	<b>10</b>	?	?
5	6	7								
<b>10</b>	?	?								
<b>12</b>	j = 1	1	<b>1</b>	<table border="1"> <tr><td>5</td><td>6</td><td>7</td></tr> <tr><td>10</td><td>?</td><td>?</td></tr> </table>	5	6	7	10	?	?
5	6	7								
10	?	?								
<b>13</b>	a[i][j] = [i + 1] * 5 + j	1	1	<table border="1"> <tr><td>5</td><td>6</td><td>7</td></tr> <tr><td>10</td><td><b>11</b></td><td>?</td></tr> </table>	5	6	7	10	<b>11</b>	?
5	6	7								
10	<b>11</b>	?								
<b>14</b>	j = 2	1	<b>2</b>	<table border="1"> <tr><td>5</td><td>6</td><td>7</td></tr> <tr><td>10</td><td>11</td><td>?</td></tr> </table>	5	6	7	10	11	?
5	6	7								
10	11	?								
<b>15</b>	a[i][j] = [i + 1] * 5 + j	1	2	<table border="1"> <tr><td>5</td><td>6</td><td>7</td></tr> <tr><td>10</td><td>11</td><td><b>12</b></td></tr> </table>	5	6	7	10	11	<b>12</b>
5	6	7								
10	11	<b>12</b>								

### 3. Solution

Step	Statement	i	j	a									
<b>1</b>	a = [ [None] * 3 for i in range(3) ]	?	?	<table border="1"> <tr><td>?</td><td>?</td><td>?</td></tr> <tr><td>?</td><td>?</td><td>?</td></tr> <tr><td>?</td><td>?</td><td>?</td></tr> </table>	?	?	?	?	?	?	?	?	?
?	?	?											
?	?	?											
?	?	?											
<b>2</b>	j = 0	?	<b>0</b>	<table border="1"> <tr><td>?</td><td>?</td><td>?</td></tr> <tr><td>?</td><td>?</td><td>?</td></tr> <tr><td>?</td><td>?</td><td>?</td></tr> </table>	?	?	?	?	?	?	?	?	?
?	?	?											
?	?	?											
?	?	?											
<b>3</b>	i = 0	0	<b>0</b>	<table border="1"> <tr><td>?</td><td>?</td><td>?</td></tr> <tr><td>?</td><td>?</td><td>?</td></tr> <tr><td>?</td><td>?</td><td>?</td></tr> </table>	?	?	?	?	?	?	?	?	?
?	?	?											
?	?	?											
?	?	?											
<b>4</b>	a[i][j] = [i + 1] * 2 + j * 4	0	0	<table border="1"> <tr><td><b>2</b></td><td>?</td><td>?</td></tr> <tr><td>?</td><td>?</td><td>?</td></tr> <tr><td>?</td><td>?</td><td>?</td></tr> </table>	<b>2</b>	?	?	?	?	?	?	?	?
<b>2</b>	?	?											
?	?	?											
?	?	?											
<b>5</b>	i = 1	<b>1</b>	0	<table border="1"> <tr><td>2</td><td>?</td><td>?</td></tr> <tr><td>?</td><td>?</td><td>?</td></tr> <tr><td>?</td><td>?</td><td>?</td></tr> </table>	2	?	?	?	?	?	?	?	?
2	?	?											
?	?	?											
?	?	?											

<b>6</b>	$a[i][j] = [i + 1] * 2 + j * 4$	1	0	<table border="1"> <tr><td>2</td><td>?</td><td>?</td></tr> <tr><td><b>4</b></td><td>?</td><td>?</td></tr> <tr><td>?</td><td>?</td><td>?</td></tr> </table>	2	?	?	<b>4</b>	?	?	?	?	?
2	?	?											
<b>4</b>	?	?											
?	?	?											
<b>7</b>	$i = 2$	<b>2</b>	0	<table border="1"> <tr><td>2</td><td>?</td><td>?</td></tr> <tr><td>4</td><td>?</td><td>?</td></tr> <tr><td>?</td><td>?</td><td>?</td></tr> </table>	2	?	?	4	?	?	?	?	?
2	?	?											
4	?	?											
?	?	?											
<b>8</b>	$a[i][j] = [i + 1] * 2 + j * 4$	2	0	<table border="1"> <tr><td>2</td><td>?</td><td>?</td></tr> <tr><td>4</td><td>?</td><td>?</td></tr> <tr><td><b>6</b></td><td>?</td><td>?</td></tr> </table>	2	?	?	4	?	?	<b>6</b>	?	?
2	?	?											
4	?	?											
<b>6</b>	?	?											
<b>9</b>	$j = 1$	2	<b>1</b>	<table border="1"> <tr><td>2</td><td>?</td><td>?</td></tr> <tr><td>4</td><td>?</td><td>?</td></tr> <tr><td>6</td><td>?</td><td>?</td></tr> </table>	2	?	?	4	?	?	6	?	?
2	?	?											
4	?	?											
6	?	?											
<b>10</b>	$i = 0$	<b>0</b>	1	<table border="1"> <tr><td>2</td><td>?</td><td>?</td></tr> <tr><td>4</td><td>?</td><td>?</td></tr> <tr><td>6</td><td>?</td><td>?</td></tr> </table>	2	?	?	4	?	?	6	?	?
2	?	?											
4	?	?											
6	?	?											
<b>11</b>	$a[i][j] = [i + 1] * 2 + j * 4$	0	1	<table border="1"> <tr><td>2</td><td><b>6</b></td><td>?</td></tr> <tr><td>4</td><td>?</td><td>?</td></tr> <tr><td>6</td><td>?</td><td>?</td></tr> </table>	2	<b>6</b>	?	4	?	?	6	?	?
2	<b>6</b>	?											
4	?	?											
6	?	?											
<b>12</b>	$i = 1$	<b>1</b>	1	<table border="1"> <tr><td>2</td><td>6</td><td>?</td></tr> <tr><td>4</td><td>?</td><td>?</td></tr> <tr><td>6</td><td>?</td><td>?</td></tr> </table>	2	6	?	4	?	?	6	?	?
2	6	?											
4	?	?											
6	?	?											
<b>13</b>	$a[i][j] = [i + 1] * 2 + j * 4$	1	1	<table border="1"> <tr><td>2</td><td>6</td><td>?</td></tr> <tr><td>4</td><td><b>8</b></td><td>?</td></tr> <tr><td>6</td><td>?</td><td>?</td></tr> </table>	2	6	?	4	<b>8</b>	?	6	?	?
2	6	?											
4	<b>8</b>	?											
6	?	?											
<b>14</b>	$i = 2$	<b>2</b>	1	<table border="1"> <tr><td>2</td><td>6</td><td>?</td></tr> <tr><td>4</td><td>8</td><td>?</td></tr> <tr><td>6</td><td>?</td><td>?</td></tr> </table>	2	6	?	4	8	?	6	?	?
2	6	?											
4	8	?											
6	?	?											
<b>15</b>	$a[i][j] = [i + 1] * 2 + j * 4$	2	1	<table border="1"> <tr><td>2</td><td>6</td><td>?</td></tr> <tr><td>4</td><td>8</td><td>?</td></tr> <tr><td>6</td><td><b>10</b></td><td>?</td></tr> </table>	2	6	?	4	8	?	6	<b>10</b>	?
2	6	?											
4	8	?											
6	<b>10</b>	?											
<b>16</b>	$j = 2$	2	<b>2</b>	<table border="1"> <tr><td>2</td><td>6</td><td>?</td></tr> <tr><td>4</td><td>8</td><td>?</td></tr> <tr><td>6</td><td>10</td><td>?</td></tr> </table>	2	6	?	4	8	?	6	10	?
2	6	?											
4	8	?											
6	10	?											

<b>17</b>	i = 0	<b>0</b>	2	2   6   ? 4   8   ? 6   10   ?
<b>18</b>	a[i][j] = [i + 1] * 2 + j * 4	0	2	2   6   <b>10</b> 4   8   ? 6   10   ?
<b>19</b>	i = 1	<b>1</b>	2	2   6   10 4   8   ? 6   10   ?
<b>20</b>	a[i][j] = [i + 1] * 2 + j * 4	1	2	2   6   10 4   8   <b>12</b> 6   10   ?
<b>21</b>	i = 2	<b>2</b>	2	2   6   10 4   8   12 6   10   ?
<b>22</b>	a[i][j] = [i + 1] * 2 + j * 4	2	2	2   6   10 4   8   12 6   10   <b>14</b>

#### 4. Solution

---

For input value of 5

0	5	10
0	6	12

For input value of 9

0	9	18
0	10	20

For input value of 3

0	3	6
0	4	8

#### 5. Solution

---

For input value of 13

0	3	3
0	17	18

For input value of 10

0	10	3
0	11	15

For input value of 8

3	3	3
11	12	13

## 6. Solution

---

19	5	31
28	6	20

## 7. Solution

---

26	29
37	34
59	49

## 8. Solution

---

- i. -1 15 22 25 12 16 7 9 1
- ii. 7 9 1 25 12 16 -1 15 22
- iii. 22 15 -1 16 12 25 1 9 7
- iv. 1 9 7 16 12 25 22 15 -1
- v. -1 25 7 15 12 9 22 16 1
- vi. 7 25 -1 9 12 15 1 16 22
- vii. 22 16 1 15 12 9 -1 25 7
- viii. 1 16 22 9 12 15 7 25 -1

## 9. Solution

---

```
ROWS = 10
COLUMNNS = 15

a = [ [None] * COLUMNNS for i in range(ROWS) ]
for i in range(ROWS):
    for j in range(COLUMNNS):
        a[i][j] = int(input())

for i in range(ROWS):
    for j in range(COLUMNNS):
        if a[i][j] % 2 != 0:
            print(i, ",", j)
```

### 10. Solution

---

```
ROWS = 10
COLUMNS = 6

a = [ [None] * COLUMNS for i in range(ROWS) ]
for i in range(ROWS):
    for j in range(COLUMNS):
        a[i][j] = float(input())

for i in range(ROWS):
    for j in range(0, COLUMNS, 2):
        print(a[i][j])
```

### 11. Solution

---

```
ROWS = 12
COLUMNS = 8

a = [ [None] * COLUMNS for i in range(ROWS) ]
for i in range(ROWS):
    for j in range(COLUMNS):
        a[i][j] = float(input())

total = 0
for i in range(1, ROWS, 2):
    for j in range(0, COLUMNS, 2):
        total += a[i][j]
print(total)
```

### 12. Solution

---

```
N = 8

a = [ [None] * N for i in range(N) ]
for i in range(N):
    for j in range(N):
        a[i][j] = float(input())

sum_diagonal = 0
sum_antidiagonal = 0
for k in range(N):
    sum_diagonal += a[k][k]
    sum_antidiagonal += a[k][N - k - 1]

print(sum_diagonal / N, sum_antidiagonal / N)
```

### 13. Solution

---

```
N = 5
```

```
a = [ [None] * N for i in range(N) ]
for i in range(N):
    for j in range(N):
        if i == N - j - 1:
            a[i][j] = 5
        elif i > N - j - 1:
            a[i][j] = 88
        else:
            a[i][j] = 11

for i in range(N):
    for j in range(N):
        print(a[i][j], end = "\t")
    print()
```

#### 14. Solution

---

```
N = 5

a = [ [None] * N for i in range(N) ]
for i in range(N):
    for j in range(N):
        if i == N - j - 1:
            a[i][j] = 5
        elif i > N - j - 1:
            a[i][j] = 88
        else:
            a[i][j] = 11
        if i == j:
            a[i][j] = 0

for i in range(N):
    for j in range(N):
        print(a[i][j], end = "\t")
    print()
```

#### 15. Solution

---

```
ROWS = 5
COLUMNS = 4

a = [ [None] * COLUMNS for i in range(ROWS) ]
for i in range(ROWS):
    for j in range(COLUMNS):
        a[i][j] = float(input())

for i in range(ROWS):
    for j in range(COLUMNS):
        if a[i][j] == int(a[i][j]):
```

```
    print(i, ", ", j)
```

### 16. Solution

---

```
ROWS = 10
COLUMNS = 4

a = [ [None] * COLUMNS for i in range(ROWS) ]
for i in range(ROWS):
    for j in range(COLUMNS):
        a[i][j] = float(input())

count = 0
for i in range(ROWS):
    for j in range(COLUMNS):
        if a[i][j] < 0:
            count += 1

print(count)
```

### 17. Solution

---

```
ROWS = 3
COLUMNS = 4

a = [ [None] * COLUMNS for i in range(ROWS) ]
for i in range(ROWS):
    for j in range(COLUMNS):
        a[i][j] = input()

for i in range(ROWS):
    for j in range(COLUMNS):
        print(a[i][j], " ", end = "")
```

### 18. Solution

---

```
ROWS = 20
COLUMNS = 14

a = [ [None] * COLUMNS for i in range(ROWS) ]
for i in range(ROWS):
    for j in range(COLUMNS):
        a[i][j] = input()

for i in range(ROWS):
    for j in range(COLUMNS):
        if len(a[i][j]) < 5:
            print(a[i][j])
```

## 19. Solution

### First approach

```
ROWS = 20
COLUMNNS = 14

a = [ [None] * COLUMNNS for i in range(ROWS) ]
for i in range(ROWS):
    for j in range(COLUMNNS):
        a[i][j] = input()

length_limits = [5, 10, 20]

for k in range(3):
    for i in range(ROWS):
        for j in range(COLUMNNS):
            if len(a[i][j]) < length_limits[k]:
                print(a[i][j])
```

### Second approach

```
ROWS = 20
COLUMNNS = 14

a = [ [None] * COLUMNNS for i in range(ROWS) ]
for i in range(ROWS):
    for j in range(COLUMNNS):
        a[i][j] = input()

for k in range(3):
    for i in range(ROWS):
        for j in range(COLUMNNS):
            if len(a[i][j]) < 5 * 2 ** k:
                print(a[i][j])
```

# Chapter 32

---

## 32.8 Review Questions: True/False

- |          |           |
|----------|-----------|
| 1. true  | 10. false |
| 2. false | 11. true  |
| 3. true  | 12. true  |
| 4. false | 13. true  |
| 5. false | 14. true  |
| 6. false | 15. true  |
| 7. true  | 16. true  |
| 8. true  | 17. true  |
| 9. false |           |

## 32.9 Review Questions: Multiple Choice

- |      |       |
|------|-------|
| 1. a | 6. a  |
| 2. b | 7. a  |
| 3. c | 8. c  |
| 4. b | 9. b  |
| 5. a | 10. a |

## 32.10 Review Exercises

### 1. Solution

---

```
STUDENTS = 15
TESTS = 5

grades = [ [None] * TESTS for i in range(STUDENTS) ]
for i in range(STUDENTS):
    for j in range(TESTS):
        grades[i][j] = int(input())

average = [None] * STUDENTS
for i in range(STUDENTS):
    average[i] = 0
    for j in range(TESTS):
        average[i] += grades[i][j]
    average[i] /= TESTS

for i in range(STUDENTS):
    print("Student No", (i + 1), ": ")

    if average[i] < 60:
        print("E/F")
    elif average[i] < 70:
        print("D")
    elif average[i] < 80:
```

```
    print("C")
elif average[i] < 90:
    print("B")
else:
    print("A")
```

## 2. Solution

### First approach

```
OBJECTS = 5
FALLS = 10

g = [ [None] * FALLS for i in range(OBJECTS) ]
for i in range(OBJECTS):
    for j in range(FALLS):
        g[i][j] = int(input())

for i in range(OBJECTS):
    total = 0
    for j in range(FALLS):
        total += g[i][j]
    print("Average g for object No", (i + 1), ":", (total / FALLS))

for j in range(FALLS):
    total = 0
    for i in range(OBJECTS):
        total += g[i][j]
    print("Average g for fall No", (j + 1), ":", (total / OBJECTS))

total = 0
for i in range(OBJECTS):
    for j in range(FALLS):
        total += g[i][j]

print("Overall average g:", (total / (OBJECTS * FALLS)))
```

### Second approach

```
import math
OBJECTS = 5
FALLS = 10

g = [ [None] * FALLS for i in range(OBJECTS) ]
for i in range(OBJECTS):
    for j in range(FALLS):
        g[i][j] = int(input())

for row in g:
    total = math.fsum(row)
    print("Average g for object No", (i + 1), ":", (total / FALLS))
```

```

for j in range(FALLS):
    total = 0
    for i in range(OBJECTS):
        total += g[i][j]
    print("Average g for fall No", (j + 1), ":", (total / OBJECTS))

total = 0
for row in g:
    total += math.fsum(row)
print("Overall average g:", (total / (OBJECTS * FALLS)))

```

### 3. Solution

---

#### First approach

```

PLAYERS = 15
MATCHES = 12

points = [ [None] * MATCHES for i in range(PLAYERS) ]
for i in range(PLAYERS):
    for j in range(MATCHES):
        points[i][j] = int(input())

for i in range(PLAYERS):
    total = 0
    for j in range(MATCHES):
        total += points[i][j]
    print("Total number of points for player No", (i + 1), ":", total)

for j in range(MATCHES):
    total = 0
    for i in range(PLAYERS):
        total += points[i][j]
    print("Total number of points for match No", (j + 1), ":", total)

```

#### Second approach

```

import math
PLAYERS = 15
MATCHES = 12

points = [ [None] * MATCHES for i in range(PLAYERS) ]
for i in range(PLAYERS):
    for j in range(MATCHES):
        points[i][j] = int(input())

for row in points:
    total = math.fsum(row)
    print("Total number of points for player No", (i + 1), ":", total)

for j in range(MATCHES):
    total = 0

```

```

for i in range(PLAYERS):
    total += points[i][j]
print("Total number of points for match No", (j + 1), ":", total)

```

#### 4. Solution

---

```

CITIES = 20
HOURS = 24

temperatures = [ [None] * HOURS for i in range(CITIES) ]
for i in range(CITIES):
    for j in range(HOURS):
        temperatures[i][j] = float(input())

for j in range(HOURS):
    total = 0
    for i in range(CITIES):
        total += temperatures[i][j]
    if total / CITIES < 10:
        print("Hour:", (j + 1))

```

#### 5. Solution

---

```

PLAYERS = 24
MATCHES = 10

names = [None] * PLAYERS
goals = [ [None] * MATCHES for i in range(PLAYERS) ]
for i in range(PLAYERS):
    names[i] = input()
    for j in range(MATCHES):
        goals[i][j] = int(input())

# Or you can do the following:
for i in range(PLAYERS):
    total = 0
    for j in range(MATCHES):
        total += goals[i][j]
    print(names[i], ":", (total / MATCHES))

for j in range(MATCHES):
    total = 0
    for i in range(PLAYERS):
        total += goals[i][j]
    print("Match No", (j + 1), ":", total)

```

#### 6. Solution

---

```

STUDENTS = 12
LESSONS = 6

```



```

for i in range(ARTISTS):
    total = 0
    for j in range(JUDGES):
        total += score[i][j]
    print(artist_names[i], ",", song_titles[i], ":", total)

for j in range(JUDGES):
    total = 0
    for i in range(ARTISTS):
        total += score[i][j]
    print(judge_names[j], ":", total / ARTISTS)

```

## 8. Solution

---

```

PEOPLE = 30
MONTHS = 12

weights = [ [None] * MONTHS for i in range(PEOPLE) ]
heights = [ [None] * MONTHS for i in range(PEOPLE) ]
for i in range(PEOPLE):
    for j in range(MONTHS):
        weights[i][j] = int(input())
        heights[i][j] = int(input())

for i in range(PEOPLE):
    sum_weights = 0
    sum_heights = 0
    for j in range(MONTHS):
        sum_weights += weights[i][j]
        sum_heights += heights[i][j]
    average_weight = sum_weights / MONTHS
    average_height = sum_heights / MONTHS
    print(average_weight, ",", average_height)
    print(average_weight * 702 / average_height ** 2)

for i in range(PEOPLE):
    print(weights[i][4] * 702 / heights[i][4] ** 2)
    print(weights[i][7] * 702 / heights[i][7] ** 2)

```

## 9. Solution

---

```

VAT = 0.19
CONSUMERS = 1000

meter_reading = [ [None] * 2 for i in range(CONSUMERS) ]
for i in range(CONSUMERS):
    meter_reading[i][0] = int(input())
    meter_reading[i][1] = int(input())

total = 0

```

```

for i in range(CONSUMERS):
    consumed = meter_reading[i][1] - meter_reading[i][0]
    print(consumed)
    payment = consumed * 0.07
    payment += VAT * payment
    print(payment)

    total += consumed

print(total, total * 0.07 + total * 0.07 * VAT)

```

## 10. Solution

---

### First approach

```

CURRENCIES = 4
DAYS = 5

usd = float(input("Enter an amount in US dollars: "))
currency = ["British Pounds Sterling", "Euros", "Canadian Dollars", "Australian Dollars"]

rate = [[1.320, 1.321, 1.332, 1.331, 1.341],
        [1.143, 1.156, 1.138, 1.122, 1.129],
        [0.757, 0.764, 0.760, 0.750, 0.749],
        [0.720, 0.725, 0.729, 0.736, 0.739]
       ]

for i in range(CURRENCIES):
    total = 0
    for j in range(DAYS):
        total += rate[i][j]
    average = total / DAYS
    print(usd, "US dollars =", usd / average, currency[i])

