Visual Basic
AND ALGORITHMIC THINKING
FOR THE COMPLETE BEGINNER

The Answers

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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 "VISUAL BASIC AND ALGORITHMIC THINKING FOR THE COMPLETE BEGINNER". Every effort has been taken to make this book compatible with all previous releases of Visual Basic, and it is almost certain to be compatible with any future releases of Visual Basic.

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Chapter 1

1.7 Answers of Review Questions: True/False

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

1.8 Answers of Review Questions: Multiple Choice

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

Chapter 4

4.16 Answers of Review Questions: True/False

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

4.17 Answers of Review Questions: Multiple Choice

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

Chapter 5

5.9 Answers of Review Questions: True/False

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

5.10 Answers of Review Questions: Multiple Choice

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

5.11 Answers of Review Exercises

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

Chapter 6

6.4 Answers of Review Questions: True/False

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

6.5 Answers of Review Questions: Multiple Choice

1. a
2. b
3. b

Chapter 7

7.6 Answers of Review Questions: True/False

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

7.7 Answers of Review Questions: Multiple Choice

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

7.8 Answers of Review Exercises

1. ii, iv, v, ix
2. i. String, ii. Boolean, iii. String, iv. String, v. Real, 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
8. i. 2, ii. 0, iii. 1, iv. 0, v. Division by zero error, vi. 0
9. i. 2, ii. 10.5
10. My name is George Malkovich
11. i. (-3), ii. 1
12. California, California

Chapter 8

8.2 Answers of Review Questions: True/False

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

8.3 Answers of Review Exercises

1. Solution

For the input value of 3

Step	Statement	a	b	c	d
1	`a = Console.ReadLine()`	**3**	?	?	?
2	`a = (a + 1) * (a + 1) + 6 / 3 * 2 + 20`	**40**	?	?	?
3	`b = a Mod 13`	40	**1**	?	?
4	`c = b Mod 7`	40	1	**1**	?
5	`d = a * b * c`	40	1	1	**40**
6	`Console.Write(a & ", " & b & ", " & c & ", " & d)`	40, 1, 1, 40 is displayed			

For the input value of 4

Step	Statement	a	b	c	d
1	`a = Console.ReadLine()`	**4**	?	?	?
2	`a = (a + 1) * (a + 1) + 6 / 3 * 2 + 20`	**49**	?	?	?
3	`b = a Mod 13`	49	**10**	?	?
4	`c = b Mod 7`	49	10	**3**	?
5	`d = a * b * c`	49	10	3	**1470**
6	`Console.Write(a & ", " & b & ", " & c & ", " & d)`	49, 10, 3, 1470 is displayed			

For the input value of 1

Step	Statement	a	b	c	d
1	`a = Console.ReadLine()`	**1**	?	?	?
2	`a = (a + 1) * (a + 1) + 6 / 3 * 2 + 20`	**28**	?	?	?
3	`b = a Mod 13`	28	**2**	?	?
4	`c = b Mod 7`	28	2	**2**	?
5	`d = a * b * c`	28	2	2	**112**
6	`Console.Write(a & ", " & b & ", " & c & ", " & d)`	28, 2, 2, 112 is displayed			

2. Solution

For the input values of 3, 4

Step	Statement	a	b	c	d	e
1	`a = Console.ReadLine()`	**3**	?	?	?	?
2	`b = Console.ReadLine()`	3	**4**	?	?	?
3	`c = a + b`	3	4	**7**	?	?
4	`d = 1 + a / b * c + 2`	3	4	7	**8.25**	?
5	`e = c + d`	3	4	7	8.25	**15.25**
6	`c += d + e`	3	4	**30.5**	8.25	15.25
7	`e -= 1`	3	4	30.5	8.25	**14.25**
8	`d -= c + d Mod c`	3	4	30.5	**-30.25**	14.25
9	`Console.Write(c & ", " & d & ", " & e)`	30.5, -30.25, 14.25 is displayed				

For the input values of 4, 4

Step	Statement	a	b	c	d	e
1	`a = Console.ReadLine()`	**4**	?	?	?	?
2	`b = Console.ReadLine()`	4	**4**	?	?	?
3	`c = a + b`	4	4	**8**	?	?
4	`d = 1 + a / b * c + 2`	4	4	8	**11**	?
5	`e = c + d`	4	4	8	11	**19**
6	`c += d + e`	4	4	**38**	11	19
7	`e -= 1`	4	4	38	11	**18**
8	`d -= c + d Mod c`	4	4	38	**-38**	18
9	`Console.Write(c & ", " & d & ", " & e)`	38, -38, 18 is displayed				

Chapter 9

9.5 Answers of 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	`a = Console.ReadLine()`	**5**	?	?	?	?
2	`b = Console.ReadLine()`	5	**5**	?	?	?
3	`c = a + b`	5	5	**10**	?	?
4	`d = 5 + a / b * c + 2`	5	5	10	**17**	?
5	`e = c - d`	5	5	10	17	**-7**
6	`c -= d + c`	5	5	**-17**	17	-7
7	`e -= 1`	5	5	-17	17	**-8**
8	`d -= c + a Mod c`	5	5	-17	**29**	-8
9	`Console.Write(c & ", " & d & ", " & e)`	-17, 29, -8 is displayed				

For the input values of 4, 8

Step	Statement	a	b	c	d	e
1	`a = Console.ReadLine()`	**4**	?	?	?	?
2	`b = Console.ReadLine()`	4	**8**	?	?	?
3	`c = a + b`	4	8	**12**	?	?
4	`d = 5 + a / b * c + 2`	4	8	12	**13**	?
5	`e = c - d`	4	8	12	13	**-1**
6	`c -= d + c`	4	8	**-13**	13	-1
7	`e -= 1`	4	8	-13	13	**-2**
8	`d -= c + a Mod c`	4	8	-13	**22**	-2
9	`Console.Write(c & ", " & d & ", " & e)`	-13, 22, -2 is displayed				

3. Solution

For the input value of 0.50

Step	Statement	a	b	c
1	`b = Console.ReadLine()`	?	**0.50**	?
2	`c = 5`	?	0.50	**5**

3	`c = c * b`	?	0.50	**2.5**
4	`a = 10 * c Mod 10`	**5**	0.50	2.5
5	`Console.Write(a)`	Value 5 is displayed		

For the input value of 3

Step	Statement	a	b	c
1	`b = Console.ReadLine()`	?	3	?
2	`c = 5`	?	3	**5**
3	`c = c * b`	?	3	**15**
4	`a = 10 * c Mod 10`	**0**	3	15
5	`Console.Write(a)`	Value 0 is displayed		

For the input value of 15

Step	Statement	a	b	c
1	`b = Console.ReadLine()`	?	15	?
2	`c = 5`	?	15	**5**
3	`c = c * b`	?	15	**75**
4	`a = 10 * c Mod 10`	**0**	15	75
5	`Console.Write(a)`	Value 0 is displayed		

Chapter 10

10.2 Answers of Review Exercises

1. Solution

```
Sub Main()
  Dim base, height, area As Double

  Console.Write("Enter base: ")
  base = Console.ReadLine()
  Console.Write("Enter height: ")
  height = Console.ReadLine()

  area = 0.5 * base * height

  Console.Write(area)

  Console.ReadKey()
End Sub
```

2. Solution

```
Sub Main()
  Dim angle1, angle2, angle3 As Double

  Console.Write("Enter 1st angle: ")
  angle1 = Console.ReadLine()
  Console.Write("Enter 2nd angle: ")
  angle2 = Console.ReadLine()

  angle3 = 180 - angle1 - angle2

  Console.Write(angle3)

  Console.ReadKey()
End Sub
```

3. Solution

```
Sub Main()
  Dim g1, g2, g3, g4 As Integer
  Dim average As Double

  Console.Write("Enter 1st grade: ")
  g1 = Console.ReadLine()
  Console.Write("Enter 2nd grade: ")
  g2 = Console.ReadLine()
  Console.Write("Enter 3rd grade: ")
  g3 = Console.ReadLine()
  Console.Write("Enter 4th grade: ")
  g4 = Console.ReadLine()
```

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

  Console.Write(average)

  Console.ReadKey()
End Sub
```

4. Solution

```
Const PI = 3.14159

Sub Main()
  Dim r, perimeter As Double

  Console.Write("Enter radius: ")
  r = Console.ReadLine()

  perimeter = 2 * PI * r

  Console.Write(perimeter)

  Console.ReadKey()
End Sub
```

5. Solution

```
Sub Main()
  Dim charge, tip, tax, total As Double

  Console.Write("Enter charge for a meal: ")
  charge = Console.ReadLine()

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

  total = charge + tip + tax

  Console.Write(total)

  Console.ReadKey()
End Sub
```

6. Solution

```
Sub Main()
  Dim a, t, s As Double

  Console.Write("Enter acceleration in m/sec2: ")
  a = Console.ReadLine()
  Console.Write("Enter time traveled in sec: ")
  t = Console.ReadLine()
```

```
  s = 0.5 * a * t * t

  Console.Write(s)

  Console.ReadKey()
End Sub
```

7. Solution

```
Sub Main()
  Dim f, c As Double

  Console.Write("Enter temperature in Fahrenheit: ")
  f = Console.ReadLine()

  c = 5 / 9 * (f - 32)

  Console.Write(c)

  Console.ReadKey()
End Sub
```

8. Solution

```
Sub Main()
  Dim w, h As Integer
  Dim bmi As Double

  Console.Write("Enter weight in pounds: ")
  w = Console.ReadLine()
  Console.Write("Enter height in inches: ")
  h = Console.ReadLine()

  bmi = w * 703 / (h * h)

  Console.Write(bmi)

  Console.ReadKey()
End Sub
```

9. Solution

```
Sub Main()
  Dim s_total, g_rate, tip, total,  As Double

  Console.Write("Enter subtotal: ")
  s_total = Console.ReadLine()
  Console.Write("Enter gratuity rate: ")
  g_rate = Console.ReadLine()

  tip = s_total * g_rate / 100

  total = s_total + tip
```

```
  Console.WriteLine("Tip is " & tip)
  Console.Write(" and Total is " & total)

  Console.ReadKey()
End Sub
```

10. Solution

```
Const VAT = 0.20

Sub Main()
  Dim btax_price1, btax_price2, btax_price3, atax_price1, atax_price2, atax_price3, avg As Double

  Console.Write("Enter before-tax price 1: ")
  btax_price1 = Console.ReadLine()
  Console.Write("Enter before-tax price 2: ")
  btax_price2 = Console.ReadLine()
  Console.Write("Enter before-tax price 3: ")
  btax_price3 = Console.ReadLine()

  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

  Console.Write(avg)

  Console.ReadKey()
End Sub
```

11. Solution

```
Const VAT = 0.20

Sub Main()
  Dim atax_price, btax_price As Double

  Console.Write("Enter after-tax price: ")
  atax_price = Console.ReadLine()

  btax_price = atax_price / (1 + VAT)

  Console.Write(btax_price)

  Console.ReadKey()
End Sub
```

12. Solution

```
Sub Main()
  Dim i_price, discount, f_price, saved As Double
```

```
  Console.Write("Enter price: ")
  i_price = Console.ReadLine()
  Console.Write("Enter discount: ")
  discount = Console.ReadLine()

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

  Console.Write(f_price & " " & saved)

  Console.ReadKey()
End Sub
```

13. Solution

```
Const VAT = 0.20

Sub Main()
  Dim i_kWh, f_kWh, kWh_consumed As Integer
  Dim cost As Double

  Console.Write("Enter kWh at the beginning of the month: ")
  i_kWh = Console.ReadLine()
  Console.Write("Enter kWh at the end of the month: ")
  f_kWh = Console.ReadLine()

  kWh_consumed = f_kWh - i_kWh

  cost = kWh_consumed * 0.06
  cost += cost * VAT

  Console.Write(kWh_consumed & " " & cost)

  Console.ReadKey()
End Sub
```

14. Solution

```
Sub Main()
  Dim day, month, days_passed, days_left As Integer

  Console.Write("Enter day: ")
  day = Console.ReadLine()
  Console.Write("Enter month: ")
  month = Console.ReadLine()

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

  Console.Write(days_left)

  Console.ReadKey()
```

```
End Sub
```

Chapter 11

11.3 Answers of Review Questions: True/False

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

11.4 Answers of Review Questions: Multiple Choice

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

11.5 Answers of Review Exercises

1. Solution

For the input value of 9

Step	Statement	a	b	c
1	`a = Console.ReadLine()`	**9**	?	?
2	`a += 6 / Math.Sqrt(a) * 2 + 20`	**33**	?	**?**
3	`b = Math.Round(a) Mod 4`	33	**1**	**?**
4	`c = b Mod 3`	33	1	**1**
5	`Console.Write(a & ", " & b & ", " & c)`	33, 1, 1 is displayed		

For the input value of 4

Step	Statement	a	b	c
1	`a = Console.ReadLine()`	**4**	?	?
2	`a += 6 / Math.Sqrt(a) * 2 + 20`	**30**	?	**?**
3	`b = Math.Round(a) Mod 4`	30	**2**	**?**
4	`c = b Mod 3`	30	2	**2**
5	`Console.Write(a & ", " & b & ", " & c)`	30, 2, 2 is displayed		

2. Solution

For the input value of -2

Step	Statement	a	b	c
1	`a = Console.ReadLine()`	**-2**	?	?
2	`b = Math.Abs(a) Mod 4 + a ^ 4`	-2	**18**	**?**
3	`c = b Mod 5`	-2	18	**3**

4	`Console.Write(b & ", " & c)`	18, 3 is displayed

For the input value of -3

Step	Statement	a	b	c
1	`a = Console.ReadLine()`	**-3**	?	?
2	`b = Math.Abs(a) Mod 4 + a ^ 4`	-3	**84**	**?**
3	`c = b Mod 5`	-3	84	**4**
4	`Console.Write(b & ", " & c)`	84, 4 is displayed		

3. Solution

```
Sub Main()
  Dim degrees, radians As Double

  Console.Write("Enter angle in radians: ")
  radians = Console.ReadLine()

  degrees = radians * 180 / Math.PI

  Console.Write(degrees)

  Console.ReadKey()
End Sub
```

4. Solution

```
Sub Main()
  Dim a, b, hypotenuse As Double

  Console.Write("Enter side A of a right-angled triangle: ")
  a = Console.ReadLine()
  Console.Write("Enter side B of a right-angled triangle: ")
  b = Console.ReadLine()

  hypotenuse = Math.Sqrt(a ^ 2 + b ^ 2)

  Console.Write(hypotenuse)

  Console.ReadKey()
End Sub
```

5. Solution

```
Sub Main()
  Dim adjacent, opposite, th As Double

  Console.Write("Enter angle (in degrees) of a right-angled triangle: ")
  th = Console.ReadLine()
  Console.Write("Enter length of adjacent side: ")
  adjacent = Console.ReadLine()
```

```
  opposite = Math.Tan(th * Math.PI / 180) * adjacent

  Console.Write(opposite)

  Console.ReadKey()
End Sub
```

Chapter 12

12.2 Answers of Review Exercises

1. Solution

i. a, e, g, h

ii. c, f

2. Solution

i. `y = (x + 3) ^ (5 * w) / (7 * (x - 4))`

ii. `y = (3 * x ^ 2 - x ^ 3 / 4) ^ (1 / 5)`

iii. `y = Math.Sqrt(x ^ 4 - 2 * x ^ 3 - 7 * x ^ 2 + x) / (4 * (7 * x ^ 4 - 3 / 4 * x ^ 3) * (7 * x ^ 2 + x)) ^ (1 / 3)`

iv. `y = x / (x - 3 * (x - 1)) + x * (x - 1) ^ (1 / 5) / ((x ^ 3 - 2) * (x - 1) ^ 3)`

v. `y = (Math.Sin(Math.PI / 3) - Math.Cos(Math.PI / 2 * w)) ^ 2`

vi. `y = (Math.Sin(Math.PI / 2 * x) + Math.Cos(3 * Math.PI / 2 * w)) ^ 3 / (Math.Tan(2 * Math.PI / 3 * w) - Math.Sin(Math.PI / 2 * x)) ^ 0.5`

3. Solution

```
Sub Main()
  Dim x, y As Double

  Console.Write("Enter value for x: ")
  x = Console.ReadLine()

  y = Math.Sqrt(x) * (x ^ 3 + x ^ 2)

  Console.Write(y)

  Console.ReadKey()
End Sub
```

4. Solution

```
Sub Main()
  Dim x, y As Double

  Console.Write("Enter value for x: ")
  x = Console.ReadLine()

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

  Console.Write(y)

  Console.ReadKey()
End Sub
```

5. Solution

```
Sub Main()
  Dim w, x, y As Double

  Console.Write("Enter value for x: ")
  x = Console.ReadLine()
  Console.Write("Enter value for w: ")
  w = Console.ReadLine()

  y = x ^ (x + 1) / (Math.Tan(2 * w / 3 + 5) - Math.Tan(x / 2 + 1)) ^ 3

  Console.Write(y)

  Console.ReadKey()
End Sub
```

6. Solution

```
Sub Main()
  Dim w, x, y As Double

  Console.Write("Enter value for x: ")
  x = Console.ReadLine()
  Console.Write("Enter value for w: ")
  w = Console.ReadLine()

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

  Console.Write(y)

  Console.ReadKey()
End Sub
```

7. Solution

```
Sub Main()
  Dim w, x, y As Double

  Console.Write("Enter value for x: ")
  x = Console.ReadLine()
  Console.Write("Enter value for w: ")
  w = Console.ReadLine()

  y = x ^ x / (Math.Sin(2 * w / 3 + 5) - x) ^ 2 + (Math.Sin(3 * x) + w) ^ (x + 1) / Math.Sqrt(7 * w) ^
(3 / 2)

  Console.Write(y)

  Console.ReadKey()
End Sub
```

8. Solution

```
Sub Main()
  Dim a, b, c, area, semi As Double

  Console.Write("Enter length A: ")
  a = Console.ReadLine()
  Console.Write("Enter length B: ")
  b = Console.ReadLine()
  Console.Write("Enter length C: ")
  c = Console.ReadLine()

  semi = (a + b + c) / 2
  area = Math.Sqrt(semi * (semi - a) * (semi - b) * (semi - c))

  Console.Write(area)

  Console.ReadKey()
End Sub
```

Chapter 13

13.2 Answers of Review Exercises

1. Solution

```
Sub Main()
  Dim last_digit, n, result As Integer

  Console.Write("Enter an integer: ")
  n = Console.ReadLine()

  last_digit = n Mod 10
  result = last_digit * 8

  Console.Write(result)

  Console.ReadKey()
End Sub
```

2. Solution

```
Sub Main()
  Dim digit1, digit2, digit3, digit4, digit5, number, r, reversed As Integer

  Console.Write("Enter a five-digit integer: ")
  number = Console.ReadLine()

  digit5 = number Mod 10
  r = number \ 10

  digit4 = r Mod 10
  r = r \ 10

  digit3 = r Mod 10
  r = r \ 10

  digit2 = r Mod 10
  digit1 = r \ 10

  reversed = digit5 * 10000 + digit4 * 1000 + digit3 * 100 + digit2 * 10 + digit1
  Console.Write(reversed)

  Console.ReadKey()
End Sub
```

3. Solution

```
Sub Main()
  Dim n, result As Integer

  Console.Write("Enter an integer: ")
```

```
  n = Console.ReadLine()

  result = n Mod 2

  Console.Write(result)

  Console.ReadKey()
End Sub
```

4. Solution

```
Sub Main()
  Dim n, result As Integer

  Console.Write("Enter an integer: ")
  n = Console.ReadLine()

  result = 1 - n Mod 2

  Console.Write(result)

  Console.ReadKey()
End Sub
```

5. Solution

```
Sub Main()
  Dim days, hours, minutes, number, r, seconds, weeks As Integer

  Console.Write("Enter a period of time in seconds: ")
  number = Console.ReadLine()

  weeks = number \ 604800      ' 60 * 60 * 24 * 7 = 604800
  r = number Mod 604800

  days = r \ 86400             ' 60 * 60 * 24 = 86400
  r = r Mod 86400

  hours = r \ 3600
  r = r Mod 3600

  minutes = r \ 60
  seconds = r Mod 60

  Console.Write(weeks & " weeks " & days & " days " & hours & " hours ")
  Console.Write(minutes & " minutes and " & seconds & " seconds")

  Console.ReadKey()
End Sub
```

6. Solution

```
Sub Main()
```

```
  Dim amount, r, usd1, usd10, usd20, usd5 As Integer

  Console.Write("Enter amount to withdraw: ")
  amount = Console.ReadLine()

  usd20 = amount \ 20
  r = amount Mod 20

  usd10 = r \ 10
  r = r Mod 10

  usd5 = r \ 5
  usd1 = r Mod 5

  Console.Write(usd20 & " notes of $20 " & usd10 & " notes of $10 ")
  Console.Write(usd5 & " notes of $5 and " & usd1 & " notes of $1")

  Console.ReadKey()
End Sub
```

7. Solution

```
Sub Main()
  Dim distance, feet, inches, miles, r, steps, yards As Integer

  Console.Write("Enter number of steps: ")
  steps = Console.ReadLine()

  distance = steps * 25

  miles = distance \ 63360
  r = distance Mod 63360

  yards = r \ 36
  r = r Mod 36

  feet = r \ 12
  inches = r Mod 12

  Console.Write(miles & " miles " & yards & " yards ")
  Console.Write(feet & " feet and " & inches & " inches")

  Console.ReadKey()
End Sub
```

Chapter 14

14.5 Answers of Review Questions: True/False

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

14.6 Answers of Review Questions: Multiple Choice

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

14.7 Answers of Review Exercises

1. Solution

```
Sub Main()
  Dim first_name, last_name, middle_name, title As String

  Console.Write("First name: ")
  first_name = Console.ReadLine()
  Console.Write("Middle name: ")
  middle_name = Console.ReadLine()
  Console.Write("Last name: ")
  last_name = Console.ReadLine()
  Console.Write("Title: ")
  title = Console.ReadLine()

  Console.WriteLine(title & " " & first_name & " " & middle_name & " " & last_name)
  Console.WriteLine(first_name & " " & middle_name & " " & last_name)
  Console.WriteLine(last_name & ", " & first_name)
  Console.WriteLine(last_name & ", " & first_name & " " & middle_name)
  Console.WriteLine(last_name & ", " & first_name & " " & middle_name & ", " & title)
  Console.Write(first_name & " " & last_name)

  Console.ReadKey()
End Sub
```

2. Solution

```
Sub Main()
```

```
  Dim alphabet As String

  Dim rnd As New Random()

  alphabet = "abcdefghijklmnopqrstuvwxyz"

  Console.Write(alphabet(rnd.Next(0, 26)).ToUpper())
  Console.Write(alphabet(rnd.Next(0, 26)))
  Console.Write(alphabet(rnd.Next(0, 26)))
  Console.Write(alphabet(rnd.Next(0, 26)))
  Console.Write(alphabet(rnd.Next(0, 26)))

  Console.ReadKey()
End Sub
```

3. Solution

```
Sub Main()
  Dim name As String
  Dim rnd As New Random()

  Console.Write("Enter name: ")
  name = Console.ReadLine().ToLower()

  Console.Write(name(rnd.Next(0, name.Length)))
  Console.Write(name(rnd.Next(0, name.Length)))
  Console.Write(name(rnd.Next(0, name.Length)))
  Console.Write(rnd.Next(1000, 10000))

  Console.ReadKey()
End Sub
```

Chapter 15

15.8 Answers of Review Questions: True/False

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

15.9 Answers of Review Questions: Multiple Choice

1. d
2. a
3. a
4. a
5. c
6. d

15.10 Answers of 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 Or c > b And c > 1	a > 3 And c > b Or c > 1
4	**-6**	**2**	True	True
-3	**2**	**-4**	False	False
2	**5**	**5**	False	True

5. Solution

Expression	Value
`(x + y) ^ 3`	8
`(x + y) / (x ^ 2 - 14)`	1
`x - 1 = y + 5`	True
`x > 2 And y = 1`	False
`x = 1 Or y = -2 And Not(flag = False)`	True
`Not(x >= 3) And (x Mod 2 > 1)`	False

6. Solution

i. False
ii. True

7. Solution

i. `age < 12 And age <> 8`
ii. `age >= 6 And age <= 9 Or age = 11`
iii. `age > 7 And age <> 10 And age <> 12`
iv. `age = 6 Or age = 9 Or age = 11`
v. `age >= 6 And age <= 12 And age <> 8`
vi. `age <> 7 And age <> 10`

8. Solution

i. `x <> 4 Or y = 3`
ii. `x + 4 > 0`
iii. `Not(x <= 5) And y <> 4`
iv. `x = False`
v. `Not(x < 4 And z <= 4)`
vi. `x = 2 Or x < -5`

9. Solution

i. `Not(x < 4 Or y = 10)`

ii. `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 Answers of Review Questions: True/False

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

16.3 Answers of Review Questions: Multiple Choice

1. b
2. c
3. d
4. d
5. d

16.4 Answers of Review Exercises

1. Solution

The corrections/additions are in red