```

### Second approach

```

import math
DAYS = 5

usd = float(input("Enter an amount in US dollars: "))
currency = ["British Pounds Sterling", "Euros", "Canadian Dollars", "Australian Dollars"]

rate = [[1.320, 1.321, 1.332, 1.331, 1.341],
        [1.143, 1.156, 1.138, 1.122, 1.129],
        [0.757, 0.764, 0.760, 0.750, 0.749],
        [0.720, 0.725, 0.729, 0.736, 0.739]
       ]

for i in range(len(rate)):
    average = math.fsum(rate[i]) / DAYS      #rate[i] returns the whole row
    print(usd, "US dollars =", usd / average, currency[i])

```

## 11. Solution

---

```
EMPLOYEES = 10
DAYS = 5

weekdays = ["Monday", "Tuesday", "Wednesday", "Thursday", "Friday"]

pay_rate = float(input())

names = [None] * EMPLOYEES
hours_worked_per_day = [ [None] * DAYS for i in range(EMPLOYEES) ]
for i in range(EMPLOYEES):
    names[i] = input()
    for j in range(DAYS):
        hours_worked_per_day[i][j] = int(input())

hours_worked_per_week = [None] * EMPLOYEES
for i in range(EMPLOYEES):
    hours_worked_per_week[i] = 0
    for j in range(DAYS):
        hours_worked_per_week[i] += hours_worked_per_day[i][j]
    if hours_worked_per_week[i] > 40:
        print(names[i])

for i in range(EMPLOYEES):
    if hours_worked_per_week[i] <= 40:
        gross_pay = pay_rate * hours_worked_per_week[i]
    else:
        gross_pay = pay_rate * 40 + 1.5 * pay_rate * (hours_worked_per_week[i] - 40)
    print(names[i], gross_pay)

for i in range(EMPLOYEES):
    if hours_worked_per_week[i] > 40:
        for j in range(DAYS):
            if hours_worked_per_day[i][j] > 8:
                print(names[i], weekdays[j], "Overtime!")

for j in range(DAYS):
    total = 0
    for i in range(EMPLOYEES):
        if hours_worked_per_day[i][j] <= 8:
            gross_pay = pay_rate * hours_worked_per_day[i][j]
        else:
            gross_pay = pay_rate * 8 + 1.5 * pay_rate * (hours_worked_per_day[i][j] - 8)
        total += gross_pay
    print(weekdays[j], total)
```

## 12. Solution

---

### First approach

```
ROWS = 3
COLUMN = 4

a = [[9, 9, 2, 6],
      [4, 1, 10, 11],
      [12, 15, 7, 3]
    ]

b = [None] * (ROWS * COLUMN)
k = 0
for i in range(ROWS):
    for j in range(COLUMN):
        b[k] = a[i][j]
        k += 1

for k in range(len(b)):
    print(b[k], end = " ")
```

### Second approach

```
a = [[9, 9, 2, 6],
      [4, 1, 10, 11],
      [12, 15, 7, 3]
    ]

b = []
for row in a:
    b = b + row

for element in b:
    print(element, end = " ")
```

## 13. Solution

---

```
ROWS = 3
COLUMN = 3

a = [16, 12, 3, 5, 6, 9, 18, 19, 20]

b = [None] * COLUMN
for i in range(ROWS):
    k = 0
    for j in range(COLUMN - 1, -1, -1):
        b[i][j] = a[k]
        k += 1

    for i in range(ROWS):
        for j in range(COLUMN):
```

```
|     print(b[i][j], end = "\t")
| print()
```

# Chapter 33

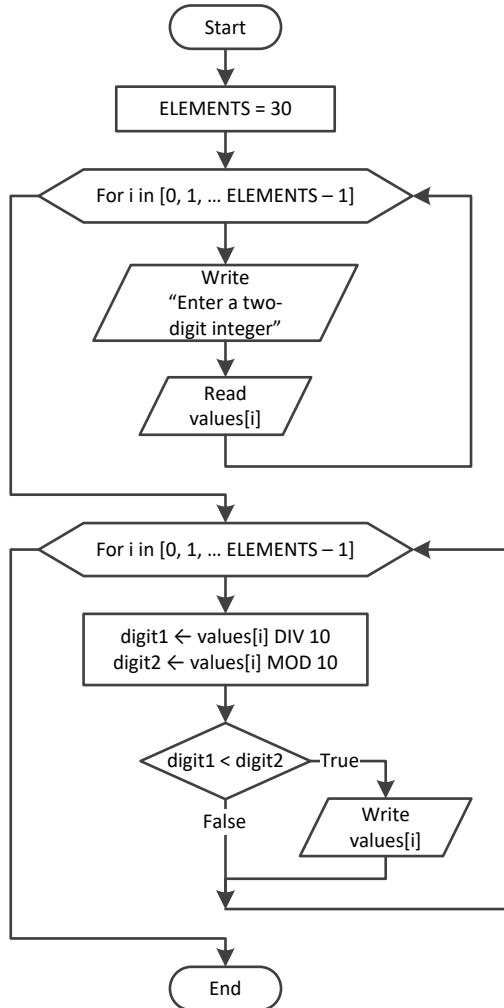
---

## 33.7 Review Questions: True/False

- |           |           |
|-----------|-----------|
| 1. true   | 21. true  |
| 2. false  | 22. true  |
| 3. true   | 23. true  |
| 4. true   | 24. false |
| 5. true   | 25. true  |
| 6. true   | 26. false |
| 7. true   | 27. false |
| 8. false  | 28. false |
| 9. true   | 29. true  |
| 10. false | 30. true  |
| 11. false | 31. true  |
| 12. true  | 32. false |
| 13. false | 33. true  |
| 14. false | 34. false |
| 15. false | 35. true  |
| 16. true  | 36. true  |
| 17. true  | 37. false |
| 18. true  | 38. true  |
| 19. false | 39. true  |
| 20. false | 40. false |

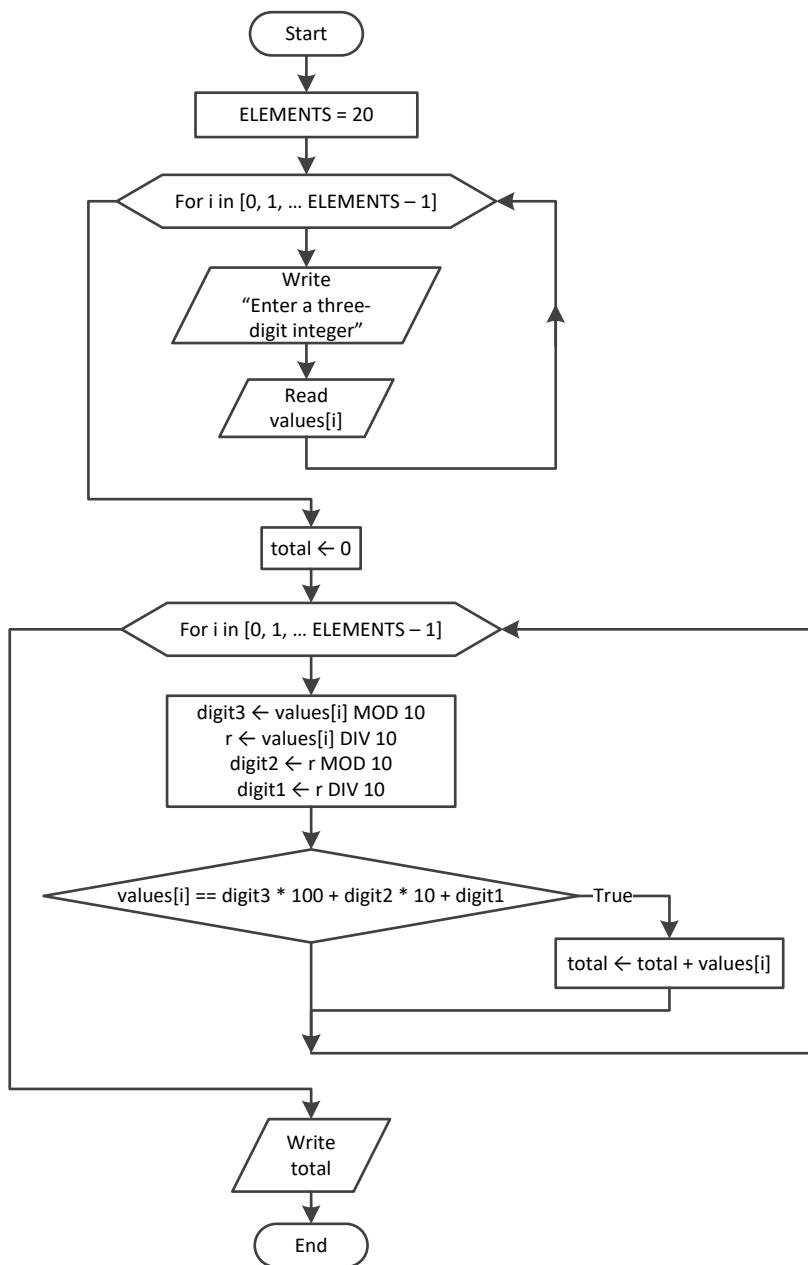
### 33.8 Review Exercises

#### 1. Solution

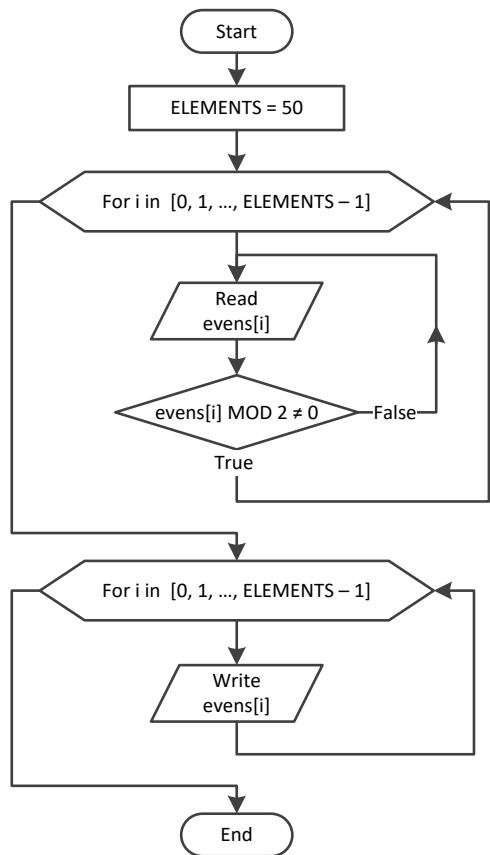


Please note that since flowcharts are a loose method to represent an algorithm, it is not necessary to initialize a list within a flowchart; that is, there is no need to represent the statement `values = [None] * ELEMENTS`.

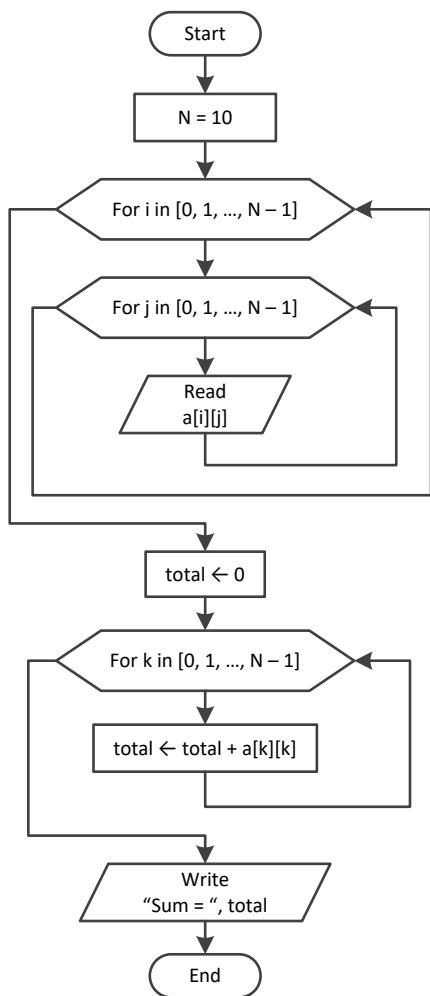
## 2. Solution



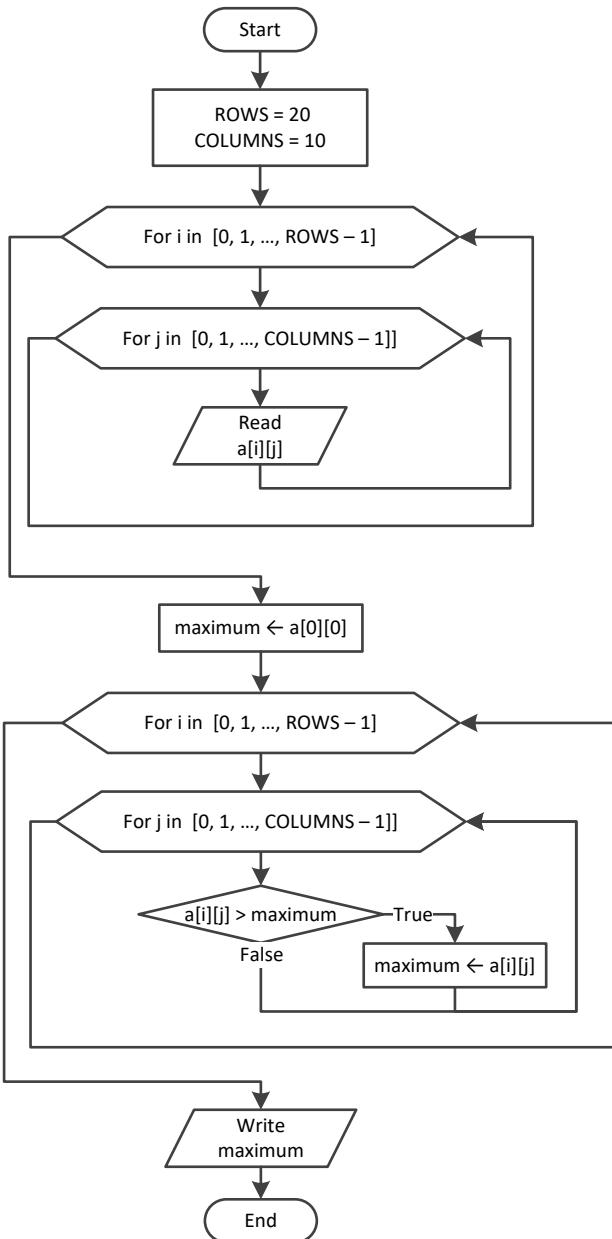
### 3. Solution



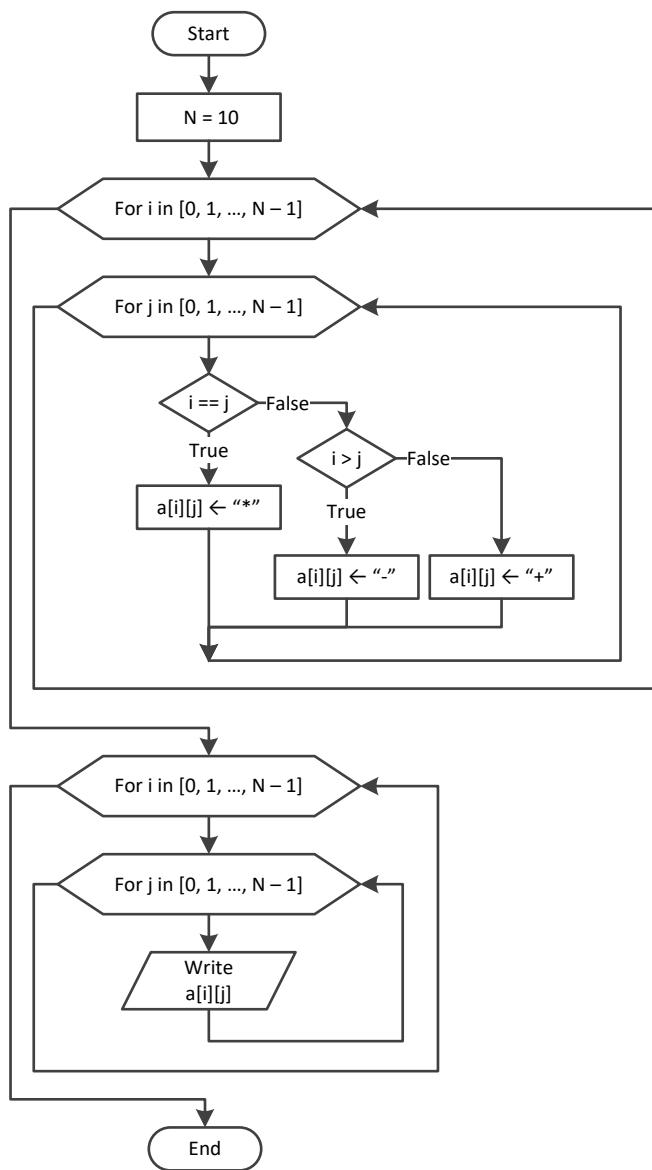
#### 4. Solution



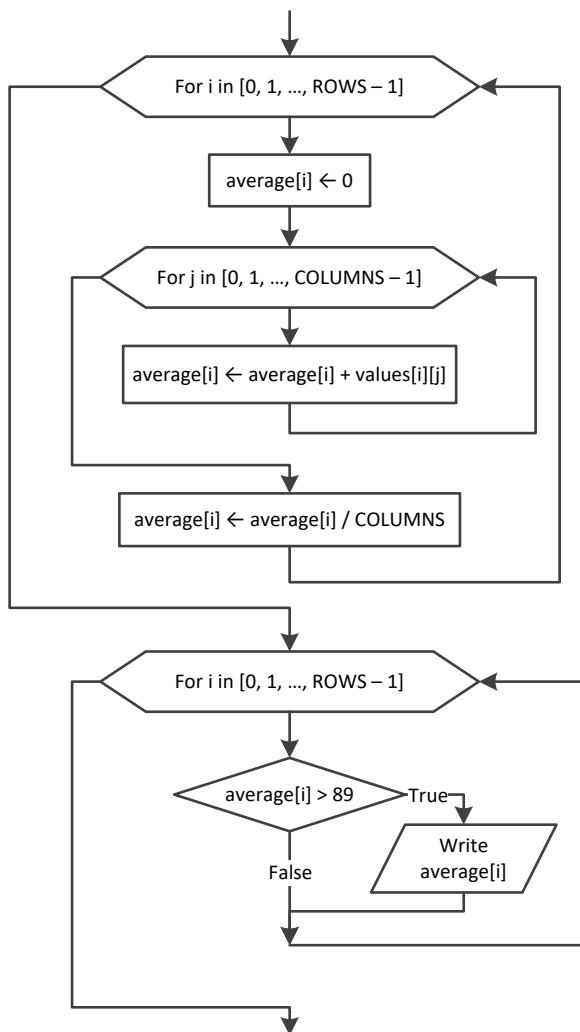
## 5. Solution



## 6. Solution



## 7. Solution



## 8. Solution

```
i = 0
while i <= CITIES - 1:
    while True:
        b[i] = float(input())
        if b[i] < 0: break
    i += 1
```

## 9. Solution

```
pos = [None] * 90
neg = [None] * 90

i = 1
m = 0
```

```

n = 0
while True:
    b = float(input())
    if b < 0:
        pos[m] = b
        m += 1
    else:
        neg[n] = b
        n += 1
    i += 1
    if i >= 90: break
print("The End")

```

### 10. Solution

---

```

i = 0
while i < PEOPLE:
    while True:
        a[i] = int(input())
        if a[i] % 2 == 2: break
    i += 1

```

### 11. Solution

---

```

max_i = 0
max_j = 0
for i in range(CITIES):
    for j in range(CITIZENS):
        if a[i][j] > a[max_i][max_j]:
            max_i = i
            max_j = j

print(a[max_i][max_j])

```

### 12. Solution

---

```

for i in range(ELEMENTS):
    a[i] = float(input())
    while a[i] < 0:
        print("Error")
        a[i] = float(input())

```

### 13. Solution

---

```

i = 0
S = 0
while True:
    a[i] = float(input())
    i += 1
    if i >= 90: break

```

```
S += a[i - 1] * i  
  
print(S)  
  
while i >= 0:  
    print(a[i])  
    i -= 5
```

#### 14. Solution

---

```
for i in range(ROWS):  
    maximum = a[i][0]  
    for j in range(1, COLUMNS):  
        if a[i][j] > maximum:  
            maximum = a[i][j]  
    print(maximum)
```

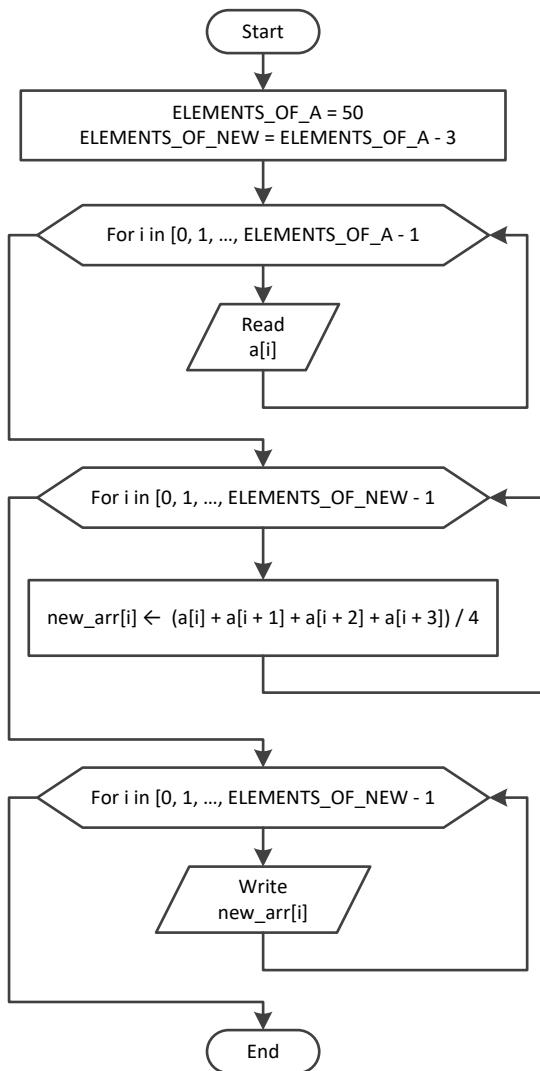
#### 15. Solution

---

```
for i in range(ROWS):  
    for j in range(COLUMNS):  
        a[i][j] = float(input())  
        while a[i][j] == 0:  
            print("Error")  
            a[i][j] = float(input())
```