```
Sub Main()
  Dim x, y, x2 As Double

  x = Console.ReadLine()

  y = - 5
  If x * y / 2 > 20 Then
    y -= 1
    x += 4 * x ^ 2
  End If

  Console.Write(x & y)

  Console.ReadKey()
End Sub
```

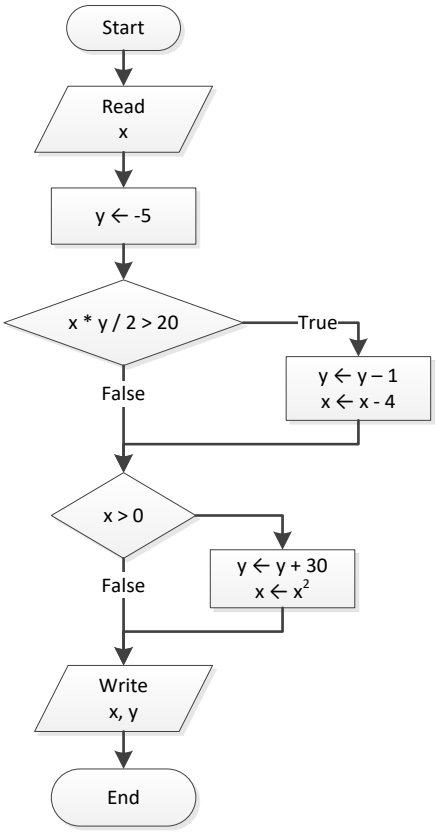
2. Solution

For the input value of 10

Step	Statement	x	y
1	`x = Console.ReadLine()`	**10**	?
2	`y = - 5`	10	**-5**
3	`If x * y / 2 > 20 Then`	False	
4	`If x > 0 Then`	True	
5	`y += 30`	10	**25**
6	`x = x ^ 2`	**100**	25
7	`Console.Write(x & ", " & y)`	100, 25 is displayed	

For the input value of -10

Step	Statement	x	y
1	`x = Console.ReadLine()`	**-10**	?
2	`y = - 5`	-10	**-5**
3	`If x * y / 2 > 20 Then`	True	
4	`y -= 1`	-10	**-6**
5	`x -= 4`	**-14**	-6
6	`If x > 0 Then`	False	
7	`Console.Write(x & ", " & y)`	-14, -6 is displayed	



3. Solution

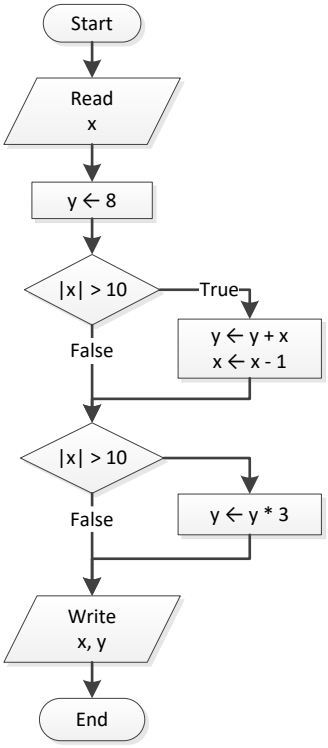
For the input value of -11

Step	Statement	x	y
1	`x = Console.ReadLine()`	**-11**	?
2	`y = 8`	-11	**8**
3	`If Math.Abs(x) > 10 Then`	True	
4	`y += x`	-11	**-3**
5	`x -= 1`	**-12**	-3

6	`If Math.Abs(x) > 10 Then`	True	
7	`y *= 3`	-12	**-9**
8	`Console.Write(x & ", " & y)`	-12, -9 is displayed	

For the input value of 11

Step	Statement	x	y
1	`x = Console.ReadLine()`	**11**	?
2	`y = 8`	11	**8**
3	`If Math.Abs(x) > 10 Then`	True	
4	`y += x`	11	**19**
5	`x -= 1`	**10**	19
6	`If Math.Abs(x) > 10 Then`	False	
7	`Console.Write(x & ", " & y)`	10, 19 is displayed	



4. Solution

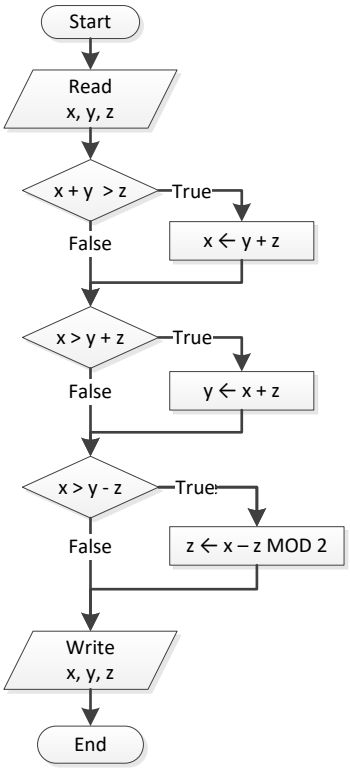
For input values of 1, 2 and 3

Step	Statement	x	y	z
1	`x = Console.ReadLine()`	**1**	?	?
2	`y = Console.ReadLine()`	1	**2**	?
3	`z = Console.ReadLine()`	1	**2**	**3**
4	`If x + y > z Then`	False		

5	`If x > y + z Then`		False	
6	`If x > y - z Then`		True	
7	`z = x - z Mod 2`	1	2	**0**
8	`Console.Write(x & ", " & y & ", " & z)`	1, 2, 0 is displayed		

For input values of 4, 2 and 1

Step	Statement	x	y	z
1	`x = Console.ReadLine()`	**4**	?	?
2	`y = Console.ReadLine()`	4	**2**	?
3	`z = Console.ReadLine()`	4	**2**	**1**
4	`If x + y > z Then`		True	
5	`x = y + z`	**3**	2	1
6	`If x > y + z Then`		False	
7	`If x > y - z Then`		True	
8	`z = x - z Mod 2`	3	2	**2**
9	`Console.Write(x & ", " & y & ", " & z)`	3, 2, 2 is displayed		



5. Solution

```
Sub Main()
  Dim x As Double

  Console.Write("Enter a number: ")
```

```
  x = Console.ReadLine()

  If x > 0 Then
    Console.WriteLine("Positive")
  End If

  Console.ReadKey()
End Sub
```

6. Solution

```
Sub Main()
  Dim x, y As Double

  Console.Write("Enter a number: ")
  x = Console.ReadLine()
  Console.Write("Enter a second number")
  y = Console.ReadLine()

  If x > 0 And y > 0 Then
    Console.WriteLine("Positive")
  End If

  Console.ReadKey()
End Sub
```

7. Solution

```
Sub Main()
  Dim x As String
  Dim x_dbl As Double

  Console.Write("Enter a number: ")
  x = Console.ReadLine()

  If Double.TryParse(x, x_dbl) = True Then
    Console.WriteLine("Numeric")
  End If

  Console.ReadKey()
End Sub
```

8. Solution

```
Sub Main()
  Dim str As String

  Console.Write("Enter a string: ")
  str = Console.ReadLine()

  If str = str.ToUpper() Then
    Console.WriteLine("Uppercase")
  End If
```

```
  Console.ReadKey()
End Sub
```

9. Solution

```
Sub Main()
  Dim str As String

  Console.Write("Enter a string: ")
  str = Console.ReadLine()

  If str.Length > 20 Then
    Console.WriteLine("Many characters")
  End If

  Console.ReadKey()
End Sub
```

10. Solution

```
Sub Main()
  Dim n1, n2, n3, n4 As Double

  Console.Write("Enter 1st number: ")
  n1 = Console.ReadLine()
  Console.Write("Enter 2nd number: ")
  n2 = Console.ReadLine()
  Console.Write("Enter 3rd number: ")
  n3 = Console.ReadLine()
  Console.Write("Enter 4th number: ")
  n4 = Console.ReadLine()

  If n1 < 0 Or n2 < 0 Or n3 < 0 Or n4 < 0 Then
    Console.WriteLine("Among the given numbers, there is a negative one!")
  End If

  Console.ReadKey()
End Sub
```

11. Solution

```
Sub Main()
  Dim a, b, c As Double

  Console.Write("Enter 1st number: ")
  a = Console.ReadLine()
  Console.Write("Enter 2nd number: ")
  b = Console.ReadLine()

  If a > b Then
    c = a
    a = b
```

```
    b = c
  End If

  Console.Write(a & ", " & b)

  Console.ReadKey()
End Sub
```

12. Solution

```
Sub Main()
  Dim average, t1, t2, t3 As Double

  Console.Write("Enter 1st temperature: ")
  t1 = Console.ReadLine()
  Console.Write("Enter 2nd temperature: ")
  t2 = Console.ReadLine()
  Console.Write("Enter 3rd temperature: ")
  t3 = Console.ReadLine()

  average = (t1 + t2 + t3) / 3

  If average > 60 Then
    Console.WriteLine("Heat Wave")
  End If

  Console.ReadKey()
End Sub
```

Chapter 17

17.2 Answers of Review Questions: True/False

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

17.3 Answers of Review Questions: Multiple Choice

1. b
2. c
3. c

17.4 Answers of Review Exercises

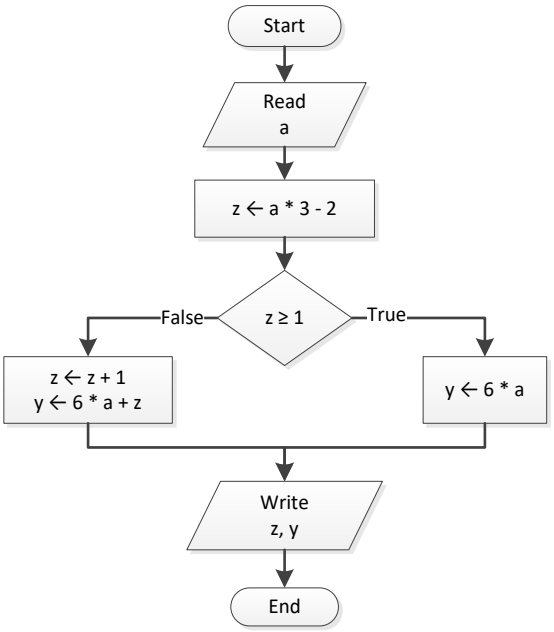
1. Solution

For input value of 3

Step	Statement	a	y	z
1	`a = Console.ReadLine()`	**3**	?	?
2	`z = a * 3 - 2`	3	?	**7**
3	`If z >= 1 Then`		True	
4	`y = 6 * a`	3	**18**	7
5	`Console.Write(z & ", " & y)`	7, 18 is displayed		

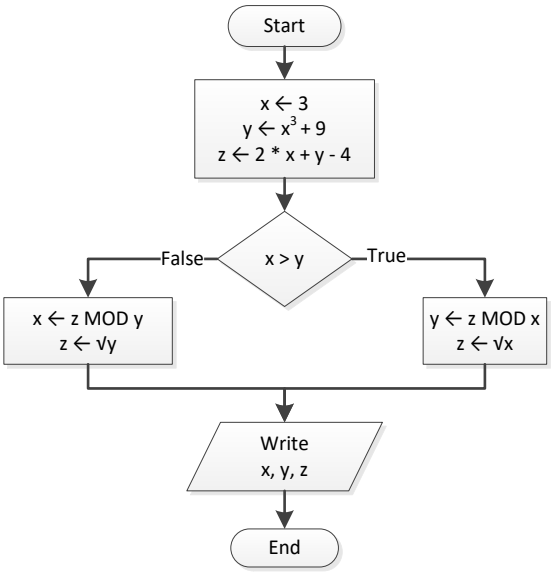
For input value of 0.5

Step	Statement	a	y	z
1	`a = Console.ReadLine()`	**0.5**	?	?
2	`z = a * 3 - 2`	0.5	?	**-0.5**
3	`If z >= 1 Then`		False	
4	`z += 1`	0.5	?	**0.5**
5	`y = 6 * a + z`	0.5	**3.5**	0.5
6	`Console.Write(z & ", " & y)`	0.5, 3.5 is displayed		



2. *Solution*

Step	Statement	x	y	z
1	`x = 3`	**3**	?	?
2	`y = x ^ 3 + 9`	3	**36**	?
3	`z = 2 * x + y - 4`	3	36	**38**
4	`If x > y Then`		False	
5	`x = z Mod y`	**2**	36	38
6	`z = Math.Sqrt(y)`	2	36	**6**
7	`Console.Write(x & ", " & y & ", " & z)`	2, 36, 6 is displayed		



3. Solution

```
Sub Main()
  Dim w, x, y, z As Double

  x = Console.ReadLine()
  w = x * 3 - 15
  z = (w + 7) * (x + 4) - 10
  If w > x And z > x Then
    x += 1
    y = x / 2 + 4
  Else
    y = x / 4 + 2
  End If
  Console.Write(y)

  Console.ReadKey()
End Sub
```

For input value of 10

Step	Statement	x	y	w	z
1	`x = Console.ReadLine()`	**10**	?	?	?
2	`w = x * 3 - 15`	10	?	**15**	?
3	`z = (w + 7) * (x + 4) - 10`	10	?	15	**298**
4	`If w > x And z > x Then`	True			
5	`x += 1`	**11**	?	15	298
6	`y = x / 2 + 4`	11	**9.5**	15	298
7	`Console.Write(y)`	9.5 is displayed			

For input value of 2

Step	Statement	x	y	w	z
1	`x = Console.ReadLine()`	**2**	?	?	?
2	`w = x * 3 - 15`	2	?	**-9**	?
3	`z = (w + 7) * (x + 4) - 10`	2	?	-9	**-22**
4	`If w > x And z > x Then`	False			
5	`y = x / 4 + 2`	2	**2.5**	-9	-22
6	`Console.Write(y)`	2.5 is displayed			

4. Solution

```
Sub Main()
  Dim x As Integer

  x = Console.ReadLine()
  If x Mod 6 = 0 Then
    Console.WriteLine(x & " is a multiple of 6")
  Else
    Console.WriteLine(x & " is not a multiple of 6")
  End If

  Console.ReadKey()
End Sub
```

5. Solution

```
Sub Main()
  Dim x As Integer

  x = Console.ReadLine()
  If x Mod 6 = 0 Or x Mod 7 = 0 Then
    Console.WriteLine(x & " is a multiple of 6 or a multiple of 7")
  Else
    Console.WriteLine(x & " is neither a multiple of 6 nor a multiple of 7")
  End If

  Console.ReadKey()
End Sub
```

6. Solution

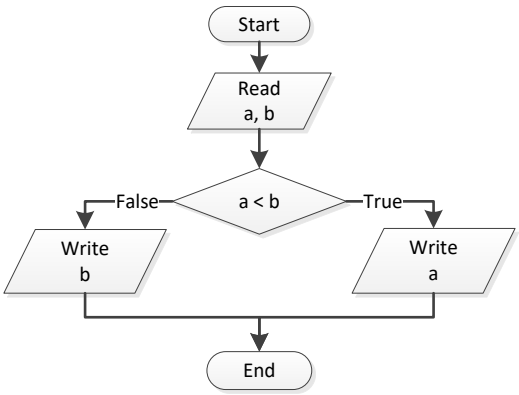
```
Sub Main()
  Dim x, y As Integer

  x = Console.ReadLine()

  y = x Mod 4
  If y = 0 Then
    Console.WriteLine(x & " is a multiple of 4")
  Else
```

```
    Console.WriteLine(x & " is not a multiple of 4")
  End If

  Console.Write("The structure is: " & x & " = " & (x \ 4) & " x 4 + " & y)

  Console.ReadKey()
End Sub
```

7. Solution

```
Sub Main()
  Dim x As Integer

  x = Console.ReadLine()

  If x >= 1000 And x <= 9999 Then
    Console.WriteLine(x & " is a four-digit integer")
  Else
    Console.WriteLine(x & " is not a four-digit integer")
  End If

  Console.ReadKey()
End Sub
```

8. Solution




```
Sub Main()
  Dim a, b As Double

  a = Console.ReadLine()
  b = Console.ReadLine()

  If a < b Then
    Console.WriteLine(a)
  Else
    Console.WriteLine(b)
  End If

  Console.ReadKey()
End Sub
```

9. Solution

```
Sub Main()
  Dim a, b, c As Double

  a = Console.ReadLine()
  b = Console.ReadLine()
  c = Console.ReadLine()

  If a < b + c And b < a + c And c < a + b Then
    Console.WriteLine("Given numbers can be lengths of the three sides of a triangle")
  Else
    Console.WriteLine("Given numbers cannot be lengths of the three sides of a triangle")
  End If

  Console.ReadKey()
End Sub
```

10. Solution

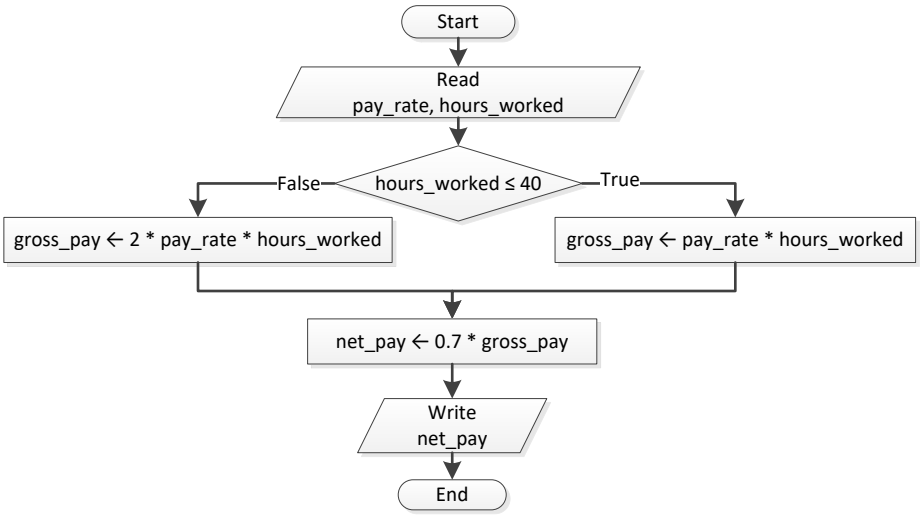
```
Sub Main()
  Dim a, b, c As Double

  a = Console.ReadLine()
  b = Console.ReadLine()
  c = Console.ReadLine()

  If a ^ 2 = b ^ 2 + c ^ 2 Or b ^ 2 = a ^ 2 + c ^ 2 Or c ^ 2 = a ^ 2 + b ^ 2 Then
    Console.WriteLine("Given numbers can be lengths of the three sides of a right triangle")
  Else
    Console.WriteLine("Given numbers cannot be lengths of the three sides of a right triangle")
  End If

  Console.ReadKey()
End Sub
```

11. Solution

```
Sub Main()
  Dim a, average, b, c As Double

  Console.Write("Enter 1st jump in meters: ")
  a = Console.ReadLine()
  Console.Write("Enter 2nd jump in meters: ")
  b = Console.ReadLine()
  Console.Write("Enter 3rd jump in meters: ")
  c = Console.ReadLine()

  average = (a + b + c) / 3

  If average < 8 Then
    Console.WriteLine("Disqualified")
  Else
```

```
    Console.WriteLine("Qualified")
  End If

  Console.ReadKey()
End Sub
```

12. Solution




```
Sub Main()
  Dim gross_pay, net_pay, pay_rate As Double
  Dim hours_worked As Integer

  pay_rate = Console.ReadLine()
  hours_worked = Console.ReadLine()

  If hours_worked <= 40 Then
    gross_pay = pay_rate * hours_worked
  Else
    gross_pay = 2 * pay_rate * hours_worked
  End If

  net_pay = 0.7 * gross_pay
  Console.Write("Net Pay: " & net_pay)

  Console.ReadKey()
End Sub
```

13. Solution

```
Sub Main()
  Dim miles, miles_left, r As Integer

  Console.Write("Enter miles traveled: ")
  miles = Console.ReadLine()

  r = miles Mod 12000
```

```
  If r > 6000 Then
    miles_left = 12000 - r
    Console.WriteLine("Your car needs a major service in " & miles_left & " miles")
  Else
    miles_left = 6000 - r
    Console.WriteLine("Your car needs a minor service in " & miles_left & " miles")
  End If

  Console.ReadKey()
End Sub
```

14. Solution

```
Sub Main()
  Dim a1, a2, s1, s2, t As Double

  Console.Write("Enter the time the two cars traveled: ")
  t = Console.ReadLine()
  Console.Write("Enter the accelaration for car A: ")
  a1 = Console.ReadLine()
  Console.Write("Enter the accelaration for car B: ")
  a2 = Console.ReadLine()

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

  If s1 > s2 Then
    Console.WriteLine("Car A is first")
  Else
    Console.WriteLine("Car B is first")
  End If

  Console.ReadKey()
End Sub
```

Chapter 18

18.2 Answers of Review Questions: True/False

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

18.3 Answers of Review Exercises

1. Solution

For input value of 5

Step	Statement	q	b
1	`q = Console.ReadLine()`	**5**	?
2	`If q > 0 And q <= 50 Then`	True	
3	`b = 1`	5	**1**
4	`Console.Write(b)`	1 is displayed	

For input value of 150

Step	Statement	q	b
1	`q = Console.ReadLine()`	**150**	?
2	`If q > 0 And q <= 50 Then`	False	
3	`ElseIf q > 50 And q <= 100 Then`	False	
4	`ElseIf q > 100 And q <= 200 Then`	True	
5	`b = 3`	150	**3**
6	`Console.Write(b)`	3 is displayed	

For input value of 250

Step	Statement	q	b
1	`q = Console.ReadLine()`	**250**	?
2	`If q > 0 And q <= 50 Then`	False	
3	`ElseIf q > 50 And q <= 100 Then`	False	
4	`ElseIf q > 100 And q <= 200 Then`	False	
5	`b = 4`	250	**4**
6	`Console.Write(b)`	4 is displayed	

For input value of -1

Step	Statement	q	b
1	`q = Console.ReadLine()`	**-1**	?
2	`If q > 0 And q <= 50 Then`	False	

3	`ElseIf q > 50 And q <= 100 Then`	False	
4	`ElseIf q > 100 And q <= 200 Then`	False	
5	`b = 4`	-1	**4**
6	`Console.Write(b)`	4 is displayed	

2. *Solution*

For input value of 5

Step	Statement	amount	discount	payment
1	`amount = Console.ReadLine()`	**5**	?	?
2	`discount = 0`	5	**0**	?
3	`If amount < 20 Then`	True		
4	`discount = 0`	5	**0**	?
5	`payment = amount - amount * discount / 100`	5	0	**5**
6	`Console.Write(discount & ", " & payment)`	0, 5 is displayed.		

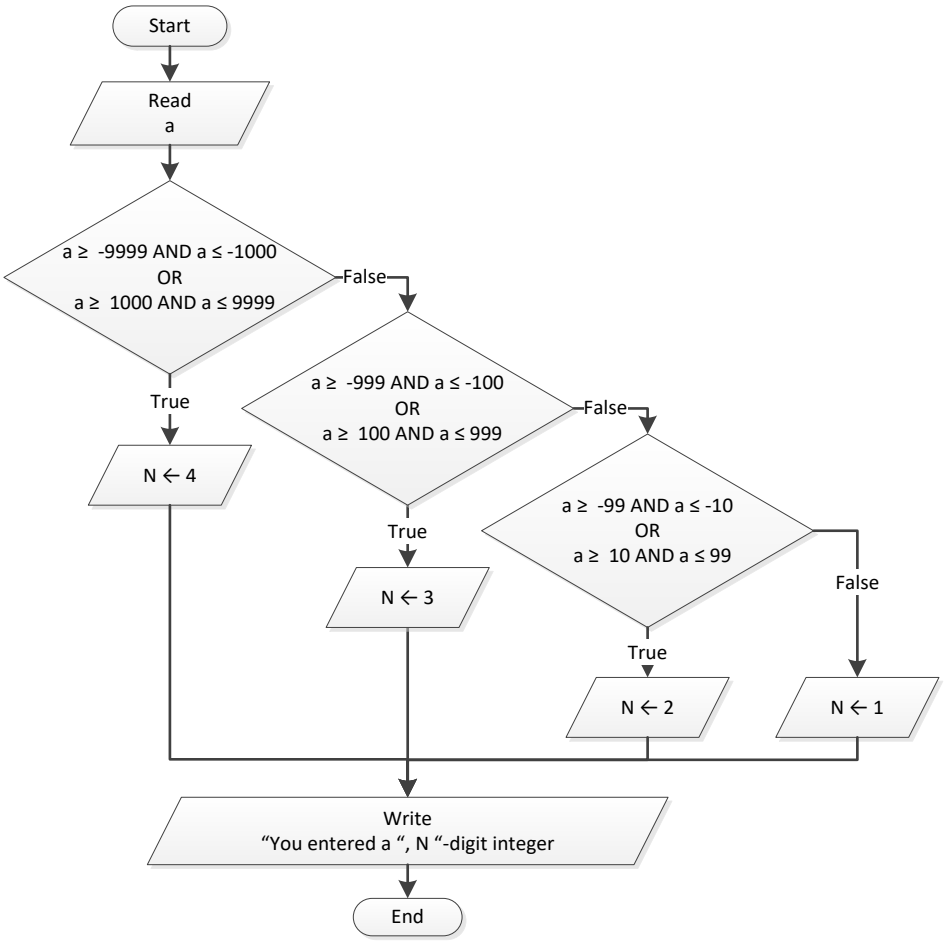
For input value of 150

Step	Statement	amount	discount	payment
1	`amount = Console.ReadLine()`	**150**	?	?
2	`discount = 0`	150	**0**	?
3	`If amount < 20 Then`	False		
4	`ElseIf amount >=20 And amount < 60 Then`	False		
5	`ElseIf amount >= 60 And amount < 100 Then`	False		
6	`ElseIf amount >= 100 Then`	True		
7	`discount = 15`	150	**15**	?
8	`payment = amount - amount * discount / 100`	150	15	**5**
9	`Console.Write(discount & ", " & payment)`	15, 127.5 is displayed.		

For input value of -1

Step	Statement	amount	discount	payment
1	`amount = Console.ReadLine()`	**-1**	?	?
2	`discount = 0`	-1	**0**	?
3	`If amount < 20 Then`	True		
4	`discount = 0`	-1	**0**	?
5	`payment = amount - amount * discount / 100`	-1	0	**-1**
6	`Console.Write(discount & ", " & payment)`	0, -1 is displayed.		

3. Solution