## 16. Solution

### First approach



```

ELEMENTS_OF_A = 50
ELEMENTS_OF_NEW = ELEMENTS_OF_A - 3

a = [None] * ELEMENTS_OF_A
for i in range(ELEMENTS_OF_A):
    a[i] = float(input())

new_arr = [None] * ELEMENTS_OF_NEW
for i in range(ELEMENTS_OF_NEW):
    new_arr[i] = (a[i] + a[i + 1] + a[i + 2] + a[i + 3]) / 4

for i in range(ELEMENTS_OF_NEW):
    print(new_arr[i], end = "\t")
  
```

**Second approach**

```
import math
ELEMENTS_OF_A = 50

a = [None] * ELEMENTS_OF_A

for i in range(ELEMENTS_OF_A):
    a[i] = float(input())

new_arr = []
for i in range(ELEMENTS_OF_A - 3):
    new_arr.append(math.fsum(a[i:i + 4]) / 4)

for element in new_arr:
    print(element, end = "\t")
```

**17. Solution**

```
ELEMENTS = 15

a = [None] * ELEMENTS
for i in range(ELEMENTS):
    a[i] = float(input())

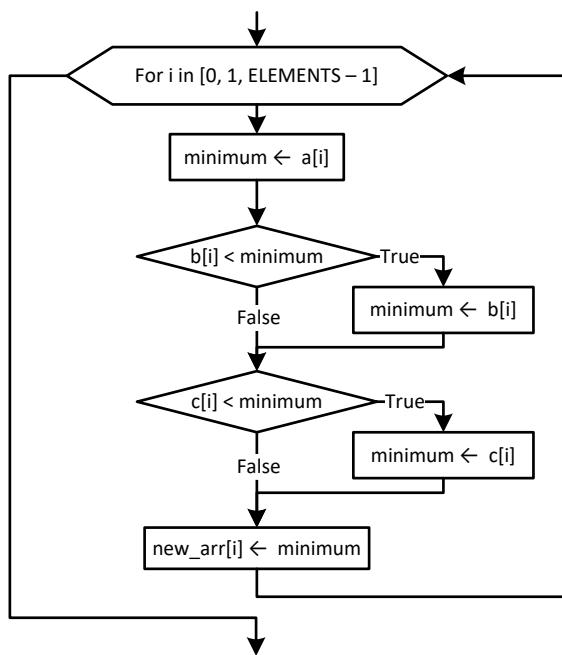
b = [None] * ELEMENTS
for i in range(ELEMENTS):
    b[i] = float(input())

c = [None] * ELEMENTS
for i in range(ELEMENTS):
    c[i] = float(input())

new_arr = [None] * ELEMENTS
for i in range(ELEMENTS): # Or you can do the following:
    minimum = a[i] # new_arr[i] = min(a[i], b[i], c[i])
    if b[i] < minimum:
        minimum = b[i]
    if c[i] < minimum:
        minimum = c[i]
    new_arr[i] = minimum #
```

```
for i in range(ELEMENTS):
    print(new_arr[i])
```



## 18. Solution

### First approach

```

ELEMENTS_OF_A = 10
ELEMENTS_OF_B = 5
ELEMENTS_OF_C = 15
ELEMENTS_OF_NEW = ELEMENTS_OF_A + ELEMENTS_OF_B + ELEMENTS_OF_C

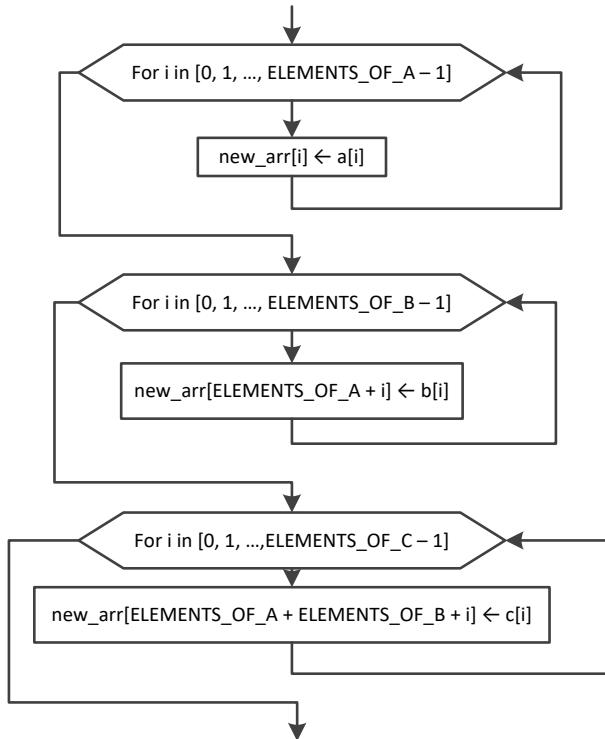
a = [None] * ELEMENTS_OF_A
for i in range(ELEMENTS_OF_A):
    a[i] = float(input())

b = [None] * ELEMENTS_OF_B
for i in range(ELEMENTS_OF_B):
    b[i] = float(input())

c = [None] * ELEMENTS_OF_C
for i in range(ELEMENTS_OF_C):
    c[i] = float(input())

new_arr = [None] * ELEMENTS_OF_NEW
for i in range(ELEMENTS_OF_C):
    new_arr[i] = c[i]
for i in range(ELEMENTS_OF_B):
    new_arr[ELEMENTS_OF_C + i] = b[i]
for i in range(ELEMENTS_OF_A):
    new_arr[ELEMENTS_OF_B + ELEMENTS_OF_C + i] = a[i]
  
```

```
for i in range(ELEMENTS_OF_NEW):
    print(new_arr[i], end = "\t")
```



### Second approach

```
ELEMENTS_OF_A = 10
ELEMENTS_OF_B = 5
ELEMENTS_OF_C = 15

a = [None] * ELEMENTS_OF_A
for i in range(ELEMENTS_OF_A):
    a[i] = float(input())

b = [None] * ELEMENTS_OF_B
for i in range(ELEMENTS_OF_B):
    b[i] = float(input())

c = [None] * ELEMENTS_OF_C
for i in range(ELEMENTS_OF_C):
    c[i] = float(input())

new_arr = []
for element in c:
    new_arr.append(element)
for element in b:
    new_arr.append(element)
for element in a:
    new_arr.append(element)
```

```

for element in new_arr:
    print(element, end = "\t")

```

### Third approach

```

ELEMENTS_OF_A = 10
ELEMENTS_OF_B = 5
ELEMENTS_OF_C = 15

a = [None] * ELEMENTS_OF_A
for i in range(ELEMENTS_OF_A):
    a[i] = float(input())

b = [None] * ELEMENTS_OF_B
for i in range(ELEMENTS_OF_B):
    b[i] = float(input())

c = [None] * ELEMENTS_OF_C
for i in range(ELEMENTS_OF_C):
    c[i] = float(input())

new_arr = c + b + a

for element in new_arr:
    print(element, end = "\t")

```

### 19. Solution

```

COLUMNS_OF_A = 10
COLUMNS_OF_B = 15
COLUMNS_OF_C = 20
ROWS = 5
COLUMNS = COLUMNS_OF_A + COLUMNS_OF_B + COLUMNS_OF_C

a = [ [None] * COLUMNS_OF_A for i in range(ROWS) ]
for i in range(ROWS):
    for j in range(COLUMNS_OF_A):
        a[i][j] = float(input())

b = [ [None] * COLUMNS_OF_B for i in range(ROWS) ]
for i in range(ROWS):
    for j in range(COLUMNS_OF_B):
        b[i][j] = float(input())

c = [ [None] * COLUMNS_OF_C for i in range(ROWS) ]
for i in range(ROWS):
    for j in range(COLUMNS_OF_C):
        c[i][j] = float(input())

new_arr = [ [None] * COLUMNS for i in range(ROWS) ]

```

```
for i in range(ROWS):
    for j in range(COLUMNS_OF_A):
        new_arr[i][j] = a[i][j]
for i in range(ROWS):
    for j in range(COLUMNS_OF_B):
        new_arr[i][COLUMNS_OF_A + j] = b[i][j]
for i in range(ROWS):
    for j in range(COLUMNS_OF_C):
        new_arr[i][COLUMNS_OF_A + COLUMNS_OF_B + j] = c[i][j]

for i in range(ROWS):
    for j in range(COLUMNS):
        print(new_arr[i][j], end = "\t")
print()
```

## 20. Solution

---

### First approach

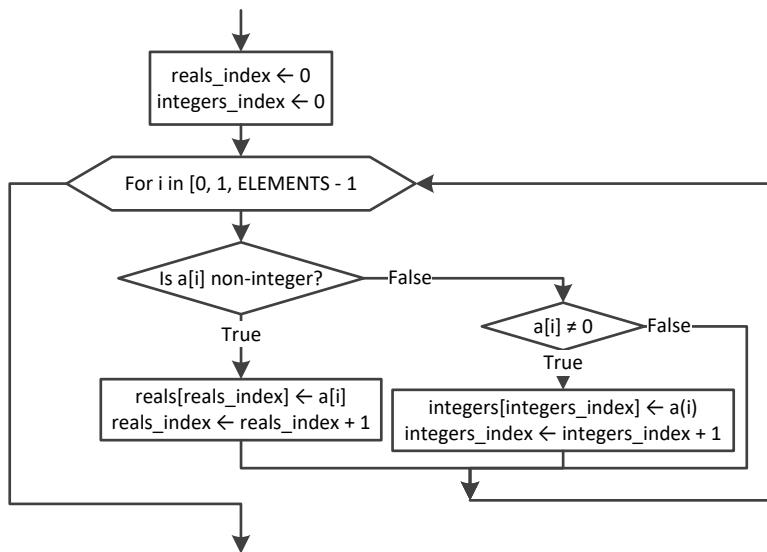
```
ELEMENTS = 50

a = [None] * ELEMENTS
for i in range(ELEMENTS):
    a[i] = float(input())

reals = [None] * ELEMENTS
integers = [None] * ELEMENTS
reals_index = 0
integers_index = 0
for i in range(ELEMENTS):
    if a[i] != int(a[i]):
        reals[reals_index] = a[i]
        reals_index += 1
    elif a[i] != 0:
        integers[integers_index] = int(a[i])
        integers_index += 1

for i in range(reals_index):
    print(reals[i], end = "\t")

print()
for i in range(integers_index):
    print(integers[i], end = "\t")
```

**Second approach**

```

ELEMENTS = 50

a = [None] * ELEMENTS

for i in range(ELEMENTS):
    a[i] = float(input())

reals = []
integers = []
for element in a:
    if element != int(element):
        reals.append(element)
    elif element != 0:
        integers.append(element)

for element in reals:
    print(element, end = "\t")

print()
for element in integers:
    print(element, end = "\t")
  
```

**21. Solution****First approach**

```

ELEMENTS = 50

a = [None] * ELEMENTS
for i in range(ELEMENTS):
    a[i] = int(input())
  
```

```

b = []
for element in a:
    digit1, r = divmod(element, 100)
    digit2, digit3 = divmod(r, 10)

    if digit1 < digit2 < digit3:
        b.append(element)

for element in b:
    print(element, end = "\t")

```

### Second approach

```

ELEMENTS = 50

a = [None] * ELEMENTS
for i in range(ELEMENTS):
    a[i] = int(input())

b = []
for element in a:
    digit1, digit2, digit3 = str(element)      #digit1, digit2, digit3 are strings

    if digit1 < digit2 < digit3:                #Compare them as strings (no need to convert to integers)
        b.append(element)

for element in b:
    print(element, end = "\t")

```

## 22. Solution

```

PRODUCTS = 10
CITIZENS = 200

prod_names = [None] * PRODUCTS
answers = [ [None] * CITIZENS for i in range(PRODUCTS) ]
for i in range(PRODUCTS):
    prod_names[i] = input()
    for j in range(CITIZENS):
        answers[i][j] = input()
        while not("A" <= answers[i][j] <= "D"):
            print("Error! ")
            answers[i][j] = input()

count_A = [None] * PRODUCTS
for i in range(PRODUCTS):
    count_A[i] = 0
    for j in range(CITIZENS):
        if answers[i][j] == "A":
            count_A[i] += 1
print(prod_names[i], count_A[i])

```

```

for j in range(CITIZENS):
    count_B = 0
    for i in range(PRODUCTS):
        if answers[i][j] == "B":
            count_B += 1
    print(count_B)

maximum = count_A[0]                      # This code fragment can be replaced by the statement
for i in range(1, PRODUCTS):               # maximum = max(count_A)
    if count_A[i] > maximum:             #
        maximum = count_A[i]             #

for i in range(PRODUCTS):
    if count_A[i] == maximum:
        print(prod_names[i])

```

### 23. Solution

---

```

US_CITIES = 20
CANADIAN_CITIES = 20

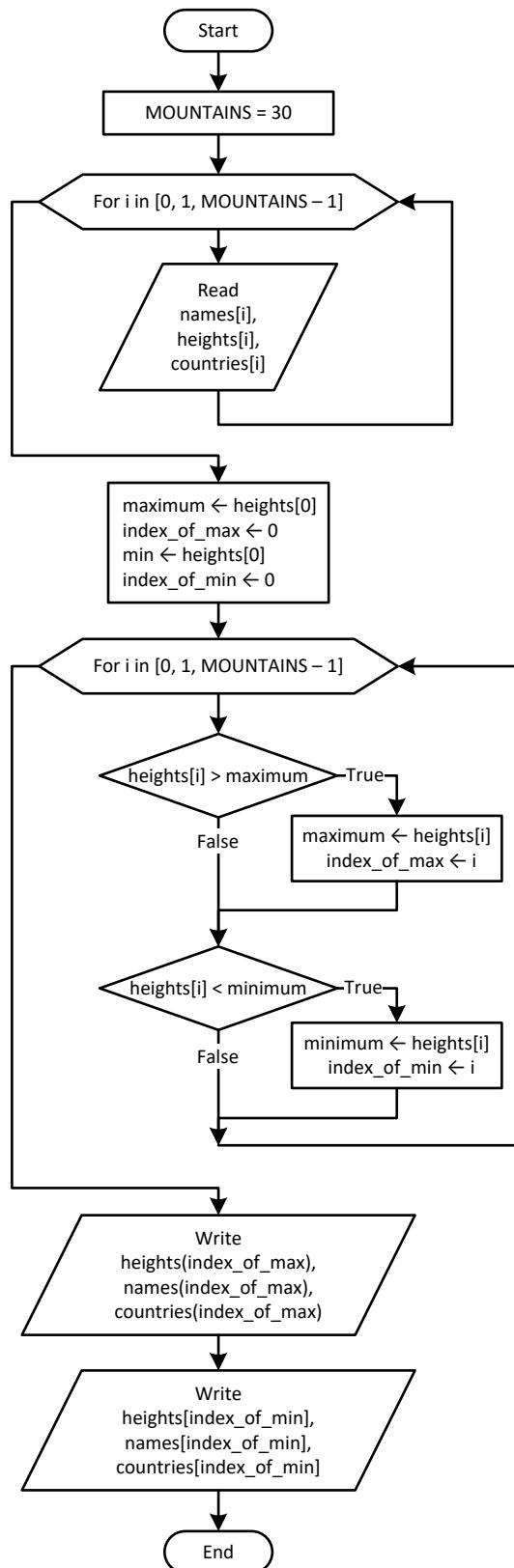
us_names = [None] * US_CITIES
for i in range(US_CITIES):
    us_names[i] = input("Enter name for US city No" + str(i + 1) + ": ")

canadian_names = [None] * CANADIAN_CITIES
for j in range(CANADIAN_CITIES):
    canadian_names[j] = input("Enter name for Canadian city No" + str(j + 1) + ": ")

distances = [ [None] * CANADIAN_CITIES for i in range(US_CITIES) ]
for i in range(US_CITIES):
    for j in range(CANADIAN_CITIES):
        distances[i][j] = float(input("Enter distance between " + us_names[i] + " and " +
                                       canadian_names[j] + ": "))

for i in range(US_CITIES):
    minimum = distances[i][0]
    min_j = 0
    for j in range(1, CANADIAN_CITIES):
        if distances[i][j] < minimum:
            minimum = distances[i][j]
            min_j = j
    print("Closest Canadian city to", us_names[i], "is", canadian_names[min_j])

```

**24. Solution**

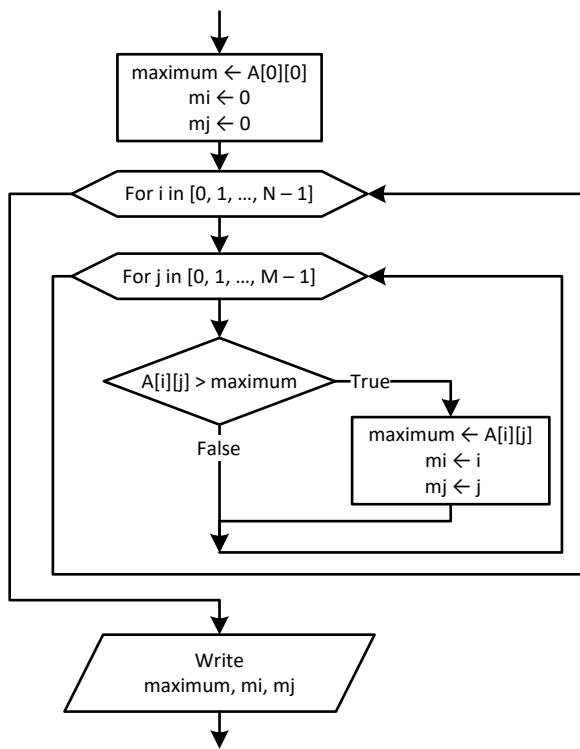
```
MOUNTAINS = 30

names = [None] * MOUNTAINS
heights = [None] * MOUNTAINS
countries = [None] * MOUNTAINS
for i in range(MOUNTAINS):
    names[i] = input()
    heights[i] = float(input())
    countries[i] = input()

maximum = heights[0]
index_of_max = 0
minimum = heights[0]
index_of_min = 0
for i in range(1, MOUNTAINS):
    if heights[i] > maximum:
        maximum = heights[i]
        index_of_max = i
    if heights[i] < minimum:
        minimum = heights[i]
        index_of_min = i

print(heights[index_of_max], names[index_of_max], countries[index_of_max])
print()
print(heights[index_of_min], names[index_of_min], countries[index_of_min])
```

## 25. Solution



## 26. Solution

```

TEAMS = 26
GAMES = 15

names = [None] * TEAMS
results = [ [None] * GAMES for i in range(TEAMS) ]
for i in range(TEAMS):
    names[i] = input()
    for j in range(GAMES):
        results[i][j] = input()

points = [None] * TEAMS
for i in range(TEAMS):
    points[i] = 0
    for j in range(GAMES):
        if results[i][j] == "W":
            points[i] += 3
        elif results[i][j] == "T":
            points[i] += 1

maximum = points[0]
m_i = 0
for i in range(1, TEAMS):
  
```

```

if points[i] > maximum:
    maximum = points[i]
    m_i = i

print(names[m_i])

```

## 27. Solution

---

### First approach

```

OBJECTS = 10
FALLS = 20

heights = [ [None] * FALLS for i in range(OBJECTS) ]
times = [ [None] * FALLS for i in range(OBJECTS) ]
for i in range(OBJECTS):
    for j in range(FALLS):
        heights[i][j] = float(input())
        times[i][j] = float(input())

g = [ [None] * FALLS for i in range(OBJECTS) ]
for i in range(OBJECTS):
    for j in range(FALLS):
        g[i][j] = 2 * heights[i][j] / times[i][j] ** 2

minimum = [None] * OBJECTS
maximum = [None] * OBJECTS
for i in range(OBJECTS):
    minimum[i] = g[i][0]
    maximum[i] = g[i][0]
    for j in range(1, FALLS):
        if g[i][j] < minimum[i]:
            minimum[i] = g[i][j]
        if g[i][j] > maximum[i]:
            maximum[i] = g[i][j]

for i in range(OBJECTS):
    print(minimum[i], maximum[i])

maxim = maximum[0]
minim = minimum[0]
for i in range(1, OBJECTS):
    if maximum[i] > maxim:
        maxim = maximum[i]
    if minimum[i] < minim:
        minim = minimum[i]

print(minim, maxim)

```

### Second approach

```
OBJECTS = 10
```

```
FALLS = 20

g = [ [None] * FALLS for i in range(OBJECTS) ]
for i in range(OBJECTS):
    for j in range(FALLS):
        height = float(input())
        time = float(input())
        g[i][j] = 2 * height / time ** 2

minimum = [None] * OBJECTS
maximum = [None] * OBJECTS
for i in range(OBJECTS):
    minimum[i] = min(g[i])      # g[i] returns the whole row
    maximum[i] = max(g[i])

for i in range(OBJECTS):
    print(minimum[i], maximum[i])

print(min(minimum), max(maximum))
```

## 28. Solution

---

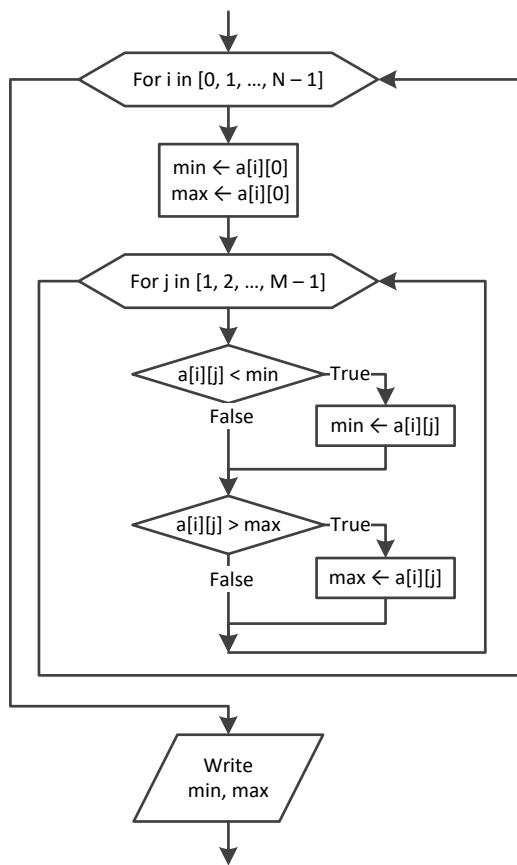
```
STATIONS = 10
DAYS = 365

names = [None] * STATIONS
co2 = [ [None] * DAYS for i in range(STATIONS) ]
for i in range(STATIONS):
    names[i] = input()
    for j in range(DAYS):
        co2[i][j] = float(input())

# Or you can do the following:
average = [None] * STATIONS
for i in range(STATIONS):          # for row in co2:
    average[i] = 0                 #     average.append(math.fsum(row) / DAYS)
    for j in range(DAYS):
        average[i] += co2[i][j]      #
    average[i] /= DAYS             #

minimum = average[0]
m_i = 0
for i in range(1, STATIONS):
    if average[i] < minimum:
        minimum = average[i]
        m_i = i
print(names[m_i])
```

## 29. Solution



## 30. Solution

### First approach

```

ROWS = 20
COLUMNNS = 30

b = [ [None] * COLUMNNS for i in range(ROWS) ]

for i in range(ROWS):
    for j in range(COLUMNNS):
        b[i][j] = float(input())

minimum = [None] * COLUMNNS
maximum = [None] * COLUMNNS

for j in range(COLUMNNS):
    minimum[j] = b[0][j]
    maximum[j] = b[0][j]
    for i in range(1, ROWS):
        if b[i][j] < minimum[j]:
            minimum[j] = b[i][j]
        if b[i][j] > maximum[j]:
            maximum[j] = b[i][j]

print(minimum)
print(maximum)
  
```

```

        minimum[j] = b[i][j]
    if b[i][j] > maximum[j]:
        maximum[j] = b[i][j]

for j in range(COLUMNS):
    print(minimum[j], maximum[j])

```

### Second approach

```

ROWS = 20
COLUMNS = 30

b = [ [None] * COLUMNS for i in range(ROWS) ]

for i in range(ROWS):
    for j in range(COLUMNS):
        b[i][j] = float(input())

for j in range(COLUMNS):
    minimum = b[0][j]
    maximum = b[0][j]
    for i in range(1, ROWS):
        if b[i][j] < minimum:
            minimum = b[i][j]
        if b[i][j] > maximum:
            maximum = b[i][j]
    print(minimum, maximum)

```

### 31. Solution

```

TEAMS = 20
GAMES = 10

names = [None] * TEAMS
results = [ [None] * GAMES for i in range(TEAMS) ]
for i in range(TEAMS):
    names[i] = input("Enter team name: ")
    for j in range(GAMES):
        results[i][j] = input("Enter result for team " + names[i] + " for game No" + str(j + 1) + ": ")
        while results[i][j] not in ["W", "L", "T"]:
            results[i][j] = input("Error! Enter only value W, L, or T: ")

points = [None] * TEAMS
for i in range(TEAMS):
    points[i] = 0
    for j in range(GAMES):
        if results[i][j] == "W":
            points[i] += 3
        elif results[i][j] == "T":
            points[i] += 1

```

```

for m in range(TEAMS - 1):
    swaps = False
    for n in range(TEAMS - 1, m, -1):
        if points[n] > points[n - 1]:
            points[n], points[n - 1] = points[n - 1], points[n]
            names[n], names[n - 1] = names[n - 1], names[n]
            swaps = True
    if not swaps: break

print("Gold:", names[0])
print("Silver:", names[1])
print("Bronze:", names[2])

```

### 32. Solution

---

```

PEOPLE = 50

names = [None] * PEOPLE
heights = [None] * PEOPLE
for i in range(PEOPLE):
    names[i] = input("Enter name for person No." + str(i + 1) + ": ")
    heights[i] = float(input("Enter height for person No." + str(i + 1) + ": "))

for m in range(PEOPLE - 1):
    for n in range(PEOPLE - 1, m, -1):
        if heights[n] > heights[n - 1]:
            heights[n], heights[n - 1] = heights[n - 1], heights[n]
            names[n], names[n - 1] = names[n - 1], names[n]
        elif heights[n] == heights[n - 1]:
            if names[n] < names[n - 1]:
                names[n], names[n - 1] = names[n - 1], names[n]

for i in range(PEOPLE):
    print(heights[i], names[i])

```

### 33. Solution

---

```

ARTISTS = 12
JUDGES = 10

artist_names = [None] * ARTISTS
score = [ [None] * JUDGES for i in range(ARTISTS) ]
for i in range(ARTISTS):
    artist_names[i] = input("Enter name for artist No." + str(i + 1) + ": ")
    for j in range(JUDGES):
        print("Enter score for artist: ", artist_names[i])
        score[i][j] = int(input(" gotten from judge No." + str(j + 1) + ": "))

total = [None] * ARTISTS # Or you can do the following:
for i in range(ARTISTS): # for row in score:

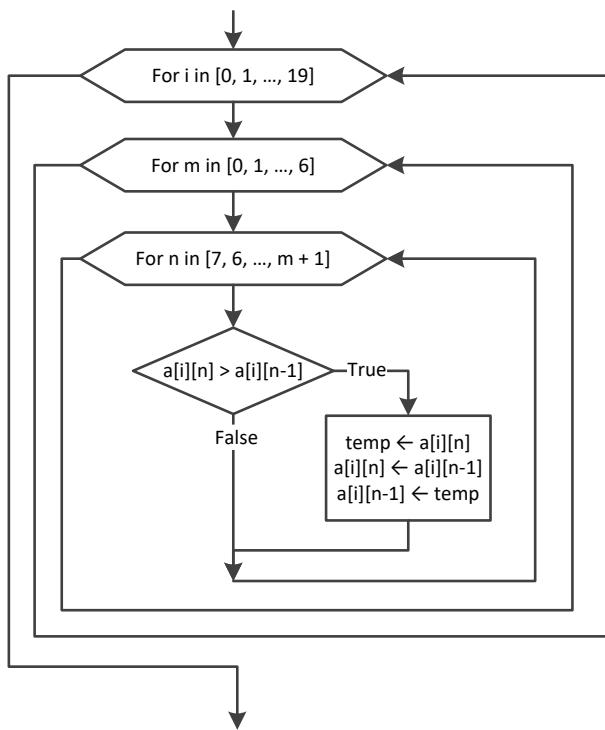
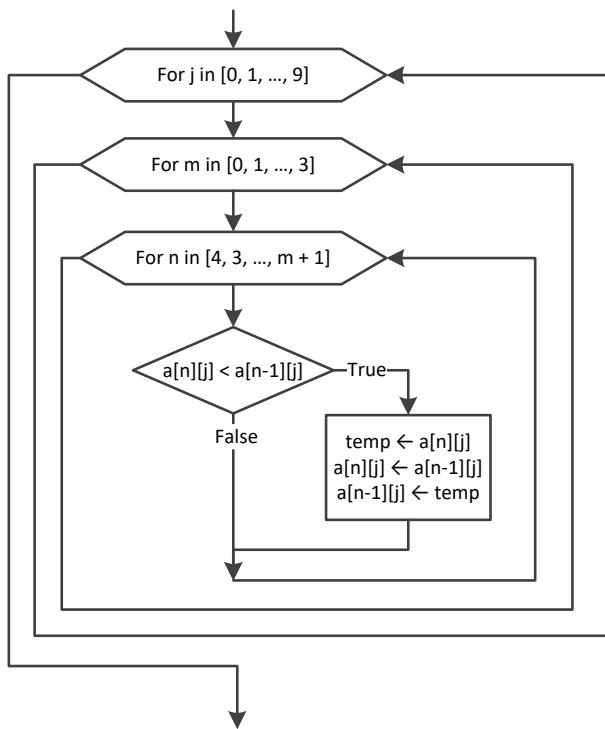
```

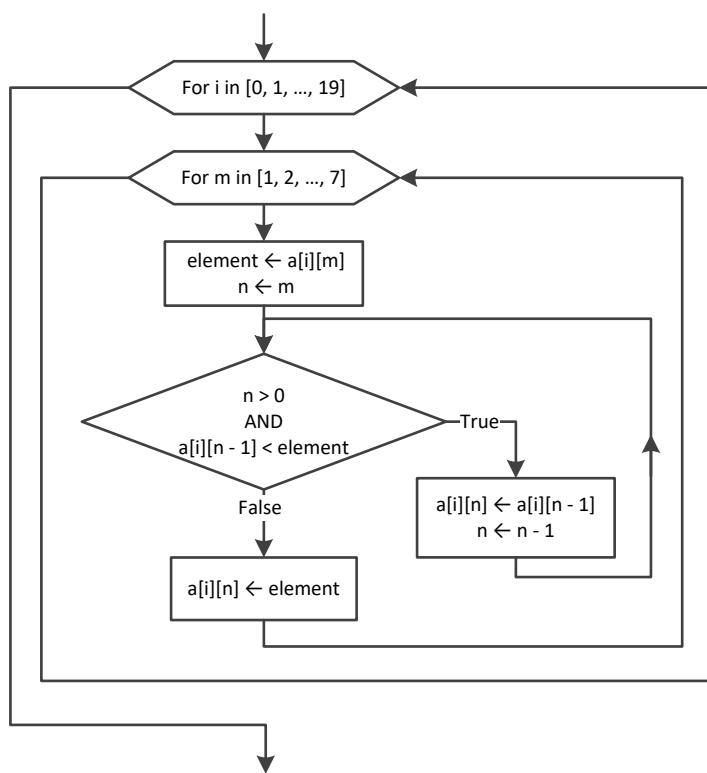
```
total[i] = 0                      #      total[i] = math.fsum(row)
for j in range(1, JUDGES):          #
    total[i] += score[i][j]          #

# Or you can do the following:
for i in range(ARTISTS):           #
    minimum = score[i][0]           #
    maximum = score[i][0]           #
    for j in range(1, JUDGES):       #
        if score[i][j] < minimum:   #
            minimum = score[i][j]   #
        if score[i][j] > maximum:   #
            maximum = score[i][j]   #
    total[i] = total[i] - minimum - maximum #
    print(total[i])                #

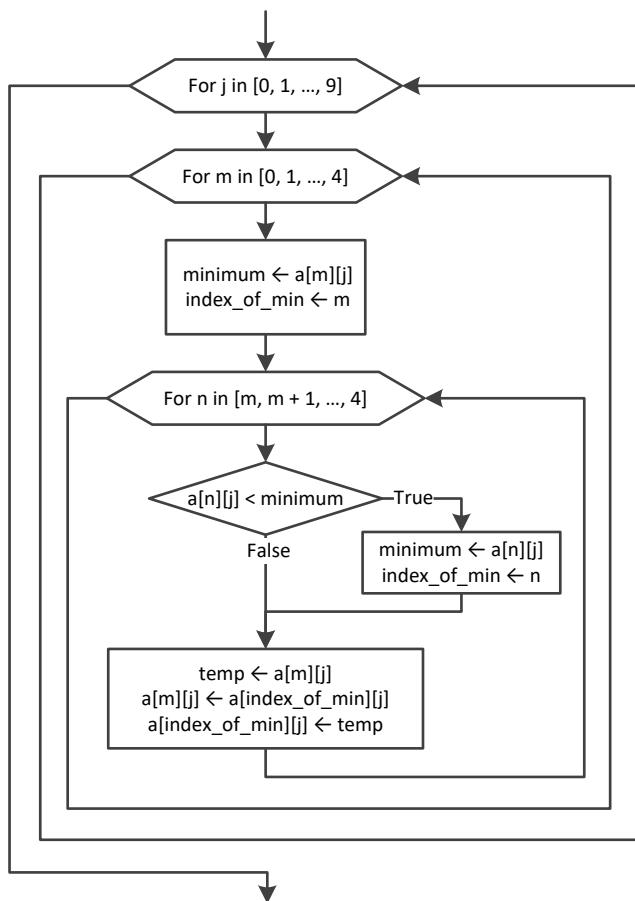
for m in range(ARTISTS - 1):
    for n in range(ARTISTS - 1, m, -1):
        if total[n] > total[n - 1]:
            total[n], total[n - 1] = total[n - 1], total[n]
            artist_names[n], artist_names[n - 1] = artist_names[n - 1], artist_names[n]
        elif total[n] == total[n - 1]:
            if artist_names[n] < artist_names[n - 1]:
                artist_names[n], artist_names[n - 1] = artist_names[n - 1], artist_names[n]

for i in range(ARTISTS):
    print(artist_names[i], total[i])
```

**34. Solution****35. Solution**

**36. Solution**

### 37. Solution



### 38. Solution

```

PEOPLE = 10
PUZZLES = 8

names = [None] * PEOPLE
times = [ [None] * PUZZLES for i in range(PEOPLE) ]
for i in range(PEOPLE):
    names[i] = input()
    for j in range(PUZZLES):
        times[i][j] = float(input())

for i in range(PEOPLE):
    for m in range(PUZZLES):
        minimum = times[i][m]
        index_of_min = m
        for n in range(m, PUZZLES):
            if times[i][n] < minimum:
                minimum = times[i][n]
                index_of_min = n
        times[i][m] = minimum
  
```

```

        index_of_min = n
    times[i][m], times[i][index_of_min] = times[i][index_of_min], times[i][m]

for i in range(PEOPLE):
    print(names[i])
    for j in range(3):
        print(times[i][j])

# Or you can do the following:
average = [None] * PEOPLE
for i in range(PEOPLE):
    average[i] = 0
    for j in range(PUZZLES):
        average[i] += times[i][j]
    average[i] /= PUZZLES

for m in range(PEOPLE):
    minimum = average[m]
    index_of_min = m
    for n in range(m, PEOPLE):
        if average[n] < minimum:
            minimum = average[n]
            index_of_min = n
    average[m], average[index_of_min] = average[index_of_min], average[m]
    names[m], names[index_of_min] = names[index_of_min], names[m]

print(names[0], names[1], names[2])

```

### 39. Solution

```

AREAS = 5
HOURS = 48

names = [None] * AREAS
CO2 = [ [None] * HOURS for i in range(AREAS) ]
for i in range(AREAS):
    names[i] = input()
    for j in range(HOURS):
        CO2[i][j] = float(input())

# Or you can do the following:
average_per_hour = [None] * AREAS
for i in range(AREAS):
    average_per_hour[i] = 0
    for j in range(HOURS):
        average_per_hour[i] += CO2[i][j]
    average_per_hour[i] /= HOURS

for i in range(AREAS):
    print(names[i], average_per_hour[i])

```

```
average_per_city = [None] * HOURS
for j in range(HOURS):
    average_per_city[j] = 0
    for i in range(AREAS):
        average_per_city[j] += CO2[i][j]
    average_per_city[j] /= AREAS

for j in range(HOURS):
    print(average_per_city[j])

maximum = average_per_city[0]
m_j = 0
for j in range(1, HOURS):
    if average_per_city[j] > max:
        maximum = average_per_city[j]
        m_j = j
print(m_j)

maximum = CO2[0][0]
m_i = 0
m_j = 0
for i in range(AREAS):
    for j in range(HOURS):
        if CO2[i][j] > max:
            maximum = CO2[i][j]
            m_i = i
            m_j = j
print(m_j, names[m_i])

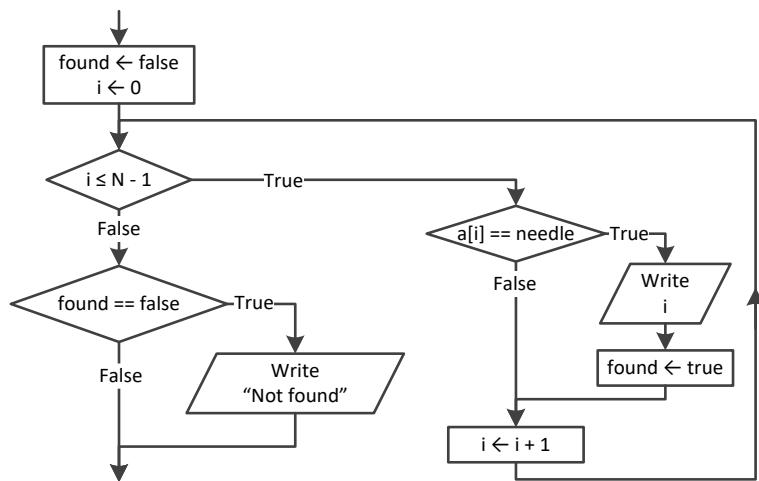
for m in range(1, AREAS):
    element_1 = average_per_hour[m]
    element_2 = names[m]

    n = m
    while n > 0 and average_per_hour[n - 1] < element_1:
        average_per_hour[n] = average_per_hour[n - 1]
        names[n] = names[n - 1]
        n -= 1

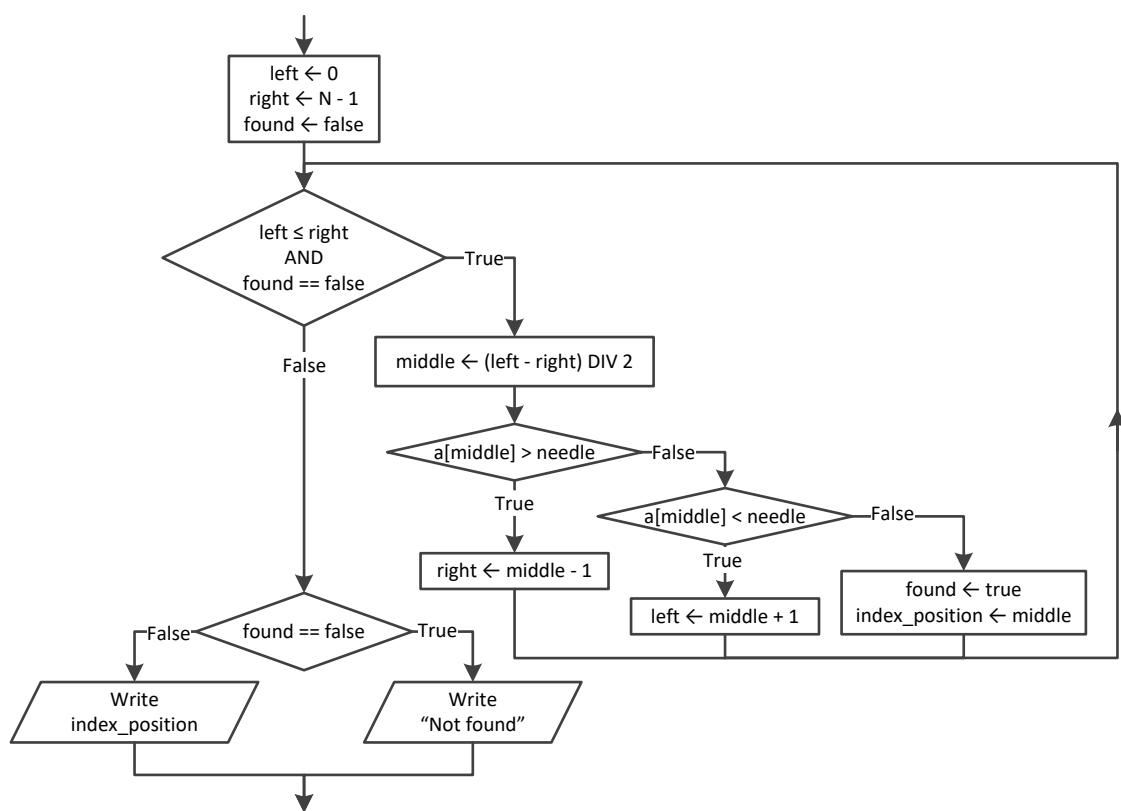
    average_per_hour[n] = element_1
    names[n] = element_2

print(names[0], names[1], names[2])
```