```
Sub Main()
  Dim a, n As Integer

  a = Console.ReadLine()

  If a >= -9999 And a <= -1000 Or a >= 1000 And a <= 9999 Then
    n = 4
  ElseIf a >= -999 And a <= -100 Or a >= 100 And a <= 999 Then
    n = 3
  ElseIf a >= -99 And a <= -10 Or a >= 10 And a <= 99 Then
    n = 2
  Else
    n = 1
  End If

  Console.Write("You entered a " & n & "-digit integer")

  Console.ReadKey()
End Sub
```

4. Solution

```
Sub Main()
  Dim cad, eur, gbp, jpy, usd As Double
  Dim ch As Integer

  Console.WriteLine("1. Convert USD to Euro (EUR)")
  Console.WriteLine("2. Convert USD to British Pound Sterling (GBP)")
  Console.WriteLine("3. Convert USD to Japanese Yen (JPY)")
  Console.WriteLine("4. Convert USD to Canadian Dollar (CAD)")

  Console.Write("Enter a choice: ")
  ch = Console.ReadLine()

  Console.Write("Enter an amount in US dollars: ")
  usd = Console.ReadLine()

  If ch = 1 Then
    eur = usd / 0.72
    Console.WriteLine("$" & usd & " = " & eur & " EUR")
  ElseIf ch = 2 Then
    gbp = usd / 0.60
    Console.WriteLine("$" & usd & " = " & gbp & " GBP")
  ElseIf ch = 3 Then
    jpy = usd / 102.15
    Console.WriteLine("$" & usd & " = " & jpy & " JPY")
  Else
    cad = usd / 1.10
    Console.WriteLine("$" & usd & " = " & cad & " CAD")
  End If

  Console.ReadKey()
End Sub
```

5. Solution

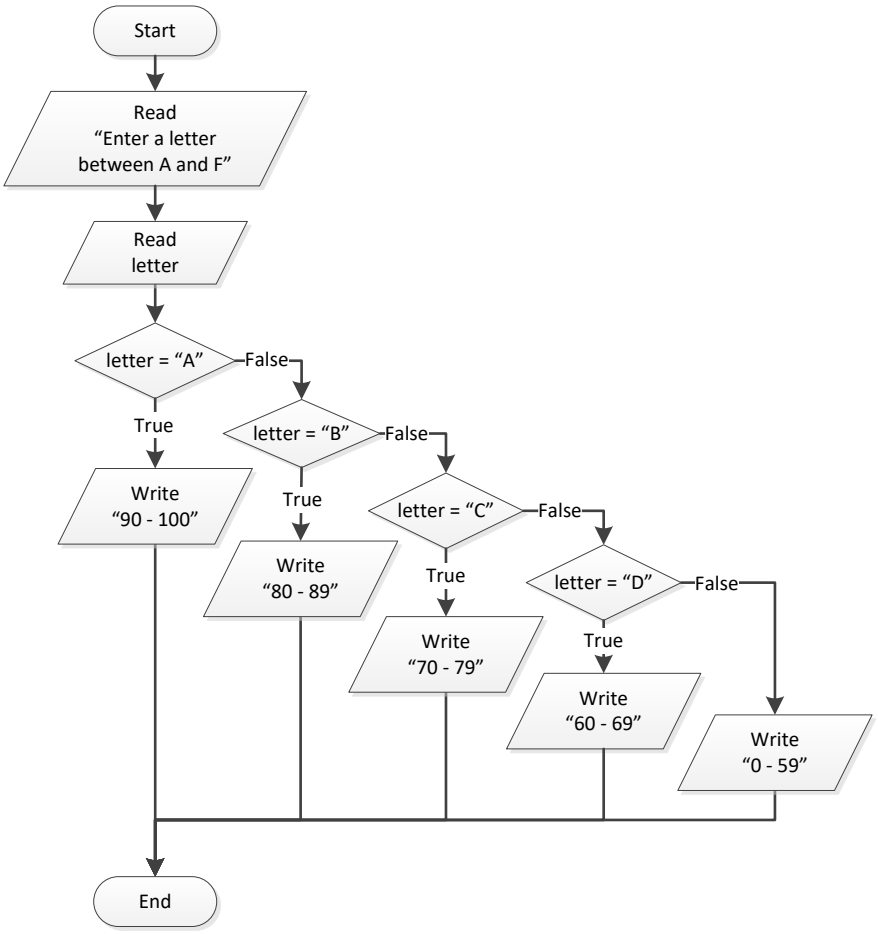
```
Sub Main()
  Dim m As Integer

  Console.Write("Enter the number of a month between 1 and 12: ")
  m = Console.ReadLine()

  If m <= 2 Or m = 12 Then
    Console.WriteLine("Winter")
  ElseIf m <= 5 Then
    Console.WriteLine("Spring")
  ElseIf m <= 8 Then
    Console.WriteLine("Summer")
  Else
    Console.WriteLine("Fall (Autumn)")
  End If

  Console.ReadKey()
```

```
End Sub
```

6. Solution

```
Sub Main()
  Dim n As Double
  Dim x, y As Integer

  Console.Write("Enter a number between 1.0 and 4.9: ")
  n = Console.ReadLine()

  x = Fix(n)
  y = Fix(n * 10) Mod 10

  If x = 1 Then
    Console.Write("One")
  ElseIf x = 2 Then
    Console.Write("Two")
  ElseIf x = 3 Then
    Console.Write("Three")
  ElseIf x = 4 Then
    Console.Write("Four")
  End If

  Console.Write(" point ")

  If y = 1 Then
    Console.WriteLine("one")
  ElseIf y = 2 Then
    Console.WriteLine("two")
  ElseIf y = 3 Then
    Console.WriteLine("three")
  ElseIf y = 4 Then
    Console.WriteLine("four")
  ElseIf y = 5 Then
    Console.WriteLine("five")
  ElseIf y = 6 Then
    Console.WriteLine("six")
  ElseIf y = 7 Then
    Console.WriteLine("seven")
  ElseIf y = 8 Then
    Console.WriteLine("eight")
  ElseIf y = 9 Then
    Console.WriteLine("nine")
  ElseIf y = 0 Then
    Console.WriteLine("zero")
  End If

  Console.ReadKey()
End Sub
```

7. Solution




```
Sub Main()
  Dim letter As String

  Console.Write("Enter a letter between A and F: ")
  letter = Console.ReadLine()

  If letter = "A" Then
    Console.WriteLine("90 - 100")
  ElseIf letter = "B" Then
    Console.WriteLine("80 - 89")
  ElseIf letter = "C" Then
    Console.WriteLine("70 - 79")
  ElseIf letter = "D" Then
    Console.WriteLine("60 - 69")
  Else
    Console.WriteLine("0 - 59")
  End If

  Console.ReadKey()
End Sub
```

Chapter 19

19.2 Answers of Review Questions: True/False

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

19.3 Answers of Review Exercises

1. Solution

For input value of 1

Step	Statement	a	x	y
1	`a = Console.ReadLine()`	**1**	?	?
2	`x = 0`	1	**0**	?
3	`y = 0`	1	0	**0**
4	`Case a = 1`		True	
5	`x = x + 5`	1	**5**	0
6	`y = y + 5`	1	5	**5**
7	`Console.Write(x & ", " & y)`	5, 5 is displayed		

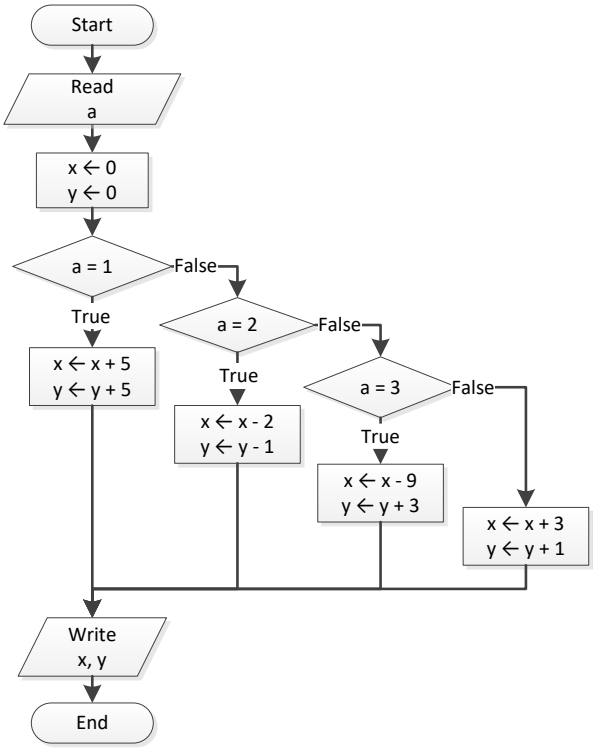
For input value of 3

Step	Statement	a	x	y
1	`a = Console.ReadLine()`	**3**	?	?
2	`x = 0`	3	**0**	?
3	`y = 0`	3	0	**0**
4	`Case a = 1`		False	
5	`Case a = 2`		False	
6	`Case a = 3`		True	
7	`x = x - 9`	3	-9	0
8	`y = y + 3`	3	-9	3
9	`Console.Write(x & ", " & y)`	-9, 3 is displayed		

For input value of 250

Step	Statement	a	x	y
1	`a = Console.ReadLine()`	**250**	?	?
2	`x = 0`	250	**0**	?
3	`y = 0`	250	0	**0**
4	`Case a = 1`		False	

5	Case a = 2	False		
6	Case a = 3	False		
7	x = x + 3	250	3	0
8	y += 1	250	3	1
9	Console.Write(x & ", " & y)	3, 1 is displayed		



2. *Solution*

For input values of 10, 2, 5

Step	Statement	a	x	y
1	a = Console.ReadLine()	**10**	?	?
2	x = Console.ReadLine()	10	**2**	?
3	y = Console.ReadLine()	10	2	**5**
4	Case a = 10	True		
5	x = x Mod 2	10	**0**	5
6	y = y ^ 2	10	0	**25**
7	Console.Write(x & ", " & y)	0, 25 is displayed		

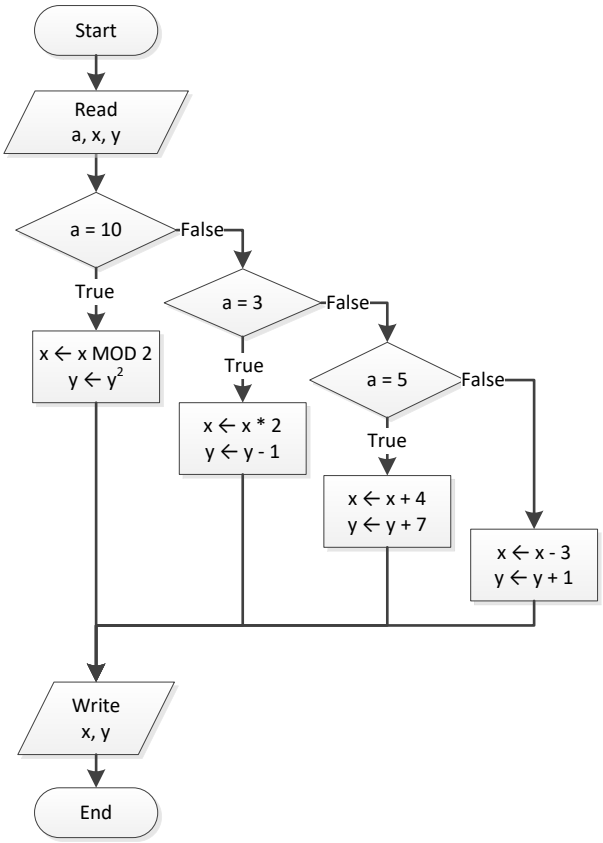
For input values of 5, 2, 3

Step	Statement	a	x	y
1	a = Console.ReadLine()	**5**	?	?
2	x = Console.ReadLine()	5	**2**	?

3	`y = Console.ReadLine()`	5	2	**3**
4	`Case a = 10`		False	
5	`Case a = 3`		False	
6	`Case a = 5`		True	
7	`x = x + 4`	5	**6**	3
8	`y += 7`	5	6	**10**
9	`Console.Write(x & ", " & y)`	6, 10 is displayed		

For input values of 4, 6, 2

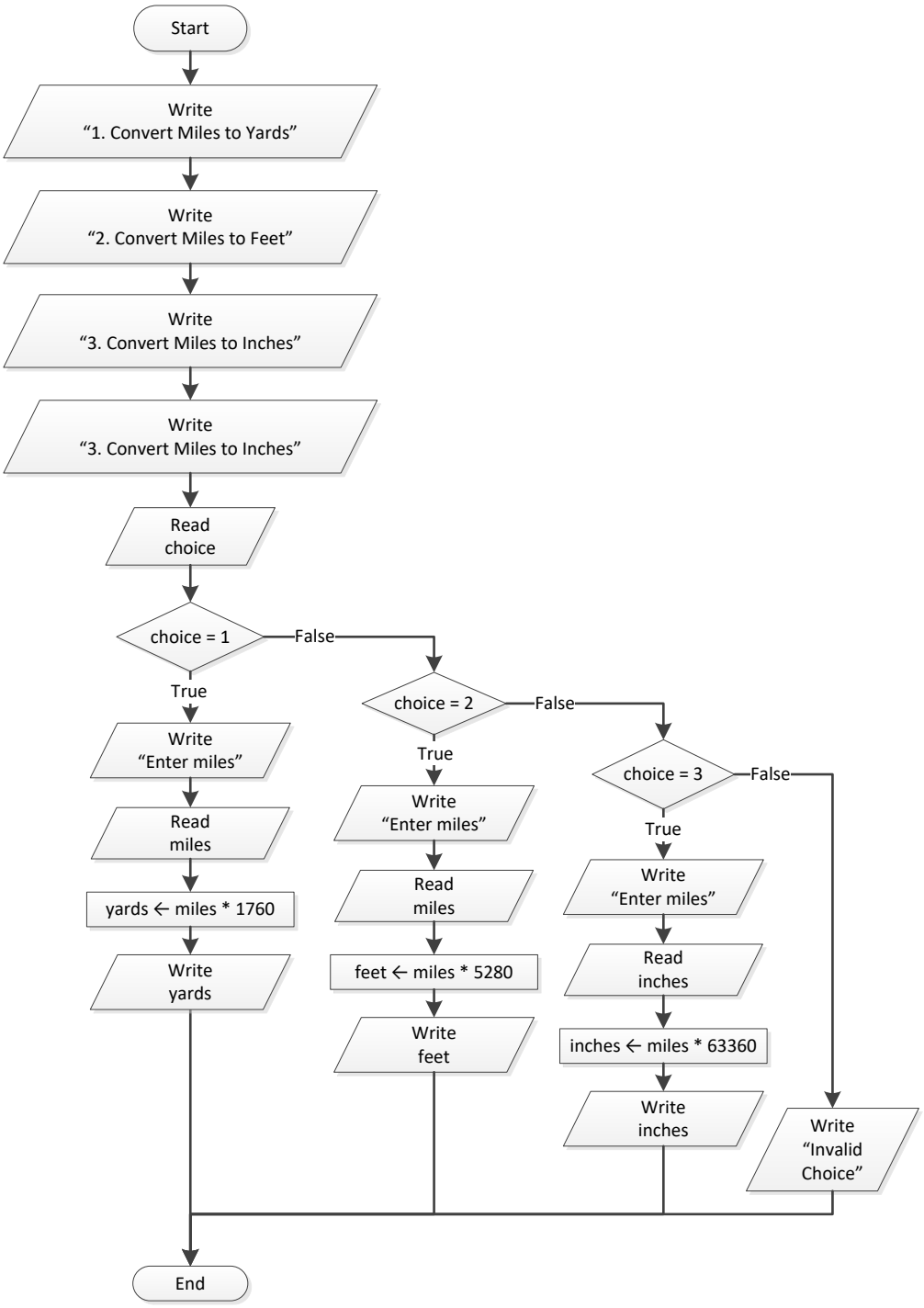
Step	Statement	a	x	y
1	`a = Console.ReadLine()`	**4**	?	?
2	`x = Console.ReadLine()`	4	**6**	?
3	`y = Console.ReadLine()`	4	6	**2**
4	`Case a = 10`		False	
5	`Case a = 3`		False	
6	`Case a = 5`		False	
7	`x -= 3`	4	**3**	2
8	`y += 1`	4	3	**3**
9	`Console.Write(x & ", " & y)`	3, 3 is displayed		



3. Solution

```
Sub Main()
  Dim number As Integer

  Console.Write("Enter the number of a month: ")
  number = Console.ReadLine()

  Select Case number
    Case 1
      Console.WriteLine("JANUARY")
    Case 2
      Console.WriteLine("FEBRUARY")
    Case 3
      Console.WriteLine("MARCH")
    Case 4
      Console.WriteLine("APRIL")
    Case 5
      Console.WriteLine("MAY")
    Case 6
      Console.WriteLine("JUNE")
    Case 7
      Console.WriteLine("JULY")
    Case 8
      Console.WriteLine("AUGUST")
    Case 9
      Console.WriteLine("SEPTEMBER")
    Case 10
      Console.WriteLine("OCTOBER")
    Case 11
      Console.WriteLine("NOVEMBER")
    Case 12
      Console.WriteLine("DECEMBER")
    Case Else
      Console.WriteLine("Error")
  End Select

  Console.ReadKey()
End Sub
```

4. Solution




```
Sub Main()
  Dim choice As Integer
  Dim feet, inches, miles, yards As Double

  Console.WriteLine("1. Convert Miles to Yards")
  Console.WriteLine("2. Convert Miles to Feet")
```

```
  Console.WriteLine("3. Convert Miles to Inches")

  Console.Write("Enter a choice: ")
  choice = Console.ReadLine()

  Select Case choice
    Case 1
      Console.Write("Enter miles: ")
      miles = Console.ReadLine()
      yards = miles * 1760
      Console.WriteLine(miles & " miles = " & yards & " yards")
    Case 2
      Console.Write("Enter miles: ")
      miles = Console.ReadLine()
      feet = miles * 5280
      Console.WriteLine(miles & " miles = " & feet & " feet")
    Case 3
      Console.Write("Enter miles: ")
      miles = Console.ReadLine()
      inches = miles * 63360
      Console.WriteLine(miles & " miles = " & inches & " inches")
    Case Else
      Console.WriteLine("Invalid choice!")
  End Select

  Console.ReadKey()
End Sub
```

5. Solution

```
Sub Main()
  Dim roman As String

  Console.Write("Enter a roman number between I and X: ")
  roman = Console.ReadLine()

  Select Case roman
    Case "I"
      Console.WriteLine(1)
    Case "II"
      Console.WriteLine(2)
    Case "III"
      Console.WriteLine(3)
    Case "IV"
      Console.WriteLine(4)
    Case "V"
      Console.WriteLine(5)
    Case "VI"
      Console.WriteLine(6)
    Case "VII"
      Console.WriteLine(7)
    Case "VIII"
      Console.WriteLine(8)
    Case "IX"
```

```
      Console.WriteLine(9)
    Case "X"
      Console.WriteLine(10)
    Case Else
      Console.WriteLine("Error")
  End Select

  Console.ReadKey()
End Sub
```

6. Solution

```
Sub Main()
  Dim total As Integer

  Console.Write("Enter the total number of CDs purchased in a month: ")
  total = Console.ReadLine()

  Select Case total
    Case 1
      Console.WriteLine("You are awarded 3 points")
    Case 2
      Console.WriteLine("You are awarded 10 points")
    Case 3
      Console.WriteLine("You are awarded 20 points")
    Case Else
      Console.WriteLine("You are awarded 45 points")
  End Select

  Console.ReadKey()
End Sub
```

7. Solution

```
Sub Main()
  Dim i As Integer
  Dim name As String

  Dim rnd As New Random()

  Console.Write("Enter your name: ")
  name = Console.ReadLine()

  i = rnd.Next(0, 3)

  Select Case i
    Case 0
      Console.WriteLine("Good morning " & name)
    Case 1
      Console.WriteLine("Good evening " & name)
    Case 2
      Console.WriteLine("Good night " & name)
  End Select
```

```
  Console.ReadKey()
End Sub
```

8. Solution

```
Sub Main()
  Dim num As String

  num = Console.ReadLine()

  Select Case num
    Case "ZERO"
      Console.WriteLine(0)
    Case "ONE"
      Console.WriteLine(1)
    Case "TWO"
      Console.WriteLine(2)
    Case "THREE"
      Console.WriteLine(3)
    Case "FOUR"
      Console.WriteLine(4)
    Case "FIVE"
      Console.WriteLine(5)
    Case "SIX"
      Console.WriteLine(6)
    Case "SEVEN"
      Console.WriteLine(7)
    Case "EIGHT"
      Console.WriteLine(8)
    Case "NINE"
      Console.WriteLine(9)
    Case Else
      Console.WriteLine("I don't know this number!")
  End Select

  Console.ReadKey()
End Sub
```

9. Solution

```
Sub Main()
  Dim b As Integer

  Console.Write("Enter Beaufort number: ")
  b = Console.ReadLine()

  Select Case b
    Case 0
      Console.WriteLine("Calm")
    Case 1
      Console.WriteLine("Light Air")
    Case 2
```

```
      Console.WriteLine("Light breeze")
    Case 3
      Console.WriteLine("Gentle breeze")
    Case 4
      Console.WriteLine("Moderate breeze")
    Case 5
      Console.WriteLine("Fresh breeze")
    Case 6
      Console.WriteLine("Strong breeze")
    Case 7
      Console.WriteLine("Moderate gale")
    Case 8
      Console.WriteLine("Gale")
    Case 9
      Console.WriteLine("Strong gale")
    Case 10
      Console.WriteLine("Storm")
    Case 11
      Console.WriteLine("Violent storm")
    Case 12
      Console.WriteLine("Hurricane force")
    Case Else
      Console.WriteLine("Invalid Beaufort number!")
  End Select