#### 40. Solution



#### 41. Solution



#### 42. Solution

TEAMS = 10
GAMES = 16

```
names = [None] * TEAMS
goals_scored = [ [None] * GAMES for i in range(TEAMS) ]
goals_let_in = [ [None] * GAMES for i in range(TEAMS) ]
for i in range(TEAMS):
    names[i] = input("Enter team name: ")
    for j in range(GAMES):
        goals_scored[i][j] = int(input("Enter goals scored: "))
        while goals_scored[i][j] < 0:
            goals_scored[i][j] = int(input("Error! Enter goals scored: "))

        goals_let_in[i][j] = int(input("Enter goals let in: "))
        while goals_let_in[i][j] < 0:
            goals_let_in[i][j] = int(input("Error! Enter goals let in: "))

needle = input("Enter a team to search: ")

i = 0
while i < TEAMS - 1 and names[i] != needle:
    i += 1

if names[i] != needle:
    print("This team does not exist")
else:
    total = 0
    for j in range(GAMES):
        if goals_scored[i][j] > goals_let_in[i][j]:
            total += 3
        elif goals_scored[i][j] == goals_let_in[i][j]:
            total += 1
    print(total)
```

### 43. Solution

```
CLASS1 = 20
CLASS2 = 25

print("Class 1")
names1 = [None] * CLASS1
for i in range(CLASS1):
    names1[i] = input("Enter name: ")

print("Class 2")
names2 = [None] * CLASS2
for i in range(CLASS2):
    names2[i] = input("Enter name: ")

#Bubblesort
for m in range(CLASS1 - 1):
```

```
for n in range(CLASS1 - 1, m, -1):
    if names1[n] < names1[n - 1]:
        names1[n], names1[n - 1] = names1[n - 1], names1[n]

for m in range(CLASS2 - 1):
    for n in range(CLASS2 - 1, m, -1):
        if names2[n] < names2[n - 1]:
            names2[n], names2[n - 1] = names2[n - 1], names2[n]

print("\nClass 1")
for i in range(CLASS1):
    print(names1[i])
print("\nClass 2")
for i in range(CLASS2):
    print(names2[i])

needle = input("Enter a name to search: ")

left = 0
right = CLASS1 - 1
found = False
while left <= right and not found:
    middle = (left + right) // 2

    if names1[middle] > needle:
        right = middle - 1
    elif names1[middle] < needle:
        left = middle + 1
    else:
        found = True

if found:
    print("Student found in Class No 1")
else:
    left = 0
    right = CLASS2 - 1
    while left <= right and not found:
        middle = (left + right) // 2

        if names2[middle] > needle:
            right = middle - 1
        elif names2[middle] < needle:
            left = middle + 1
        else:
            found = True

    if found:
        print("Student found in Class No 2")
    else:
```

```
    print("Student not found in either class")
```

#### 44. Solution

---

```
usr = input("Enter username: ").upper()
pwd = input("Enter password: ").upper()

i = 0
while i < 99 and usernames[i].upper() != usr:
    i += 1

if usernames[i].upper() == usr and passwords[i].upper() == pwd:
    print("Login OK!")
else:
    print("Login Failed!")
```

#### 45. Solution

---

```
value_str = input("Enter a value to search: ")
found = False

for i in range(1000):
    if names[i] == value_str:
        print(SSNs[i])
        found = True

if not found:
    value = int(value_str)
    i = 0
    while i < 999 and SSNs[i] != value:
        i += 1

    if SSNs[i] == value:
        found = True
        print(names[i])

if not found:
    print("This value does not exist")
```

#### 46. Solution

---

```
STUDENTS = 12
LESSONS = 6

grades = [ [None] * LESSONS for i in range(STUDENTS) ]
for i in range(STUDENTS):
    for j in range(LESSONS):
        while True:
            grades[i][j] = int(input())
            failure = False
```

```

if grades[i][j] < 0:
    print("Error! You entered a negative value")
    failure = True
elif grades[i][j] > 100:
    print("Error! You entered a value grater than 100")
    failure = True

if not failure: break

average = [None] * STUDENTS
for i in range(STUDENTS):
    average[i] = 0
    for j in range(LESSONS):
        average[i] += grades[i][j]
    average[i] /= LESSONS

found = False
for i in range(STUDENTS):
    if average[i] < 70:
        found = True
        break

if found:
    print("There is at least one student that has an average value below 70")

```

## 47. Solution

---

```

morseAlphabet ={
    "A" : ".-",
    "B" : "-...",
    "C" : "-.-.",
    "D" : "-..",
    "E" : ".",
    "F" : "...",
    "G" : "--.",
    "H" : "....",
    "I" : "..",
    "J" : ".---",
    "K" : "-.-",
    "L" : ".-..",
    "M" : "--",
    "N" : "-.",
    "O" : "---",
    "P" : ".--.",
    "Q" : "--.-",
    "R" : ".-.",
    "S" : "...",
    "T" : "-",
}

```

```
"U" : "...-",
"V" : "...-",
"W" : ".--",
"X" : "-..-",
"Y" : "-.-",
"Z" : "--..",
" " : "/"
}

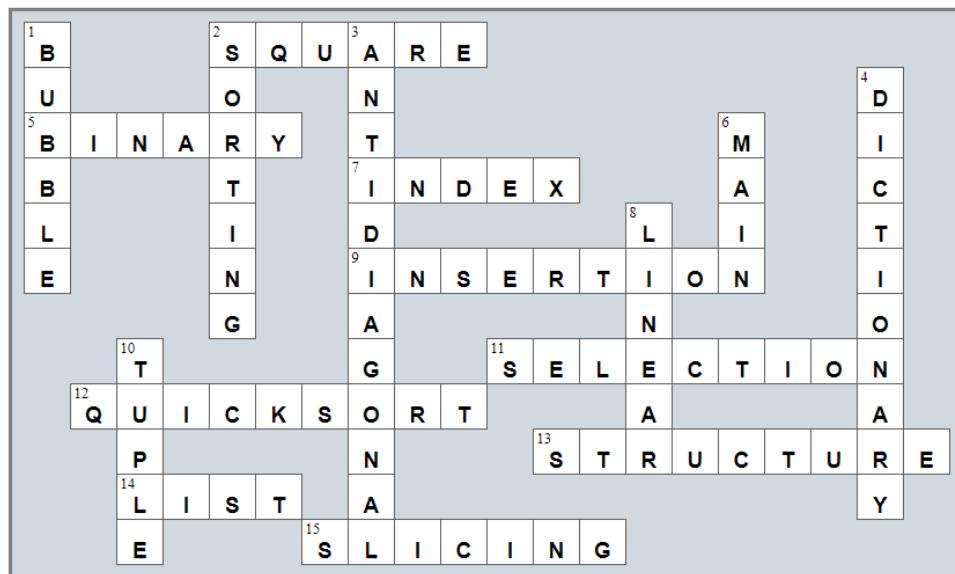
word = input("Enter a word: ")

for letter in word:
    print(morseAlphabet[letter.upper()], end = " ")
```

## Review in "Data Structures in Python"

### Review Crossword Puzzle

1.



# Chapter 34

---

## 34.4 Review Questions: True/False

- |          |           |
|----------|-----------|
| 1. true  | 7. true   |
| 2. true  | 8. false  |
| 3. false | 9. true   |
| 4. false | 10. true  |
| 5. true  | 11. false |
| 6. true  | 12. true  |

# Chapter 35

---

## 35.8 Review Questions: True/False

- |           |           |
|-----------|-----------|
| 1. false  | 18. true  |
| 2. true   | 19. false |
| 3. false  | 20. true  |
| 4. true   | 21. true  |
| 5. true   | 22. true  |
| 6. false  | 23. true  |
| 7. true   | 24. false |
| 8. false  | 25. true  |
| 9. true   | 26. false |
| 10. false | 27. true  |
| 11. true  | 28. false |
| 12. true  | 29. true  |
| 13. true  | 30. true  |
| 14. true  | 31. true  |
| 15. true  | 32. true  |
| 16. false | 33. false |
| 17. false |           |

## 35.9 Review Exercises

### 1. Solution

```
def find_max(a, b):
    if a > b:
        maximum = a
    else:
        maximum = b
    return maximum
```

### 2. Solution

Step	Statement	Main Code		Function sum_digits()		
		s	i	a	d1	d2
1	s = 0	0	?			
2	i = 25	0	25			
3	s += sum_digits(i)			25	?	?
4	d1 = a % 10			25	5	?
5	d2 = a // 10			25	5	2
6	return d1 + d2	7	25			
7	i = 26	7	26			

<b>8</b>	s += sum_digits(i)			<b>26</b>	?	?
<b>9</b>	d1 = a % 10			26	<b>6</b>	?
<b>10</b>	d2 = a // 10			26	6	<b>2</b>
<b>11</b>	return d1 + d2	<b>15</b>	26			
<b>12</b>	i = 27	15	<b>27</b>			
<b>13</b>	s += sum_digits(i)			<b>27</b>	?	?
<b>14</b>	d1 = a % 10			27	<b>7</b>	?
<b>15</b>	d2 = a // 10			27	7	<b>2</b>
<b>16</b>	return d1 + d2	<b>24</b>	27			
<b>17</b>	print(s)	It displays: 24				

### 3. Solution

---

Step	Statement	Main Code		Function sss()		
		s	i	a	total	k
<b>1</b>	i = 1	?	<b>1</b>			
<b>2</b>	s = 0	<b>0</b>	1			
<b>3</b>	while i < 6:	True				
<b>4</b>	if i % 2 == 1:	True				
<b>5</b>	s += 1	<b>1</b>	1			
<b>6</b>	i += 1	1	<b>2</b>			
<b>7</b>	while i < 6:	True				
<b>8</b>	if i % 2 == 1:	False				
<b>9</b>	s += sss(i)			<b>2</b>	?	?
<b>10</b>	total = 0			2	<b>0</b>	?
<b>11</b>	k = 1			2	0	<b>1</b>
<b>12</b>	total += k			2	<b>1</b>	1
<b>13</b>	k = 2			2	1	<b>2</b>
<b>14</b>	total += k			2	<b>3</b>	2
<b>15</b>	return total	<b>4</b>	2			
<b>16</b>	i += 1	4	<b>3</b>			
<b>17</b>	while i < 6:	True				
<b>18</b>	if i % 2 == 1:	True				
<b>19</b>	s += 1	<b>5</b>	3			
<b>20</b>	i += 1	5	<b>4</b>			
<b>21</b>	while i < 6:	True				
<b>22</b>	if i % 2 == 1:	False				

<b>23</b>	s += sss(i)			<b>4</b>	?	?
<b>24</b>	total = 0			4	<b>0</b>	?
<b>25</b>	k = 1			4	0	<b>1</b>
<b>26</b>	total += k			4	<b>1</b>	1
<b>27</b>	k = 2			4	1	<b>2</b>
<b>28</b>	total += k			4	<b>3</b>	2
<b>29</b>	k = 3			4	3	<b>3</b>
<b>30</b>	total += k			4	<b>6</b>	4
<b>31</b>	k = 4			4	6	<b>4</b>
<b>32</b>	total += k			4	<b>10</b>	4
<b>33</b>	return total	<b>15</b>	4			
<b>34</b>	i += 1	15	<b>5</b>			
<b>35</b>	while i < 6:	True				
<b>36</b>	if i % 2 == 1:	True				
<b>37</b>	s += 1	<b>16</b>	5			
<b>38</b>	i += 1	16	<b>6</b>			
<b>39</b>	while i < 6:	False				
<b>40</b>	print(s)	It displays: 16				

#### 4. Solution

Step	Statement	Main Code				Function custom_div()	
		k	m	a	x	b	d
<b>1</b>	k = int(input())	<b>12</b>	?	?	?		
<b>2</b>	m = 2	12	<b>2</b>	?	?		
<b>3</b>	a = 1	12	2	<b>1</b>	?		
<b>4</b>	while a < 6:	True					
<b>5</b>	if k % m != 0:	False					
<b>6</b>	x = a + m + custom_div(m, a)					2	1
<b>7</b>	return (b + d) // 2	12	2	1	<b>4</b>		
<b>8</b>	print(m, a, x)	It displays: 2 1 4					
<b>9</b>	a += 2	12	2	<b>3</b>	4		
<b>10</b>	m += 1	12	<b>3</b>	3	4		
<b>11</b>	while a < 6:	True					
<b>12</b>	if k % m != 0:	False					
<b>13</b>	x = a + m + custom_div(m, a)					3	3

<b>14</b>	return (b + d) // 2	12	3	3	<b>9</b>		
<b>15</b>	print(m, a, x)	It displays: 3 3 9					
<b>16</b>	a += 2	12	3	<b>5</b>	9		
<b>17</b>	m += 1	12	<b>4</b>	5	9		
<b>18</b>	while a < 6:	True					
<b>19</b>	if k % m != 0:	False					
<b>20</b>	x = a + m + custom_div(m, a)					4	5
<b>21</b>	return (b + d) // 2	12	4	5	<b>13</b>		
<b>22</b>	print(m, a, x)	It displays: 4 5 13					
<b>23</b>	a += 2	12	4	<b>7</b>	13		
<b>24</b>	m += 1	12	<b>5</b>	7	13		
<b>25</b>	while a < 6:	False					

## 5. Solution

---

Step	Statement	Main Code			Function display()
		i	x	a	
<b>1</b>	i = 0	<b>0</b>	?		
<b>2</b>	x = int(input())	0	<b>3</b>		
<b>3</b>	display(x)				<b>3</b>
<b>4</b>	if a % 2 == 0:				False
<b>5</b>	print(a, "is odd")	It displays: 3 is odd			
<b>6</b>	i = 1	<b>1</b>	3		
<b>7</b>	x = int(input())	1	<b>7</b>		
<b>8</b>	display(x)				<b>7</b>
<b>9</b>	if a % 2 == 0:				False
<b>10</b>	print(a, "is odd")	It displays: 7 is odd			
<b>11</b>	i = 2	<b>2</b>	7		
<b>12</b>	x = int(input())	2	<b>9</b>		
<b>13</b>	display(x)				<b>9</b>
<b>14</b>	if a % 2 == 0:				False
<b>15</b>	print(a, "is odd")	It displays: 9 is odd			
<b>16</b>	i = 3	<b>3</b>	9		
<b>17</b>	x = int(input())	3	<b>2</b>		
<b>18</b>	display(x)				<b>2</b>
<b>19</b>	if a % 2 == 0:				True

<b>20</b>	print(a + " is even")	It displays: 2 is even			
<b>21</b>	i = 4	<b>4</b>	2		
<b>22</b>	x = int(input())	4	<b>4</b>		
<b>23</b>	display(x)				<b>4</b>
<b>24</b>	if a % 2 == 0:				True
<b>25</b>	print(a, "is even")	It displays: 4 is even			

## 6. Solution

---

Step	Statement	Main Code		Function division()	
		x	y	a	b
<b>1</b>	x = 20	<b>20</b>	?		
<b>2</b>	y = 30	20	<b>30</b>		
<b>3</b>	while x % y < 30:	True			
<b>4</b>	division(y, x)			<b>30</b>	<b>20</b>
<b>5</b>	b = b // a			30	<b>0</b>
<b>6</b>	print(a * b)	It displays: 0			
<b>7</b>	x = 4 * y	<b>120</b>	30		
<b>8</b>	y += 1	120	<b>31</b>		
<b>9</b>	while x % y < 30:	True			
<b>10</b>	division(y, x)			<b>31</b>	<b>120</b>
<b>11</b>	b = b // a			31	<b>3</b>
<b>12</b>	print(a * b)	It displays: 93			
<b>13</b>	x = 4 * y	<b>124</b>	31		
<b>14</b>	y += 1	124	<b>32</b>		
<b>15</b>	while x % y < 30:	True			
<b>16</b>	division(y, x)			<b>32</b>	<b>124</b>
<b>17</b>	b = b // a			32	<b>3</b>
<b>18</b>	print(a * b)	It displays: 96			
<b>19</b>	x = 4 * y	<b>128</b>	32		
<b>20</b>	y += 1	128	<b>33</b>		
<b>21</b>	while x % y < 30:	True			
<b>22</b>	division(y, x)			<b>33</b>	<b>128</b>
<b>23</b>	b = b // a			33	<b>3</b>
<b>24</b>	print(a * b)	It displays: 99			
<b>25</b>	x = 4 * y	<b>132</b>	33		

<b>26</b>	y += 1	132	<b>34</b>		
<b>27</b>	while x % y < 30:	False			

## 7. Solution

Step	Statement	Main Code		Function calculate()		
		i	m	n	s	j
<b>1</b>	i = 0	<b>0</b>	?			
<b>2</b>	m = int(input())	0	<b>2</b>			
<b>3</b>	calculate(m)			<b>2</b>	?	?
<b>4</b>	s = 0			2	<b>0</b>	?
<b>5</b>	j = 2			2	0	<b>2</b>
<b>6</b>	s = s + j ** 2			2	<b>4</b>	2
<b>7</b>	j = 4			2	4	<b>4</b>
<b>8</b>	s = s + j ** 2			2	<b>20</b>	4
<b>9</b>	print(s)	It displays: 20				
<b>10</b>	i = 1	<b>1</b>	2			
<b>11</b>	m = int(input())	1	<b>3</b>			
<b>12</b>	calculate(m)			<b>3</b>	?	?
<b>13</b>	s = 0			3	<b>0</b>	?
<b>14</b>	j = 2			3	0	<b>2</b>
<b>15</b>	s = s + j ** 2			3	<b>4</b>	2
<b>16</b>	j = 4			3	4	<b>4</b>
<b>17</b>	s = s + j ** 2			3	<b>20</b>	4
<b>18</b>	j = 6			3	20	<b>6</b>
<b>19</b>	s = s + j ** 2			3	<b>56</b>	6
<b>20</b>	print(s)	It displays: 56				
<b>21</b>	i = 2	<b>2</b>	3			
<b>22</b>	m = int(input())	2	<b>4</b>			
<b>23</b>	calculate(m)			<b>4</b>	?	?
<b>24</b>	s = 0			4	<b>0</b>	?
<b>25</b>	j = 2			4	0	<b>2</b>
<b>26</b>	s = s + j ** 2			4	<b>4</b>	2
<b>27</b>	j = 4			4	4	<b>4</b>
<b>28</b>	s = s + j ** 2			4	<b>20</b>	4
<b>29</b>	j = 6			4	20	<b>6</b>

<b>30</b>	s = s + j ** 2			4	<b>56</b>	6
<b>31</b>	j = 8			4	56	<b>8</b>
<b>32</b>	s = s + j ** 2			4	<b>120</b>	8
<b>33</b>	print(s)		It displays: 120			

**8. Solution**

```
def find_sum(a, b, c):
    return a + b + c
```

**9. Solution**

```
def find_avg(a, b, c, d):
    return (a + b + c + d) / 4
```

**10. Solution**

```
def maximum(a, b, c):
    m = a
    if b > m:
        m = b
    if c > m:
        m = c

    return m
```

**11. Solution****First approach**

```
def display_max(a, b, c, d, e):
    m = a
    if b > m:
        m = b
    if c > m:
        m = c
    if d > m:
        m = d
    if e > m:
        m = e
    print(m)
```

**Second approach**

```
def display_max(a, b, c, d, e):
    print(max(a, b, c, d, e))
```

**12. Solution**

```
def my_round(x):
    digit_to_check = int(x * 1000) % 10
    if digit_to_check >= 5:
```

```

        return_value = (int(x * 100) + 1) / 100.0
    else:
        return_value = (int(x * 100)) / 100.0

    return return_value

```

### 13. Solution

---

```

def find_min(a, b):
    minimum = a
    if b < minimum:
        minimum = b
    return minimum

#Main code starts here
print("Enter four numbers: ")
x1 = float(input())
x2 = float(input())
x3 = float(input())
x4 = float(input())

                                # Or you can do the following
temp1 = find_min(x1, x2)      #
temp2 = find_min(x3, x4)      #
print(find_min(temp1, temp2)) # print(find_min(find_min(x1, x2), find_min(x3, x4)))

```

### 14. Solution

---

```

def Kelvin_to_Fahrenheit(kelvin):
    return 1.8 * kelvin - 459.67

def Kelvin_to_Celsius(kelvin):
    return kelvin - 273.15

#Main code starts here
k = float(input("Enter a temperature in degrees Kelvin: "))
print("Fahrenheit:", Kelvin_to_Fahrenheit(k))
print("Celsius:", Kelvin_to_Celsius(k))

```

### 15. Solution

---

```

def bmi(w, h):
    b = w * 703 / h ** 2
    if b < 16:
        return_value = "You must add weight."
    elif b < 18.5:
        return_value = "You should add some weight."
    elif b < 25:
        return_value = "Maintain your weight."
    elif b < 30:

```

```

        return_value = "You should lose some weight."
else:
    return_value = "You must lose weight."

return return_value

#Main code starts here
weight = float(input("Enter your weight (in pounds): "))
while weight < 0:
    weight = float(input("Error! Enter your weight (in pounds):"))

age = int(input("Enter your age: "))
while age < 18:
    age = int(input("Error! Enter your age:"))

height = float(input("Enter your height (in inches): "))
while height < 0:
    height = float(input("Error! Enter your height (in inches):"))

print(bmi(weight, height))

```

## 16. Solution

```

def num_of_days(year, month):
    if month in [4, 6, 9, 11]:
        days = 30
    elif month == 2:
        if year % 4 == 0 and year % 100 != 0 or year % 400 == 0:
            days = 29
        else:
            days = 28
    else:
        days = 31
    print(days)

#Main code starts here
y = int(input("Enter a year: "))
for m in range(1, 13):
    num_of_days(y, m)

```

## 17. Solution

```

def display_menu():
    print()
    print("1. Convert meters to miles")
    print("2. Convert miles to meters")
    print("3. Exit")
    print("Enter a choice: ", end = "")

def meters_to_miles(meters):

```

```
print(meters, "meters equals", (meters / 1609.344), "miles")

def miles_to_meters(miles):
    print(miles, "miles equals", (miles * 1609.344), "meters")

#Main code starts here
display_menu()
choice = int(input())
while choice != 3:
    distance = float(input("Enter distance: "))
    if choice == 1:
        meters_to_miles(distance)
    else:
        miles_to_meters(distance)

    display_menu()
    choice = int(input())
```

## 18. Solution

---

```
def amount_to_pay(seconds):
    if seconds <= 600:
        extra = 0
    elif seconds <= 1200:
        extra = (seconds - 600) * 0.01
    else:
        extra = 600 * 0.01 + (seconds - 1200) * 0.02

    total_without_tax = 10 + extra
    tax = total_without_tax * 11 / 100
    total = total_without_tax + tax

    print("Total amount to pay:", total)

#Main code starts here
seconds = int(input("Enter number of seconds: "))
amount_to_pay(seconds)
```

# Chapter 36

## 36.9 Review Questions: True/False

- |           |           |
|-----------|-----------|
| 1. true   | 14. false |
| 2. true   | 15. true  |
| 3. true   | 16. true  |
| 4. false  | 17. false |
| 5. true   | 18. false |
| 6. false  | 19. false |
| 7. true   | 20. false |
| 8. false  | 21. true  |
| 9. true   | 22. true  |
| 10. false | 23. false |
| 11. true  | 24. true  |
| 12. true  | 25. true  |
| 13. true  | 26. true  |

## 36.10 Review Exercises

### 1. Solution

It displays: 5

### 2. Solution

It displays: 14

### 3. Solution

It displays: 14

### 4. Solution

Step	Statement	Main Code				Function swap()	
		a	m	k	x	x	y
1	<code>k = int(input())</code>	?	?	12	?		
2	<code>m = 1</code>	?	1	12	?		
3	<code>a = 1</code>	1	1	12	?		
4	<code>while a &lt; 8:</code>	True					
5	<code>if k % m != 0:</code>	False					
6	<code>x = a + m + int(a - m)</code>	1	1	12	2		
7	<code>print(m, a, x)</code>	It displays: 1 1 2					
8	<code>a += 2</code>	3	1	12	2		

<b>9</b>	<code>m += 1</code>	3	<b>2</b>	12	2		
<b>10</b>	<code>a, m = swap(a, m)</code>					<b>3</b>	<b>2</b>
<b>11</b>	<code>x, y = y, x</code>					<b>2</b>	<b>3</b>
<b>12</b>	<code>while a &lt; 8:</code>	<b>2</b>	<b>3</b>	12	2		
		True					
<b>13</b>	<code>if k % m != 0:</code>	False					
<b>14</b>	<code>x = a + m + int(a - m)</code>	2	3	12	<b>4</b>		
<b>15</b>	<code>print(m, a, x)</code>	It displays: 3 2 4					
<b>16</b>	<code>a += 2</code>	<b>4</b>	3	12	4		
<b>17</b>	<code>m += 1</code>	4	<b>4</b>	12	4		
<b>18</b>	<code>a, m = swap(a, m)</code>					<b>4</b>	<b>4</b>
<b>19</b>	<code>x, y = y, x</code>					<b>4</b>	<b>4</b>
<b>20</b>	<code>while a &lt; 8:</code>	<b>4</b>	<b>4</b>	12	4		
		True					
<b>21</b>	<code>if k % m != 0:</code>	False					
<b>22</b>	<code>x = a + m + int(a - m)</code>	4	4	12	<b>8</b>		
<b>23</b>	<code>print(m, a, x)</code>	It displays: 4 4 8					
<b>24</b>	<code>a += 2</code>	<b>6</b>	4	12	8		
<b>25</b>	<code>m += 1</code>	6	<b>5</b>	12	8		
<b>26</b>	<code>a, m = swap(a, m)</code>					<b>6</b>	<b>5</b>
<b>27</b>	<code>x, y = y, x</code>					<b>5</b>	<b>6</b>
<b>28</b>	<code>while a &lt; 8:</code>	<b>5</b>	<b>6</b>	12	8		
		True					
<b>29</b>	<code>if k % m != 0:</code>	False					
<b>30</b>	<code>x = a + m + int(a - m)</code>	5	6	12	<b>10</b>		
<b>31</b>	<code>print(m, a, x)</code>	It displays: 6 5 10					
<b>32</b>	<code>a += 2</code>	<b>7</b>	6	12	10		
<b>33</b>	<code>m += 1</code>	7	<b>7</b>	12	10		
<b>34</b>	<code>a, m = swap(a, m)</code>					<b>7</b>	<b>7</b>
<b>35</b>	<code>x, y = y, x</code>					<b>7</b>	<b>7</b>
<b>36</b>	<code>while a &lt; 8:</code>	<b>7</b>	<b>7</b>	12	10		
		True					
<b>37</b>	<code>if k % m != 0:</code>	True					
<b>38</b>	<code>x = a % m</code>	7	7	12	<b>0</b>		
<b>39</b>	<code>m, a = swap(m, a)</code>					<b>7</b>	<b>7</b>
<b>40</b>	<code>x, y = y, x</code>					<b>7</b>	<b>7</b>

<b>41</b>	print(m, a, x)	7	7	12	0		
It displays: 7 7 0							
<b>42</b>	a += 2	9	7	12	0		
<b>43</b>	m += 1	9	8	12	0		
<b>44</b>	a, m = swap(a, m)					<b>9</b>	<b>8</b>
<b>45</b>	x, y = y, x					<b>8</b>	<b>9</b>
<b>46</b>	while a < 8:	8	9	12	0		
False							

**5. Solution**


---

It displays: hellohellohello

**6. Solution**


---

It displays: 15

**7. Solution**


---

It displays: 11 4

**8. Solution**

```

STUDENTS = 10
LESSONS = 5

def part1(names, grades):
    for i in range(STUDENTS):
        names[i] = input("Enter name No." + str(i + 1) + ": ")
        for j in range(LESSONS):
            grades[i][j] = int(input("Enter grade for lesson No." + str(j + 1) + ": "))

def part2(grades):
    average = [None] * STUDENTS

    for i in range(STUDENTS):
        average[i] = 0
        for j in range(LESSONS):
            average[i] += grades[i][j]
        average[i] /= LESSONS
    return average

def part3(average, names):
    for m in range(1, STUDENTS):
        for n in range(STUDENTS - 1, m - 1, -1):
            if average[n] > average[n - 1]:
                average[n], average[n - 1] = average[n - 1], average[n]
                names[n], names[n - 1] = names[n - 1], names[n]
```

```
    elif average[n] == average[n - 1]:
        if names[n] < names[n - 1]:
            names[n], names[n - 1] = names[n - 1], names[n]

#Main code starts here
names = [None] * STUDENTS
grades = [ [None] * LESSONS for i in range(STUDENTS) ]

part1(names, grades)
average = part2(grades)
part3(average, names)

for i in range(STUDENTS):
    print(names[i], "\t", average[i])
```

## 9. Solution

```
def part1():
    message = input("Enter a message: ").lower()
    return message

def part2(message):
    message_clean = ""
    for i in range(len(message)):
        if message[i] not in ",.?":
            message_clean += message[i]
    return message_clean

def part3(message_clean):
    middle_pos = (len(message_clean) - 1) // 2
    j = len(message_clean) - 1
    palindrome = True
    for i in range(middle_pos + 1):
        if message_clean[i] != message_clean[j]:
            palindrome = False
            break
        j -= 1
    return palindrome

def part4(message):
    message_clean = part2(message)
    palindrome = part3(message_clean)
    return palindrome

#Main code starts here
message = part1()
palindrome = part4(message)
if palindrome:
    print("The message is palindrome")
```

### 10. Solution

```
a = int(input())
b = int(input())
c = int(input())
d = input()

maximum = a
if b > maximum:
    maximum = b
if c > maximum:
    maximum = c
if d > maximum:
    maximum = d

print(maximum)
```

### 11. Solution

```
def f1(a, b, c, returning_list):
    total = a + b + c
    average = total / 3

    returning_list = [total, average]
```

### 12. Solution

```
def my_round(x, decimal_places = 2):
    digit_to_check = x * 10 ** (decimal_places + 1) % 10
    if digit_to_check >= 5:
        return_value = int(x * 10 ** decimal_places + 1) / 10 ** decimal_places
    else:
        return_value = int(x * 10 ** decimal_places) / 10 ** decimal_places
    return return_value
```

### 13. Solution

```
def get_input():
    while True:
        answer = input("Enter Yes or No: ").upper()
        if answer == "YES" or answer == "NO": break

    return answer == "YES" #This returns True or False

def find_area(b, h):
    return b * h

#Main code starts here
while True:
    b = float(input("Enter the base of the parallelogram: "))
```

```

h = float(input("Enter the height of the parallelogram: "))

print("Area =", find_area(b, h))

print("Would you like to repeat? ")
if get_input() == False: break #Or you can write: if not get_input(): break

```

#### 14. Solution

---

```

STUDENTS = 100

def get_lists(names, grades):
    for i in range(STUDENTS):
        names[i] = input("Enter name: ")
        grades[i] = int(input("Enter grade: "))

def get_average(grades):
    total = 0           # Or you can do the following:
    for i in range(STUDENTS): #
        total += grades[i] #
    return total / STUDENTS      # return math.fsum(grades) / STUDENTS

def sort_lists(grades, names):
    for m in range(1, STUDENTS):
        element_grds = grades[m]
        element_nms = names[m]

        n = m
        while n > 0 and grades[n - 1] > element_grds:
            grades[n] = grades[n - 1]
            names[n] = names[n - 1]
            n -= 1

        grades[n] = element_grds
        names[n] = element_nms

#Main code starts here
names = [None] * STUDENTS
grades = [None] * STUDENTS
get_lists(names, grades)
average = get_average(grades)
sort_lists(grades, names)
for i in range(STUDENTS):
    if grades[i] < average:
        print(names[i])

```

#### 15. Solution

---

##### First approach

```
JUDGES = 10
```

```
def get_list():
    score = [None] * JUDGES
    for i in range(JUDGES):
        score[i] = int(input("Judge No" + str(i + 1) + ". Enter score: "))
    return score

def find_min_max(score):
    minimum = score[0]
    maximum = score[0]
    for i in range(1, JUDGES):
        if score[i] > maximum:
            maximum = score[i]
        if score[i] < minimum:
            minimum = score[i]

    return minimum, maximum

#Main code starts here
name = input("Enter artist's name: ")
score = get_list()
minimum, maximum = find_min_max(score)

total = 0
for i in range(JUDGES):
    total += score[i]

points = total - minimum - maximum
print("Artist", name, "got", points, "points")
```

### Second approach

```
import math
JUDGES = 10

def get_list():
    score = [None] * JUDGES
    for i in range(JUDGES):
        score[i] = int(input("Judge No" + str(i + 1) + ". Enter score: "))
    return score

def find_min_max(score):
    return min(score), max(score)

#Main code starts here
name = input("Enter artist's name: ")
score = get_list()
minimum, maximum = find_min_max(score)

points = math.fsum(score) - minimum - maximum
print("Artist", name, "got", points, "points")
```

## 16. Solution

---

```
def woc(index):
    if index == 1:
        return_value = 1
    else:
        return_value = 2 * woc(index - 1)
    return return_value

#Main code starts here
total = 0
for i in range(1, 65):
    total += woc(i)
print(total)
```

## 17. Solution

---

```
import math
def factorial(value):
    if value == 1:
        return_value = 1
    else:
        return_value = value * factorial(value - 1)

    return return_value

def my_cos(x, i = 40):
    if i == 0:
        return_value = 1
    else:
        return_value = my_cos(x, i - 4) + x ** i / factorial(i) - x ** (i - 2) / factorial(i - 2)

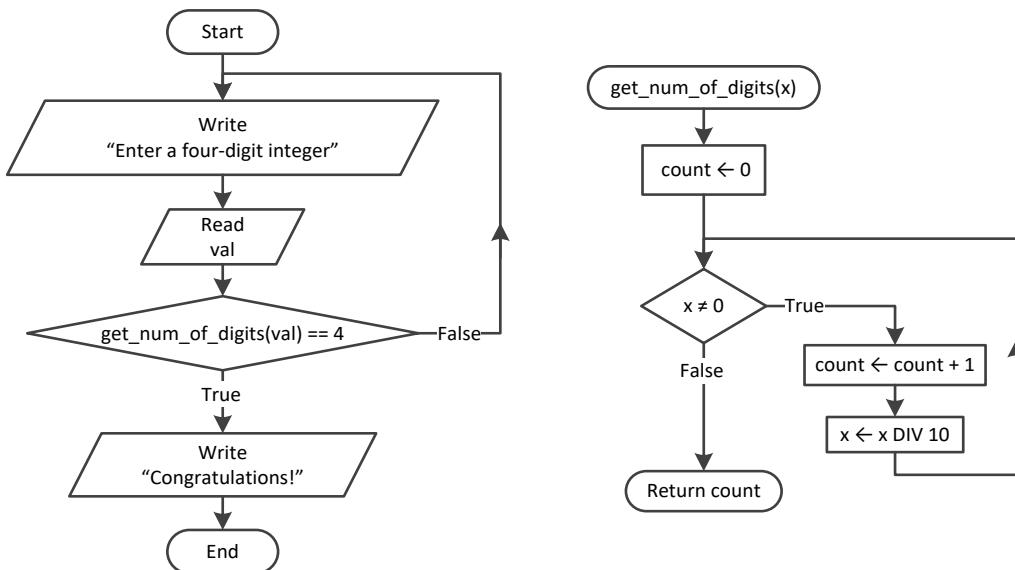
    return return_value

#Main code starts here
print(my_cos(math.pi / 4))
```

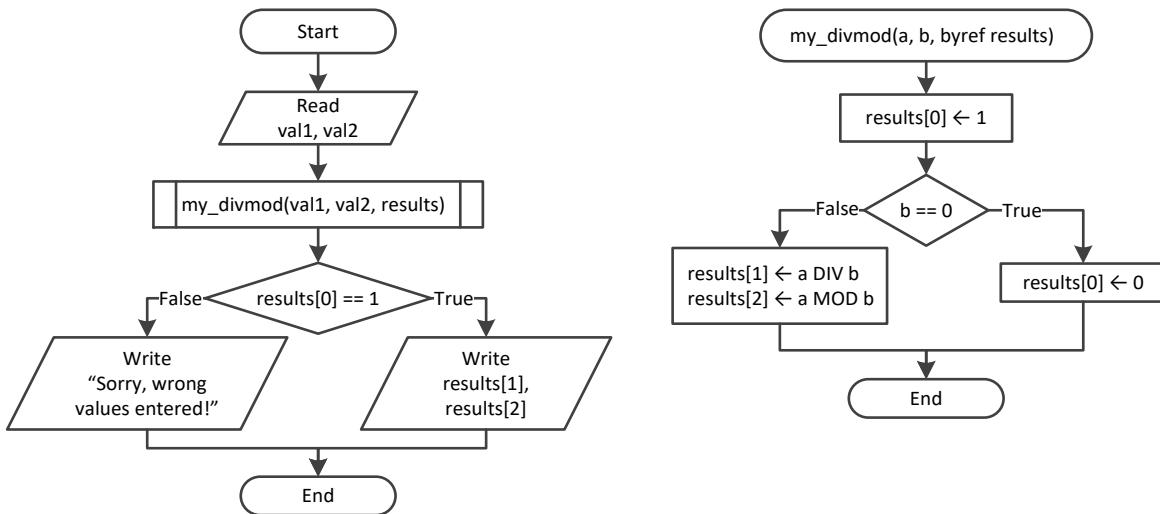
# Chapter 37

## 37.3 Review Exercises

### 1. Solution



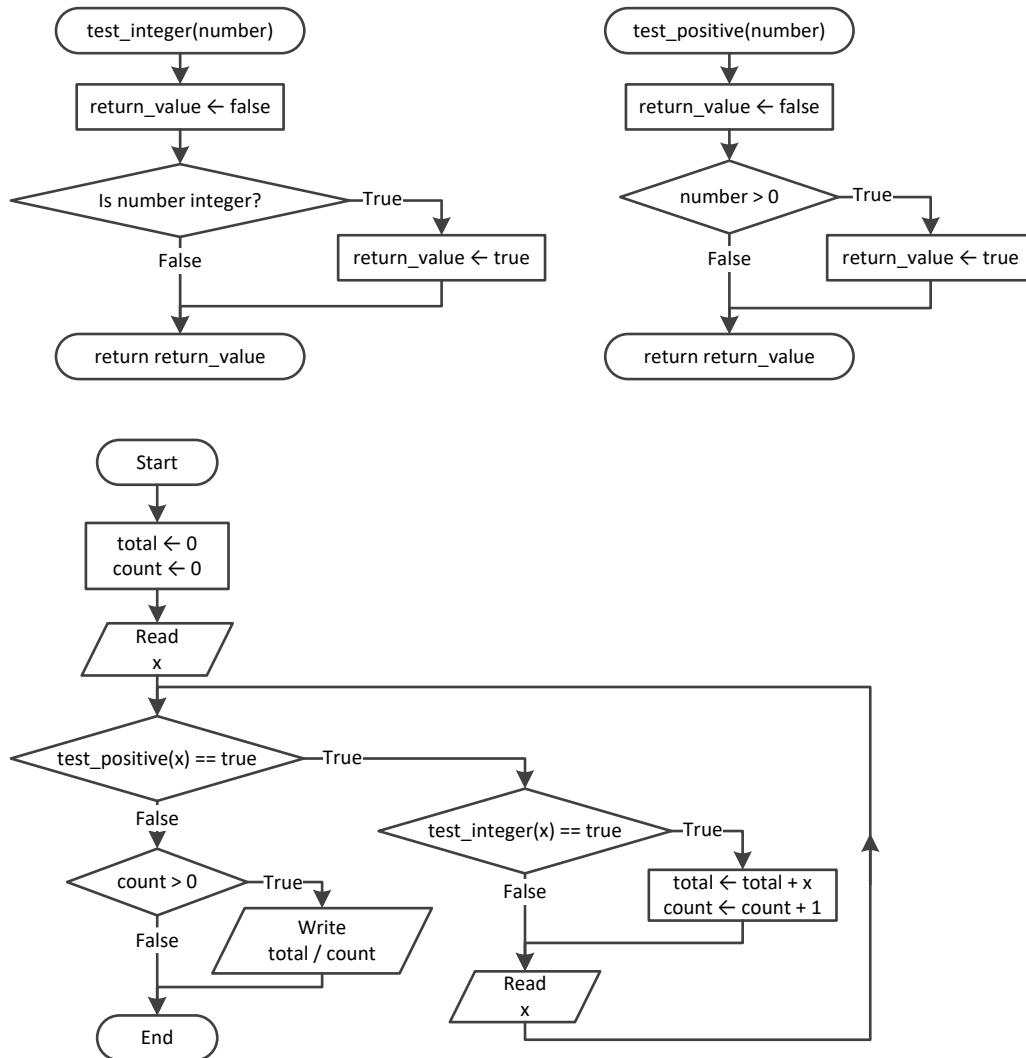
### 2. Solution



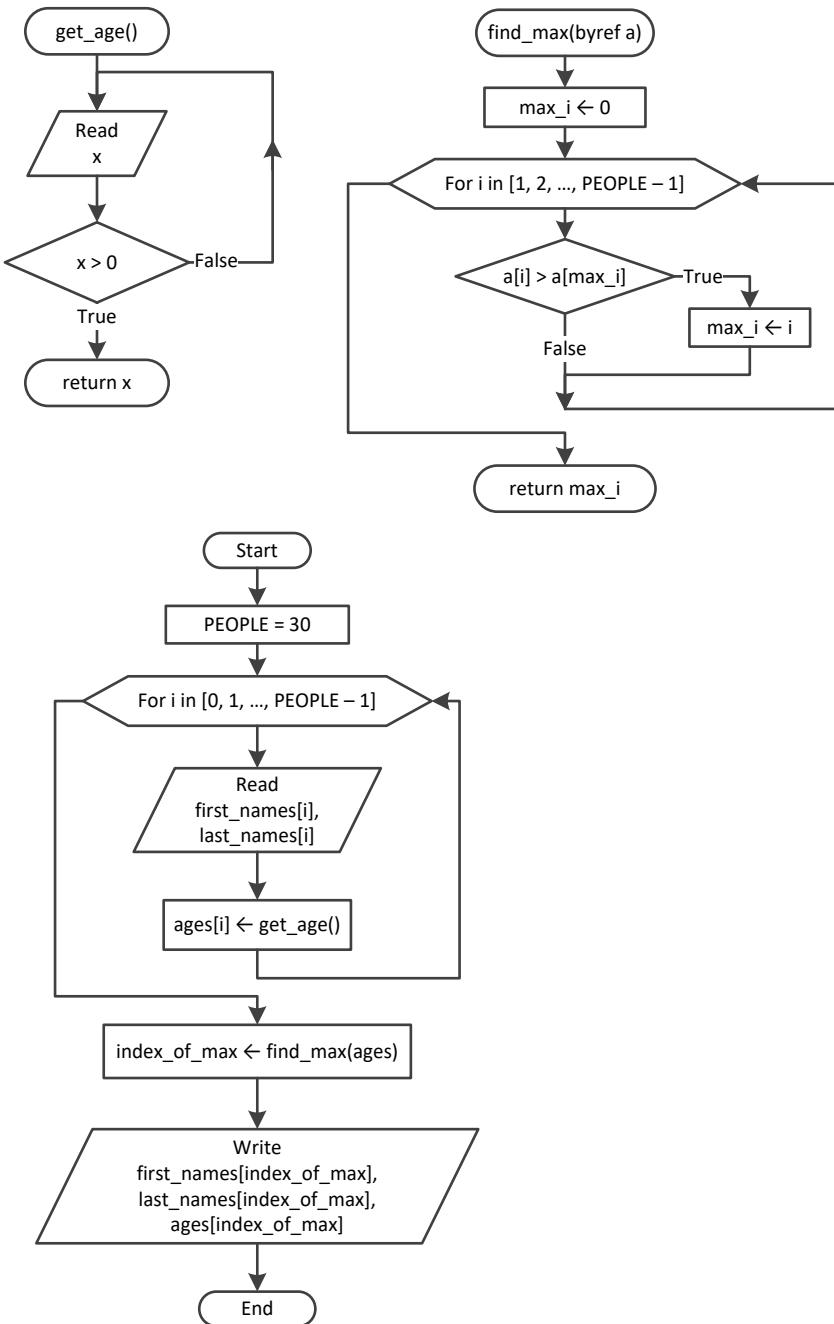
Flowcharts are a loose method of representing an algorithm. Thus, you can represent a pass by reference using the keyword `byref`, which clearly denotes what it actually does.