  Console.ReadKey()
End Sub
```

Chapter 20

20.3 Answers of Review Questions: True/False

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

20.4 Answers of Review Exercises

1. Solution

For input values of 20, 1

Step	Statement	x	y
1	`x = Console.ReadLine()`	**20**	?
2	`y = Console.ReadLine()`	20	**1**
3	`If x < 30 Then`	True	
4	`Case y = 1`	True	
5	`x = x Mod 3`	**2**	1
6	`y = 5`	2	**5**
7	`Console.Write(x & ", " & y)`	2, 5 is displayed	

For input values of 20, 3

Step	Statement	x	y
1	`x = Console.ReadLine()`	**20**	?
2	`y = Console.ReadLine()`	20	**3**
3	`If x < 30 Then`	True	
4	`Case y = 1`	False	
5	`Case y = 2`	False	
6	`Case y = 3`	True	
7	`x = x + 5`	**25**	3
8	`y += 3`	25	**6**
9	`Console.Write(x & ", " & y)`	25, 6 is displayed	

For input values of 12, 8

Step	Statement	x	y
1	`x = Console.ReadLine()`	**12**	?
2	`y = Console.ReadLine()`	12	**8**
3	`If x < 30 Then`	True	
4	`Case y = 1`	False	
5	`Case y = 2`	False	

6	`Case y = 3`	False	
7	`x -= 2`	**10**	8
8	`y += 1`	10	**9**
9	`Console.Write(x & ", " & y)`	10, 9 is displayed	

For input values of 50, 0

Step	Statement	x	y
1	`x = Console.ReadLine()`	**50**	?
2	`y = Console.ReadLine()`	50	**0**
3	`y += 1`	50	**1**
4	`Console.Write(x & ", " & y)`	50, 1 is displayed	

2. Solution

For input values of 60, 25

Step	Statement	x	y
1	`x = Console.ReadLine()`	**60**	?
2	`y = Console.ReadLine()`	60	25
3	`If (x + y) / 2 <= 20 Then`	False	
4	`If y < 15 Then`	False	
5	`ElseIf y < 23 Then`	False	
6	`x = 2 * x + 5`	**125**	25
7	`y += 1`	125	**26**
8	`Console.Write(x & ", " & y)`	125, 26 is displayed	

For input values of 50, 8

Step	Statement	x	y
1	`x = Console.ReadLine()`	**50**	?
2	`y = Console.ReadLine()`	50	8
3	`If (x + y) / 2 <= 20 Then`	False	
4	`If y < 15 Then`	True	
5	`x = x Mod 4`	**2**	8
6	`y = 2`	2	**2**
7	`Console.Write(x & ", " & y)`	2, 2 is displayed	

For input values of 20, 15

Step	Statement	x	y
1	`x = Console.ReadLine()`	**20**	?
2	`y = Console.ReadLine()`	20	15
3	`If (x + y) / 2 <= 20 Then`	True	

4	`If y < 10 Then`	False	
5	`ElseIf y < 20 Then`	True	
6	`x = x * 5`	**100**	15
7	`y += 2`	100	**17**
8	`Console.Write(x & ", " & y)`	100, 17 is displayed	

For input values of 10, 30

Step	Statement	x	y
1	`x = Console.ReadLine()`	**10**	?
2	`y = Console.ReadLine()`	10	30
3	`If (x + y) / 2 <= 20 Then`	True	
4	`If y < 10 Then`	False	
5	`ElseIf y < 20 Then`	False	
6	`x = x - 2`	**8**	30
7	`y += 3`	8	**33**
8	`Console.Write(x & ", " & y)`	8, 33 is displayed	

3. Solution

```
Sub Main()
  Dim a, b, c As Double

  Console.Write("Enter the three sides of a triangle: ")
  a = Console.ReadLine()
  b = Console.ReadLine()
  c = Console.ReadLine()

  If a >= b + c Or b >= a + c Or c >= a + b Then
    Console.WriteLine("Given numbers cannot be lengths of the three sides of a triangle")
  Else
    If a = b And b = c Then
      Console.WriteLine("Equilateral")
    ElseIf a ^ 2 = b ^ 2 + c ^ 2 Or b ^ 2 = a ^ 2 + c ^ 2 Or c ^ 2 = a ^ 2 + b ^ 2 Then
      Console.WriteLine("Right (or right-angled)")
    Else
      Console.WriteLine("Not special")
    End If
  End If

  Console.ReadKey()
End Sub
```

4. Solution

```
Sub Main()
  Dim amount, pin, r, usd1, usd10, usd5 As Integer
```

```
  Console.Write("Enter your four-digit PIN : ")
  pin = Console.ReadLine()
  If pin <> 1234 Then
    Console.Write("Wrong PIN. Enter your four-digit PIN : ")
    pin = Console.ReadLine()
    If pin <> 1234 Then
      Console.Write("Wrong PIN. Enter your four-digit PIN : ")
      pin = Console.ReadLine()
    End If
  End If

  If pin <> 1234 Then
    Console.WriteLine("PIN locked!")
  Else
    Console.Write("Enter the amount of money (an integer value) that you want to withdraw: ")
    amount = Console.ReadLine()
    usd10 = amount \ 10
    r = amount Mod 10
    usd5 = r \ 5
    usd1 = r Mod 5
    Console.Write(usd10 & " notes of $10 " & usd5 & " notes of $5 ")
    Console.WriteLine("and " & usd1 & " notes of $1")
  End If

  Console.ReadKey()
End Sub
```

5. Solution

First Approach

```
Sub Main()
  Dim t, w As Double

  Console.Write("Enter temperature (in Fahrenheit): ")
  t = Console.ReadLine()
  Console.Write("Enter wind speed (in miles/hour): ")
  w = Console.ReadLine()

  If t > 75 Then
    If w > 12 Then
      Console.WriteLine("The day is hot and windy")
    Else
      Console.WriteLine("The day is hot and not windy")
    End If
  Else
    If w > 12 Then
      Console.WriteLine("The day is cold and windy")
    Else
      Console.WriteLine("The day is cold and not windy")
    End If
  End If

  Console.ReadKey()
```

```
End Sub
```

Second Approach

```
Sub Main()
  Dim t, w As Double
  Dim message1, message2 As String

  Console.Write("Enter temperature (in Fahrenheit): ")
  t = Console.ReadLine()
  Console.Write("Enter wind speed (in miles/hour): ")
  w = Console.ReadLine()

  If t > 75 Then
    message1 = "hot"
  Else
    message1 = "cold"
  End If

  If w > 12 Then
    message2 = "windy"
  Else
    message2 = "not windy"
  End If

  Console.Write("The day is " & message1 & " and " & message2)

  Console.ReadKey()
End Sub
```

Chapter 21

21.13 Answers of Review Questions: True/False

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

21.14 Answers of Review Questions: Multiple Choice

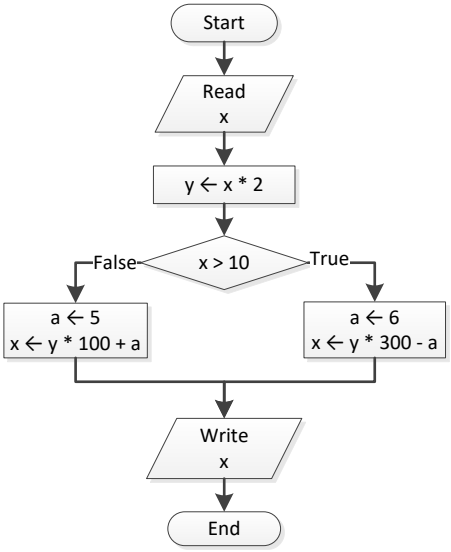
1. c
2. b
3. a
4. a
5. b
6. c
7. c
8. d

21.15 Answers of Review Exercises

1. Solution

```
Sub Main()
  Dim a, x, y As Integer

  y = Console.ReadLine()
  x = Console.ReadLine()

  If y > 0 Then
    a = x * 4 * y + 1
  Else
    a = x * 2 * y + 6
  End If
  Console.WriteLine(y)
  Console.Write(a)

  Console.ReadKey()
End Sub
```

2. Solution



3. Solution

```
Sub Main()
  Dim a, y As Double

  a = Console.ReadLine()

  If a >= 10 Then
    Console.WriteLine("Error!")
  Else
    If a < 1 Then
      y = 5 + a
    ElseIf a < 5 Then
      y = 23 / a
    Else
      y = 5 * a
    End If
    Console.WriteLine(y)
  End If

  Console.ReadKey()
End Sub
```

4. Solution

```
Sub Main()
  Dim day, month As Integer
  Dim name As String

  day = Console.ReadLine()
  month = Console.ReadLine()
  name = Console.ReadLine()
```

```
  If day = 16 And month = 2 And name = "Loukia" Then
    Console.WriteLine("Happy Birthday!!!")
  Else
    Console.WriteLine("No match!")
  End If

  Console.ReadKey()
End Sub
```

5. Solution

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

```
Sub Main()
  Dim a, b, c, d As Double

  a = Console.ReadLine()
  b = Console.ReadLine()
  c = Console.ReadLine()

  If a > 10 Then
    If c < 2000 Then
      d = (a + b + c) / 12
      Console.WriteLine("The result is: " & d)
    Else
      Console.WriteLine("Error!")
    End If
  Else
    Console.WriteLine("Error!")
  End If

  Console.ReadKey()
End Sub
```

6. Solution

```
Sub Main()
  Dim a, b, c, d As Double

  a = Console.ReadLine()
  b = Console.ReadLine()
  c = Console.ReadLine()

  If a > 10 And b < 2000 And c <> 10 Then
    d = (a + b + c) / 12
    Console.WriteLine("The result is: " & d)
  End If

  If a <= 10 Then
    Console.WriteLine("Error!")
  End If

  Console.ReadKey()
```

```
End Sub
```

7. Solution

```
Sub Main()
  Dim a, b, y As Integer

  a = Console.ReadLine()
  b = Console.ReadLine()

  y = 3
  If a > 0 Then
    y = y * a
    Console.WriteLine("Hello Zeus")
  End If

  Console.Write(y & ", " & b)

  Console.ReadKey()
End Sub
```

8. Solution

```
Sub Main()
  Dim a, b, y As Double

  a = Console.ReadLine()
  b = Console.ReadLine()

  y = 0
  If a > 0 Then
    y = y + 7
  Else
    Console.WriteLine("Hello Zeus")
    Console.WriteLine(Math.Abs(a))
  End If
  Console.Write(y)

  Console.ReadKey()
End Sub
```

9. Solution

```
Sub Main()
  Dim os As String

  Console.Write("What is your tablet's OS? ")
  os = Console.ReadLine()

  If os = "iOS" Then
    Console.WriteLine("Apple")
  ElseIf os = "Android" Then
    Console.WriteLine("Google")
```

```
  ElseIf os = "Windows" Then
    Console.WriteLine("Microsoft")
  End If

  Console.ReadKey()
End Sub
```

10. Solution

```
Sub Main()
  Dim a As Integer
  Dim x, y As Double

  a = Console.ReadLine()
  x = Console.ReadLine()
  y = Console.ReadLine()

  If a = 3 Or a = 15 Or a = 25 Then
    x = x / 4
    y = y ^ 5
  ElseIf a >= 7 And a <= 12 Then
    x = x * 3
    y += 1
  ElseIf a > 52 Then
    x = x Mod 4
    y += 9
  Else
    x -= 9
    y += 1
  End If

  Console.Write(x & ", " & y)

  Console.ReadKey()
End Sub
```

11. Solution

```
Sub Main()
  Dim a As Integer
  Dim x, y As Double

  a = Console.ReadLine()
  x = Console.ReadLine()
  y = Console.ReadLine()

  If a = 3 Or a = 15 Or a = 25 Then
    x = x / 4
    y = y ^ 5
  Else
    If a >= 7 And a <= 12 Then
      x = x * 3
      y += 1
```

```
    Else
      If a > 52 Then
        x = x Mod 4
        y += 9
      Else
        x -= 9
        y += 1
      End If
    End If
  End If

  Console.Write(x & ", " & y)

  Console.ReadKey()
End Sub
```

12. Solution

```
Sub Main()
  Dim color As Integer

  Console.WriteLine("1. Red")
  Console.WriteLine("2. Green")
  Console.WriteLine("3. Blue")
  Console.WriteLine("4. White")
  Console.WriteLine("5. Black")
  Console.WriteLine("6. Gray")
  Console.Write("Select a color: ")
  color = Console.ReadLine()

  Console.Write("Your color in hexadecimal is: ")

  Select Case color
    Case 1
      Console.WriteLine("FF0000")
    Case 2
      Console.WriteLine("00FF00")
    Case 3
      Console.WriteLine("0000FF ")
    Case 4
      Console.WriteLine("FFFFFF ")
    Case 4
      Console.WriteLine("000000")
    Case 6
      Console.WriteLine("7F7F7F ")
    Case Else
      Console.WriteLine("Unknown color!")
  End Select

  Console.ReadKey()
End Sub
```

13. Solution

```
Sub Main()
  Dim color As Integer

  Console.WriteLine("1. Red")
  Console.WriteLine("2. Green")
  Console.WriteLine("3. Blue")
  Console.WriteLine("4. White")
  Console.WriteLine("5. Black")
  Console.WriteLine("6. Gray")
  Console.Write("Select a color: ")
  color = Console.ReadLine()

  Console.Write("Your color in hexadecimal is: ")

  If color = 1 Then
    Console.WriteLine("FF0000")
  Else
    If color = 2 Then
      Console.WriteLine("00FF00")
    Else
      If color = 3 Then
        Console.WriteLine("0000FF ")
      Else
        If color = 4 Then
          Console.WriteLine("FFFFFF ")
        Else
          If color = 5 Then
            Console.WriteLine("000000")
          Else
            If color = 6 Then
              Console.WriteLine("7F7F7F ")
            Else
              Console.WriteLine("Unknown color!")
            End If
          End If
        End If
      End If
    End If
  End If