Some programmers, instead of using the keyword `byref`, prefer to write the keyword `inout`, which denotes pretty much the same thing—that the variable is both input (it accepts values) and output (it returns values).

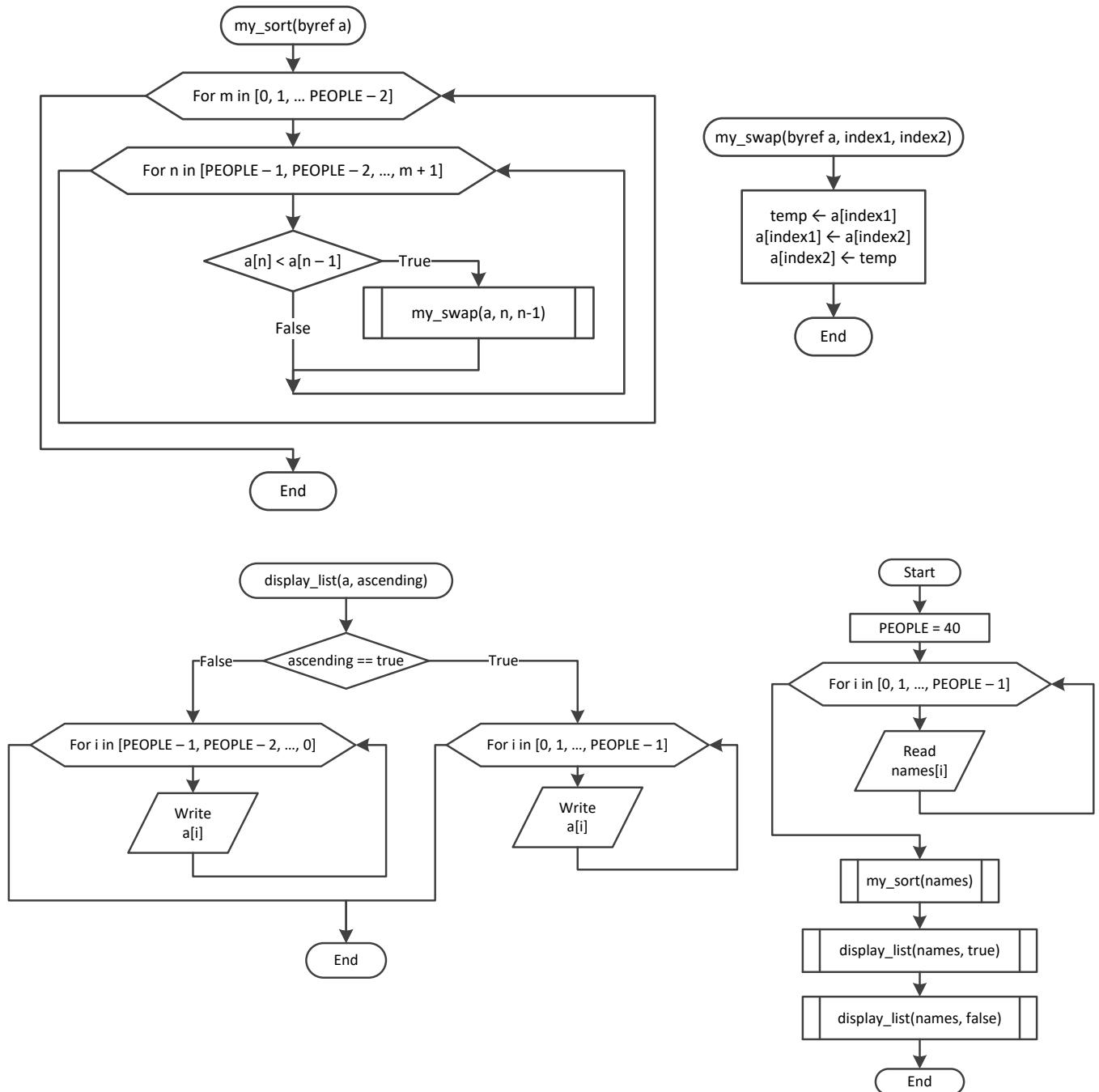
### 3. Solution



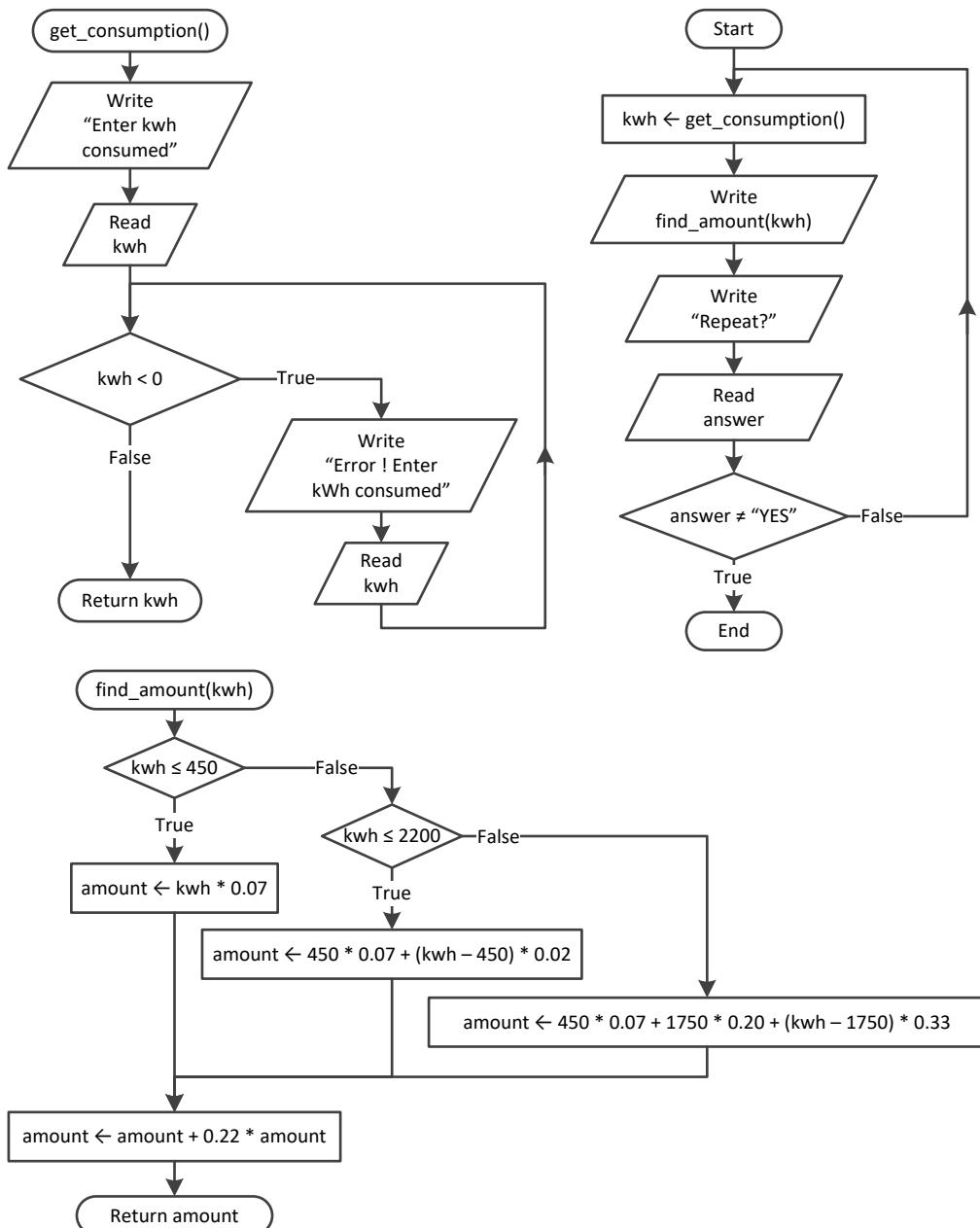
#### 4. Solution



## 5. Solution



## 6. Solution



## 7. Solution

```
def f1(n):
    s = 0
    for i in range(1, n + 1):
        if i < n / 2:
            s += n ** 2
        else:
            s += n ** 3
    return s
```

```
while True:  
    val = int(input("Enter a positive integer "))  
    if val >= 0: break  
  
    print(f1(val))
```

## 8. Solution

```
ELEMENTS = 100  
  
def read_values():  
    values = [None] * ELEMENTS  
    for i in range(ELEMENTS):  
        values[i] = float(input())  
    return values  
  
def find_min_max(values):  
    min_i = 0  
    max_i = 0  
    for i in range(1, ELEMENTS):  
        if values[i] < values[min_i]:  
            min_i = i  
        if values[i] > values[max_i]:  
            max_i = i  
  
    return min_i, max_i  
  
#Main code starts here  
v = read_values()  
a, b = find_min_max(v)  
print(v[a], v[b])
```

 Please note the way the void function `find_min_max()` finds the index positions of the minimum and the maximum values of the array `values`. This method is not the same as the one you learned in paragraph 33.3; however, it can be used as an alternative.

## 9. Solution

```
STUDENTS = 20  
LESSONS = 10  
  
def get_lists(names, grades):  
    for i in range(STUDENTS):  
        names[i] = input()  
        for j in range(LESSONS):  
            grades[i][j] = int(input())  
  
def find_average(grades):  
    average = [None] * STUDENTS
```

```
for i in range(STUDENTS):
    average[i] = 0
    for j in range(LESSONS):
        average[i] += grades[i][j]
    average[i] /= LESSONS
return average

def display(names, average):
    for i in range(STUDENTS):
        if average[i] > 89:
            print(names[i], average[i])

#Main code starts here
names = [None] * STUDENTS
grades = [ [None] * LESSONS for i in range(STUDENTS) ]

get_lists(names, grades)
av = find_average(grades)
display(names, av)
```

## 10. Solution

```
import math
ACCURACY = 0.000000001

def factorial(n):
    return_value = 1
    for i in range(1, n + 1):
        return_value *= i
    return return_value

def my_sin(x):
    sign = 1
    sinus = 0
    i = 1
    while True:
        sinus_previous = sinus
        sinus += sign * x ** i / factorial(i)

        sign = -sign
        i += 2
        if abs(sinus - sinus_previous) <= ACCURACY: break
    return sinus

def degrees_to_rad(degrees):
    return 2 * math.pi * degrees / 360

#Main code starts here
```

```
for i in range(361):
    print("sin(", i, ") ~=", my_sin(degrees_to_rad(i)), sep = "")
```

## 11. Solution

---

```
def is_leap(year):
    return_value = False
    if year % 4 == 0 and year % 100 != 0 or year % 400 == 0:
        return_value = True
    return return_value

def num_of_days(year, month):
    if month in [4, 6, 9, 11]:
        days = 30
    elif month == 2:
        if is_leap(year):
            days = 29
        else:
            days = 28
    else:
        days = 31

    return days

def check_date(day, month, year):
    return_value = True
    if month not in range(1, 13):
        return_value = False
    elif day < 1 or day > num_of_days(year, month):
        return_value = False
    return return_value

#Main code starts here
day = int(input("Enter day: "))
month = int(input("Enter month: "))
year = int(input("Enter year: "))
while not check_date(day, month, year):
    print("Error!")
    day = int(input("Enter day: "))
    month = int(input("Enter month: "))
    year = int(input("Enter year: "))

total = 0
for i in range(1, month):
    total += num_of_days(year, i)
total += day

print(total)
```

## 12. Solution

---

```
def display_menu():
    print("-----")
    print("1. Convert USD to Euro (EUR)")
    print("2. Convert USD to British Pound Sterling (GBP)")
    print("3. Convert EUR to USD")
    print("4. Convert EUR to GBP")
    print("5. Convert GBP to USD")
    print("6. Convert GBP to EUR")
    print("7. Exit")
    print("-----")
    print("Enter a choice: ", end = "")

def USD_to_EUR(value):
    return value * 0.87

def USD_to_GBP(value):
    return value * 0.76

#Main code starts here
display_menu()
choice = int(input())
while choice != 7:

    amount = float(input("Enter an amount: "))
    if choice == 1:
        print(amount, "USD =", USD_to_EUR(amount), "Euro")
    elif choice == 2:
        print(amount, "USD =", USD_to_GBP(amount), "GBP")
    elif choice == 3:
        print(amount, "EUR =", 1 / USD_to_EUR(1 / amount), "USD")
    elif choice == 4:
        print(amount, "EUR =", USD_to_GBP(1 / USD_to_EUR(1 / amount)), "GBP")
    elif choice == 5:
        print(amount, "GBP =", 1 / USD_to_GBP(1 / amount), "USD")
    elif choice == 6:
        print(amount, "GBP =", USD_to_EUR(1 / USD_to_GBP(1 / amount)), "EUR")

    display_menu()
    choice = int(input())
```

## 13. Solution

---

```
import random

def dice():
    return random.randrange(1, 7)
```

```
#Main code starts here
names = [None] * 2
names[0] = input("Player1 - Enter name: ")
names[1] = input("Player2 - Enter name: ")

for player in range(2):
    total = 0
    for i in range(10):
        print("Player " + names[player] + ", hit enter to roll the dice!")
        input() #This statement just waits the user to hit the enter key

        dice1 = dice()
        dice2 = dice()
        print(dice1, dice2)
        total += dice1 + dice2

    if player == 0:
        total_player1 = total
    else:
        total_player2 = total

if total_player1 == total_player2:
    print("Tie!")
elif total_player1 > total_player2:
    print(names[0], " wins")
else:
    print(names[1], " wins")
```

#### 14. Solution

```
GAS = 1
DIESEL = 2
HYBRID = 3
TAX_RATE = 0.1
CARS = 40

def get_choice():
    print("1. Gas")
    print("2. Diesel")
    print("3. Hybrid")
    choice = int(input("Enter type of the car: "))
    return choice

def get_days():
    days = int(input("Enter total number of rental days: "))
    return days

def get_charge(car_type, rental_days):

    if car_type == GAS:
```

```
if rental_days <= 5:
    charge = rental_days * 24
elif rental_days <= 8:
    charge = 5 * 24 + (rental_days - 5) * 22
else:
    charge = 5 * 24 + 3 * 22 + (rental_days - 8) * 18
elif car_type == DIESEL:
    if rental_days <= 5:
        charge = rental_days * 28
    elif rental_days <= 8:
        charge = 5 * 28 + (rental_days - 5) * 25
    else:
        charge = 5 * 28 + 3 * 25 + (rental_days - 8) * 21
else:
    if rental_days <= 5:
        charge = rental_days * 30
    elif rental_days <= 8:
        charge = 5 * 30 + (rental_days - 5) * 28
    else:
        charge = 5 * 30 + 3 * 28 + (rental_days - 8) * 23
charge = charge * (1 + TAX_RATE) #This is equivalent to charge += charge * TAX_RATE
return charge

#Main code starts here
rented_car_types = [None] * CARS
rented_days = [None] * CARS

for i in range(CARS):
    rented_car_types[i] = get_choice()
    rented_days[i] = get_days()

total = 0
for i in range(CARS):
    charge = get_charge(rented_car_types[i], rented_days[i])
    print("Car No", (i + 1), ":", charge)
    total += charge

count = 0
for i in range(CARS):
    if rented_car_types[i] == HYBRID:
        count += 1

print("Hybrids rented:", count)
print("Net profit:", total / (1 + TAX_RATE))
```

## 15. Solution

```
CHANNELS = 10
DAYS = 7
```

```

def get_data(names, viewers):
    day_names = ["Monday", "Tuesday", "Wednesday", "Thursday", "Friday", "Saturday", "Sunday"]

    for i in range(CHANNELS):
        names[i] = input("Enter name for channel No." + str(i + 1) + ": ")
        for j in range(DAYS):
            viewers[i][j] = int(input("Enter the number of viewers of the main news program on " + \
                day_names[j] + " for channel " + names[i] + ":"))

def get_average(a):
    total = 0          # Or you can do the following
    for i in range(5): #
        total += a[i]
    return total / 5  # return math.fsum(total) / 5

#Main code starts here
names = [None] * CHANNELS
viewers = [ [None] * DAYS for i in range(CHANNELS) ]
get_data(names, viewers)

for i in range(CHANNELS):
    weekend = (viewers[i][DAYS - 2] + viewers[i][DAYS - 1]) / 2
    if weekend >= 1.2 * get_average(viewers[i]):      # viewers[i] represents the whole row
        print(names[i])

for i in range(CHANNELS):
    increasing = True
    for j in range(1, DAYS):
        if viewers[i][j] <= viewers[i][j - 1]:
            increasing = False
    if increasing:
        print(names[i])

```

## 16. Solution

```

CITIZENS = 300

def input_data(SSNs, answers):
    for i in range(CITIZENS):
        SSNs[i] = int(input("Enter SSN: "))
        answers[i] = input("Enter answer: ")

def sort_lists(SSNs, answers):
    for m in range(CITIZENS):
        minimum = SSNs[m]
        index_of_min = m
        for n in range(m, CITIZENS):
            if SSNs[n] < minimum:

```

```
        minimum = SSNs[n]
        index_of_min = n
    SSNs[m], SSNs[index_of_min] = SSNs[index_of_min], SSNs[m]
    answers[m], answers[index_of_min] = answers[index_of_min], answers[m]

def search_list(SSNs, SSN):
    left = 0
    right = CITIZENS - 1
    found = False
    while left <= right and not found:
        middle = (left + right) // 2

        if SSNs[middle] > SSN:
            right = middle - 1
        elif SSNs[middle] < SSN:
            left = middle + 1
        else:
            found = True
            index_position = middle

    if not found:
        print("SSN not found!")
        return_value = -1
    else:
        return_value = index_position
    return return_value

def count_answers(answers, answer):

    count = 0
    for i in range(CITIZENS):
        if answers[i] == answer:
            count += 1
    return count

#Main code starts here
SSNs = [None] * CITIZENS
answers = [None] * CITIZENS

while True:
    input_data(SSNs, answers)
    sort_lists(SSNs, answers)

    SSN = int(input("Enter an SSN to search: "))

    index = search_list(SSNs, SSN)
    if index != -1:
        answer = answers[index]
        print(answer)
```

```
    count = count_answers(answers, answer)
    print(count * 100 / CITIZENS)
    answer = input("Repeat? ")
    if answer != "yes": break
```

## 17. Solution

```
TEAMS = 8
GAMES = 12

def input_data(names, results):
    for i in range(TEAMS):
        names[i] = input("Enter team name: ")
        for j in range(GAMES):
            results[i][j] = input("Enter result (W, L, T): ")

def display_result(names, results):
    result = input("Enter a result to search (W, L, T): ")
    for i in range(TEAMS):
        print("Team:", names[i])
        found = False
        for j in range(GAMES):
            if results[i][j] == result:
                print("Week:", (j + 1))
                found = True
        if not found:
            print("nothing found")

def find_team(names):
    name = input("Enter a name to search: ")

    i = 0
    while i < TEAMS - 1 and names[i] != name:
        i += 1

    if names[i] != name:
        return_value = -1
    else:
        return_value = i
    return return_value

#Main code starts here
names = [None] * TEAMS
results = [ [None] * GAMES for i in range(TEAMS) ]

input_data(names, results)
display_result(names, results)
```

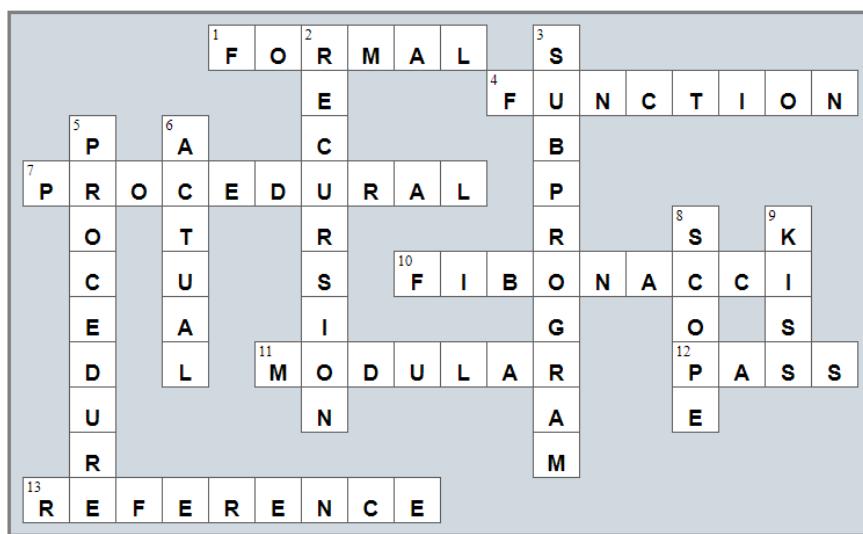
```
index = find_team(names)
while index != -1:
    total = 0
    for j in range(GAMES):
        if results[index][j] == "W":
            total += 3
        elif results[index][j] == "T":
            total += 1
    print("Points:", total)
    index = find_team(names)

if index == -1:
    print "Team not found"
```

## Review in “Subprograms”

### Review Crossword Puzzle

1.



# Chapter 38

## 38.9 Review Questions: True/False

- |          |           |           |
|----------|-----------|-----------|
| 1. False | 7. False  | 13. True  |
| 2. True  | 8. True   | 14. False |
| 3. True  | 9. True   | 15. True  |
| 4. False | 10. False | 16. False |
| 5. False | 11. True  | 17. False |
| 6. False | 12. True  |           |

## 38.10 Review Exercises

### 1. Solution

```
class Trigonometry:  
    def square_area(self, side):  
        return side * side  
  
    def rectangle_area(self, b, h):  
        return b * h  
  
    def triangle_area(self, b, h):  
        return b * h / 2  
  
#Main code starts here  
tr = Trigonometry()  
  
sqr_side = float(input("Enter square side: "))  
  
rctngl_base = float(input("Enter rectangle base: "))  
rctngl_height = float(input("Enter rectangle height: "))  
  
trngl_base = float(input("Enter triangle base: "))  
trngl_height = float(input("Enter triangle height: "))  
  
print(tr.square_area(sqr_side))  
print(tr.rectangle_area(rctngl_base, rctngl_height))  
print(tr.triangle_area(trngl_base, trngl_height))
```

### 2. Solution

```
class Pet:  
    def __init__(self):  
        self.kind = None  
        self.legs_number = None  
  
    def start_running(self):  
        print("Pet is running")
```

```
def stop_running(self):
    print("Pet stopped")

#Main code starts here
pet1 = Pet()
pet1.kind = "dog"
pet1.legs_number = 4

pet2 = Pet()
pet2.kind = "monkey"
pet2.legs_number = 2

pet1.start_running()
pet2.start_running()
pet1.stop_running()
```

### 3. Solution

```
class Pet:
    def __init__(self, kind, legs_number):
        self.kind = kind
        self.legs_number = legs_number

    #Define the getter
    @property
    def kind(self):
        return self._kind

    #Define the setter
    @kind.setter
    def kind(self, value):
        if value != "":
            self._kind = value
        else:
            raise ValueError("Cannot be empty")

    #Define the getter
    @property
    def legs_number(self):
        return self._legs_number

    #Define the setter
    @legs_number.setter
    def legs_number(self, value):
        if value >= 0:
            self._legs_number = value
        else:
            raise ValueError("Cannot be negative")
```

```
def start_running(self):
    print("Pet is running")

def stop_running(self):
    print("Pet stopped")

#Main code starts here
pet1 = Pet("dog", 4)

pet1.start_running()
pet1.stop_running()

pet1.kind = ""           #This will throw an error
pet1.legs_number = -3   #This will throw an error
```

#### 4. Solution

---

```
BOXES = 3

class Box:
    def __init__(self, width, length, height):
        self.width = width
        self.length = length
        self.height = height

    def display_volume():
        print("Volume", self.width * self.length * self.height)

    def display_dimensions():
        print(self.width, "x", self.length, "x", self.height)

#Main code starts here
list_of_obj = [None] * BOXES  #create a list

for i in range(BOXES):
    w = float(input("Enter width: "))
    l = float(input("Enter length: "))
    h = float(input("Enter height: "))

    #add each new object to the list
    list_of_obj[i] = Box(w, l, h)

for i in range(BOXES):
    list_of_obj[i].display_dimensions()
    list_of_obj[i].display_volume()
```

#### 5. Solution

---

```
BOXES = 3
```

```
class Box:
    def __init__(self, width, length, height):
        self.width = width
        self.length = length
        self.height = height

    #Define the getter
    @property
    def width(self):
        return self._width

    #Define the setter
    @width.setter
    def width(self, value):
        if value > 0:
            self._width = value
        else:
            raise ValueError("Cannot be negative or zero")

    #Define the getter
    @property
    def length(self):
        return self._length

    #Define the setter
    @length.setter
    def length(self, value):
        if value > 0:
            self._length = value
        else:
            raise ValueError("Cannot be negative or zero")

    #Define the getter
    @property
    def height(self):
        return self._height

    #Define the setter
    @height.setter
    def height(self, value):
        if value > 0:
            self._height = value
        else:
            raise ValueError("Cannot be negative or zero")

    def display_volume(self):
        print("Volume", self.width * self.length * self.height)
```

```

def display_dimensions(self):
    print(self.width, "x", self.length, "x", self.height)

#Main code starts here
list_of_obj = [None] * BOXES    #create a list

for i in range(BOXES):
    w = float(input("Enter width: "))
    l = float(input("Enter length: "))
    h = float(input("Enter height: "))

    #add each new object to the list
    list_of_obj[i] = Box(w, l, h)

for i in range(BOXES):
    list_of_obj[i].display_dimensions()
    list_of_obj[i].display_volume()

```

## 6. Solution

---

```

class Cube:
    def __init__(self, edge):
        self.edge = edge

    def display_volume(self):
        print("Volume:", self.edge ** 3)

    def display_one_surface(self):
        print("One surface:", self.edge ** 2)

    def display_total_surface(self):
        print("Total surface:", 6 * self.edge ** 2)

#Main code starts here
edge = float(input("Enter edge length of a cube: "))

cube1 = Cube(edge)

cube1.display_volume()
cube1.display_one_surface()
cube1.display_total_surface()

```

## 7. Solution

---

```

class Cube:
    def __init__(self, edge):
        self.edge = edge

    #Define the getter
    @property

```

```
def edge(self):
    return self._edge

#Define the setter
@edge.setter
def edge(self, value):
    if value > 0:
        self._edge = value
    else:
        raise ValueError("Cannot be negative or zero")

def display_volume(self):
    print("Volume:", self.edge ** 3)

def display_one_surface(self):
    print("One surface:", self.edge ** 2)

def display_total_surface(self):
    print("Total surface:", 6 * self.edge ** 2)

#Main code starts here
edge = float(input("Enter edge length of a cube: "))

cubel = Cube(edge)

cubel.display_volume()
cubel.display_one_surface()
cubel.display_total_surface()
```

## 8. Solution

---

```
def display_menu():
    print("1. Enter radius")
    print("2. Display radius")
    print("3. Display diameter")
    print("4. Display area")
    print("5. Display perimeter")
    print("6. Exit")

class Circle:
    def __init__(self):
        self._radius = None    #Private field

    #Define the getter
    @property
    def radius(self):
        if self._radius != None:
            return self._radius
        else:
```

```
        raise ValueError("Radius is not set")

#Define the setter
@radius.setter
def radius(self, value):
    if value > 0:
        self._radius = value
    else:
        raise ValueError("Cannot be negative or zero")

def get_diameter(self):
    return 2 * self.radius

def get_area(self):
    return 3.14 * self.radius ** 2

def get_perimeter(self):
    return 2 * 3.14 * self.radius

#Main code starts here
circle1 = Circle()

while True:
    display_menu()

    choice = int(input("Enter a choice: "))

    if choice == 6:
        print("Bye")
        break
    elif choice == 1:
        radius = float(input("Enter radius: "))
        circle1.radius = radius
    elif choice == 2:
        print("Radius:", circle1.radius)
    elif choice == 3:
        print("Diameter:", circle1.get_diameter())
    elif choice == 4:
        print("Area:", circle1.get_area())
    else:
        print("Perimeter:", circle1.get_perimeter())
```

## 9. Solution

```
class Info:
    def __init__(self):
        self._user_text = None    #Private field. It does not call the setter!

    #Define the getter
```

```
@property
def user_text(self):
    return self._user_text

#Define the setter
@user_text.setter
def user_text(self, value):
    if value != "":
        self._user_text = value
    else:
        raise ValueError("Cannot be set to empty")

def get_spaces_count(self):
    count = 0
    for char in self.user_text:
        if char == " ":
            count += 1
    return count

def get_words_count(self):
    return self.get_spaces_count() + 1

def get_vowels_count(self):
    count = 0
    for char in self.user_text.lower():
        if char in "aeiou":
            count += 1
    return count

def get_letters_count(self):
    return len(self.user_text) - self.get_spaces_count()

#Main code starts here
inf = Info()

text = input("Enter a text: ")

inf.user_text = text

print("Text:", inf.user_text)
print("Spaces:", inf.get_spaces_count())
print("Words:", inf.get_words_count())
print("Vowels:", inf.get_vowels_count())
print("Total number of letters:", inf.get_letters_count())
```

## 10. Solution

```
def display_menu():
    print("1. Enter encryption/decryption key")
```

```
print("2. Encrypt a message")
print("3. Decrypt a message")
print("4. Exit")

class EncryptDecrypt:

    def __init__(self):
        self._encr_decr_key = None #Private field. #It does not call the setter!

        self._alphabet = " abcdefghijklmnopqrstuvwxyz" #Space is a valid character!

    #Define the getter
    @property
    def encr_decr_key(self):
        if self._encr_decr_key != None:
            return self._encr_decr_key
        else:
            raise ValueError("Key is not set")

    #Define the setter
    @encr_decr_key.setter
    def encr_decr_key(self, value):
        if value in range(1,27):
            self._encr_decr_key = value
        else:
            raise ValueError("Key must be between 1 and 26")

    def encrypt(self, message):
        return_value = ""
        for char in message:
            index = self._alphabet.find(char)
            new_index = index + self._encr_decr_key
            if new_index >= 27:
                new_index -= 27
            new_letter = self._alphabet[new_index]
            return_value += new_letter
        return return_value

    def decrypt(self, enc_message):
        return_value = ""
        for char in enc_message:
            index = self._alphabet.find(char)
            new_index = index - self._encr_decr_key
            if new_index < 0:
                new_index += 27
            new_letter = self._alphabet[new_index]
            return_value += new_letter
        return return_value
```

```
#Main code starts here
ed = EncryptDecrypt()

display_menu()
choice = int(input("Enter a choice: "))
while choice != 4:

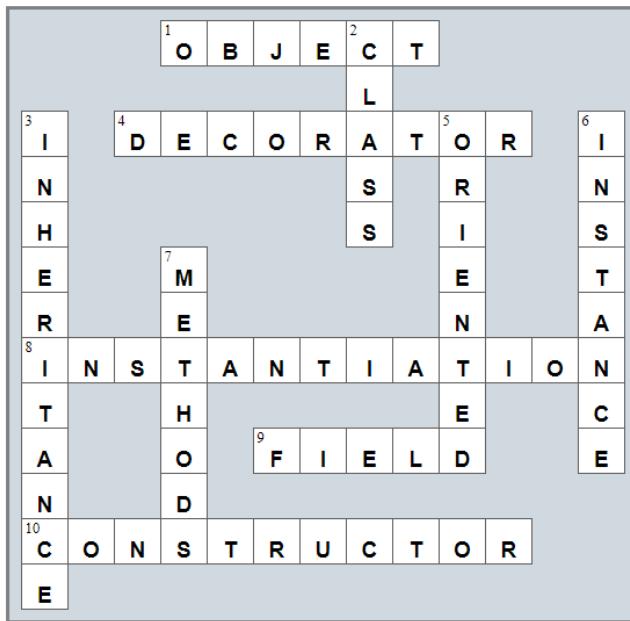
    if choice == 1:
        encr_decr_key = int(input("Enter encryption/decryption key: "))
        ed.encr_decr_key = encr_decr_key
    elif choice == 2:
        text = input("Enter message to encrypt: ")
        print("Encrypted message:", ed.encrypt(text))
    else:
        text = input("Enter message to decrypt: ")
        print("Decrypted message:", ed.decrypt(text))

display_menu()
choice = int(input("Enter a choice: "))
```

## Review in "Object Oriented Programming"

### Review Crossword Puzzle

1.



## Some Final Words from the Author

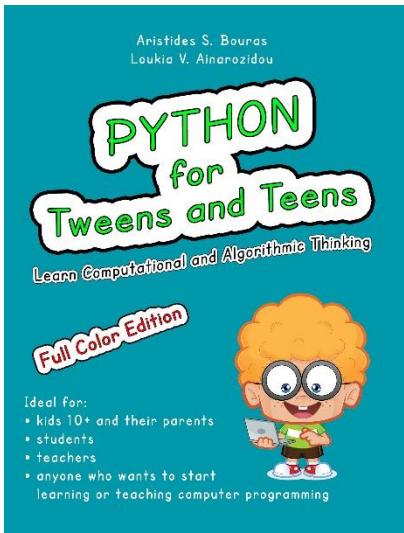
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I hope you really enjoyed reading this book. I made every possible effort to make it comprehensible even by people that probably have no previous experience in programming.

So if you liked this book, please visit the web store where you bought it and show me your gratitude by writing a good review and giving me as many stars as possible. By doing this, you will encourage me to continue writing and of course you'll help other readers to reach me.

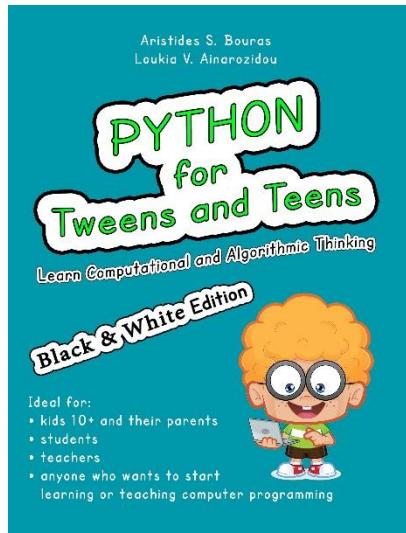
And remember: Learning is a process within an endless loop. It begins at birth and continues throughout your lifetime!

# Some of my Books



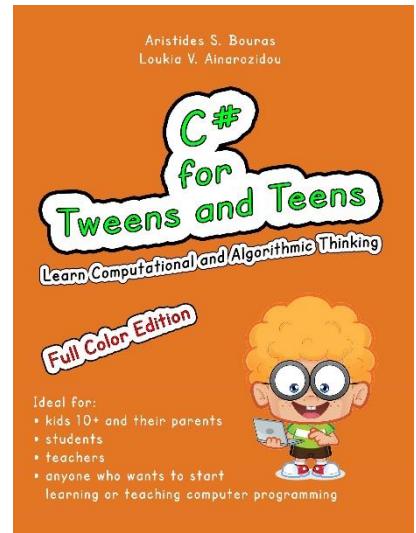
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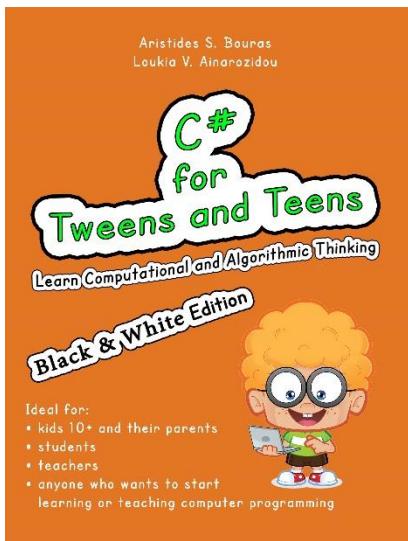
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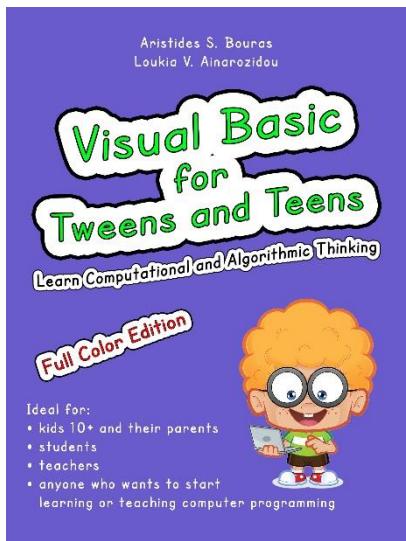
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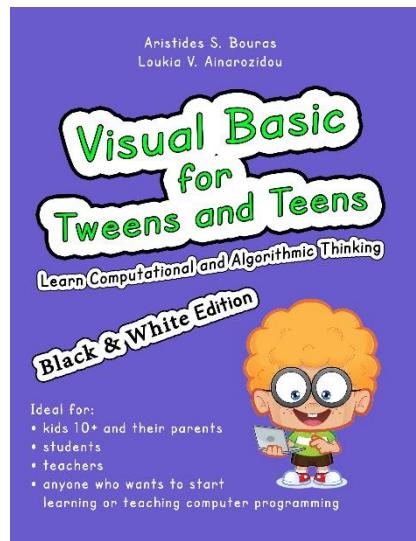
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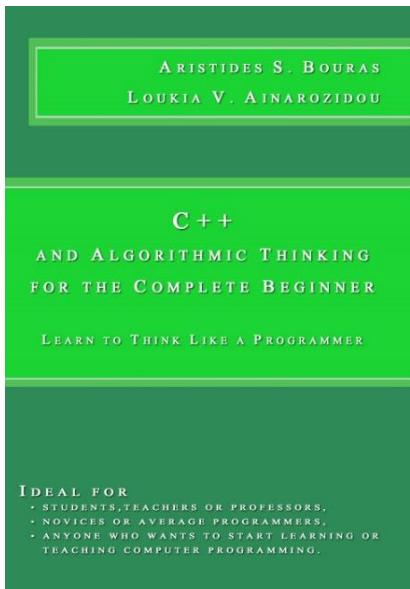
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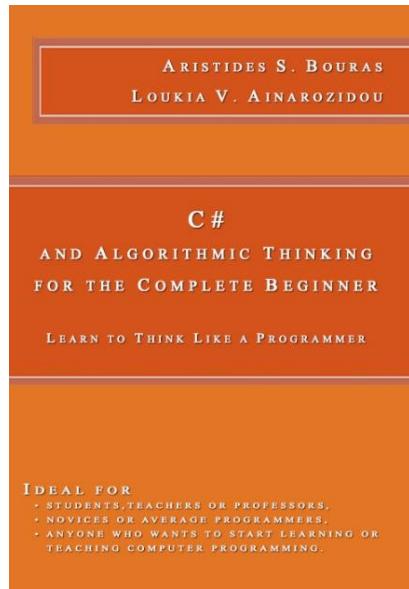


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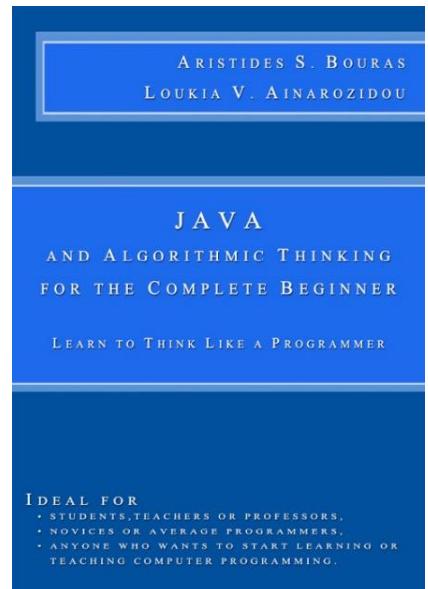
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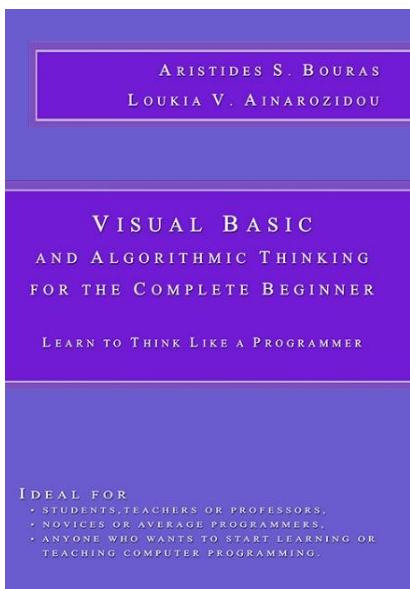
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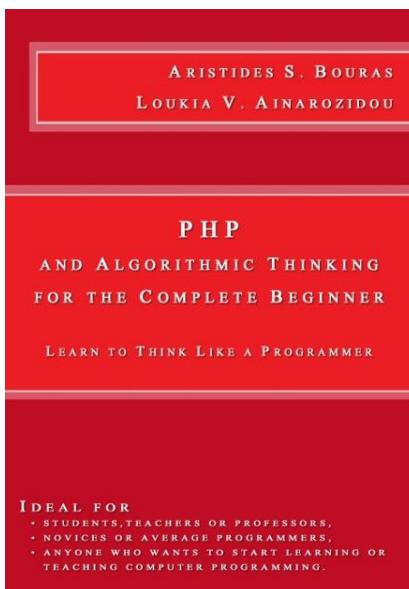
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