  Console.ReadKey()
End Sub
```

14. Solution

```
Sub Main()
  Dim a As Integer

  a = Console.ReadLine()

  If a > 1000 Then
```

```
    Console.WriteLine("Big Positive")
  Else
    If a > 0 Then
      Console.WriteLine("Positive")
    Else
      If a < -1000 Then
        Console.WriteLine("Big Negative")
      Else
        If a < 0 Then
          Console.WriteLine("Negative")
        Else
          Console.WriteLine("Zero")
      End If
    End If
  End If

  Console.ReadKey()
End If
```

```
Sub Main()
  Dim a As Integer

  a = Console.ReadLine()

  If a > 1000 Then
    Console.WriteLine("Big Positive")
  ElseIf a > 0 Then
    Console.WriteLine("Positive")
  ElseIf a < -1000 Then
    Console.WriteLine("Big Negative")
  ElseIf a < 0 Then
    Console.WriteLine("Negative")
  Else
    Console.Write("Zero")

  Console.ReadKey()
End If
```

15. Solution

```
Sub Main()
  Dim a, y As Double

  a = Console.ReadLine()

  If a < 1 Then
    y = 5 + a
    Console.WriteLine(y)
  ElseIf a < 5 Then
    y = 23 / a
    Console.WriteLine(y)
  ElseIf a < 10 Then
    y = 5 * a
```

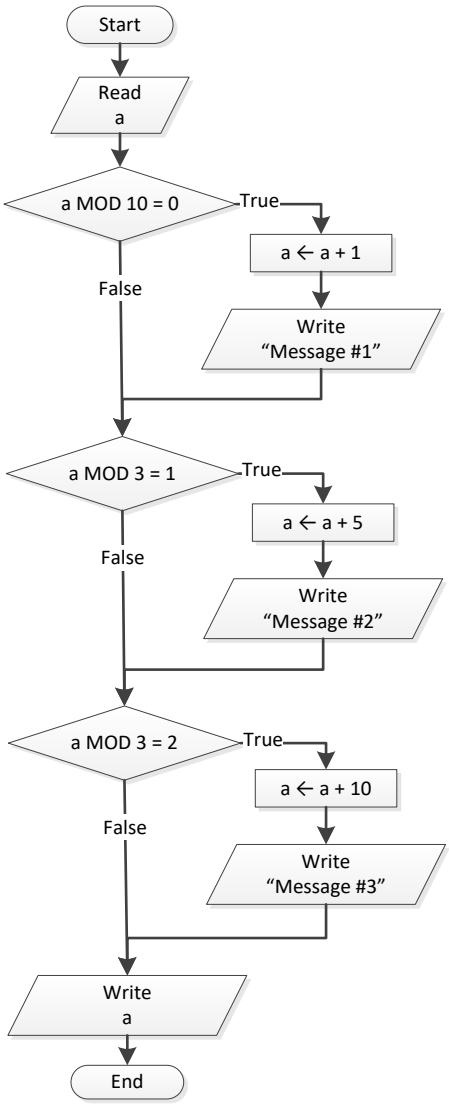
```
    Console.WriteLine(y)
  Else
    Console.WriteLine("Error!")
  End If

  Console.ReadKey()
End Sub
```

```
Sub Main()
  Dim a, y As Double

  a = Console.ReadLine()

  If a < 1 Then
    y = 5 + a
    Console.WriteLine(y)
  Else
    If a < 5 Then
      y = 23 / a
      Console.WriteLine(y)
    Else
      If a < 10 Then
        y = 5 * a
        Console.WriteLine(y)
      Else
        Console.WriteLine("Error!")
      End If
    End If
  End If

  Console.ReadKey()
End Sub
```

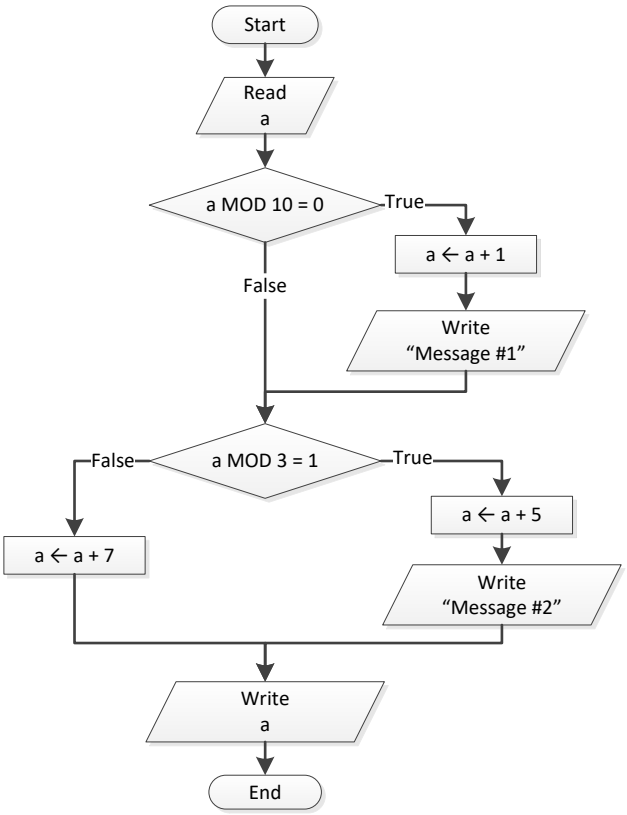
Chapter 22

22.4 Answers of Review Exercises

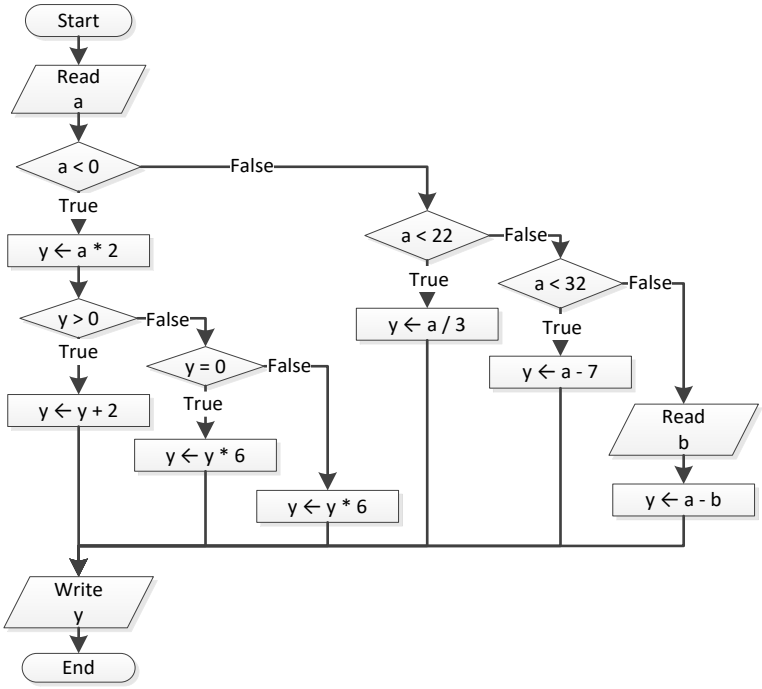
1. Solution



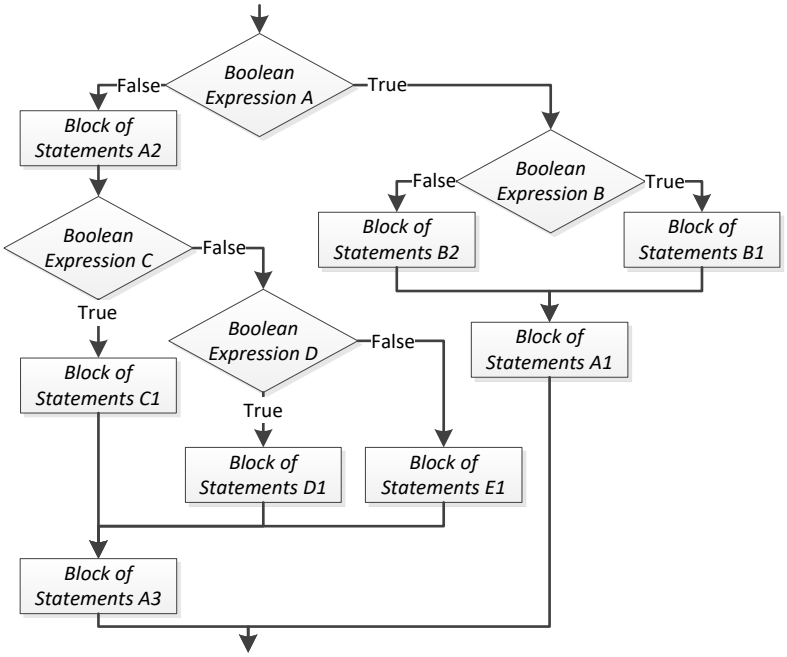
2. Solution



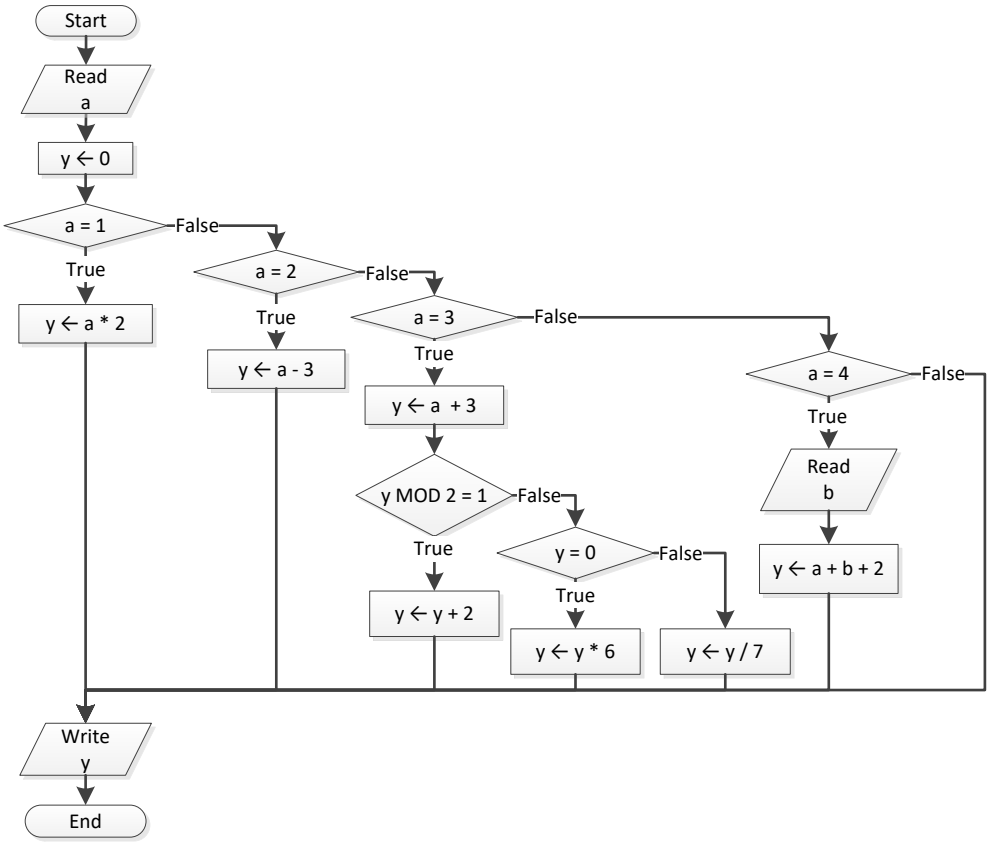
3. Solution



4. Solution



5. Solution



6. Solution

```
Sub Main()
  Dim x, y, z As Double

  x = Console.ReadLine()
  y = Console.ReadLine()

  If x <> 100 Or y <= 10 Then
    z = Console.ReadLine()
    If z <= x + y Then
      x -= 3
      y = x + 4
    End If
  End If
  Console.Write(x & ", " & y)

  Console.ReadKey()
End Sub
```

7. Solution

```
Sub Main()
  Dim x As Integer

  x = Console.ReadLine()

  If x = 1 Then
    Console.WriteLine("Good Morning")
    Console.WriteLine("How Do you do?")
    Console.WriteLine("Is everything okay?")
  ElseIf x = 2 Then
    Console.WriteLine("Good Evening")
    Console.WriteLine("How Do you do?")
    Console.WriteLine("Is everything okay?")
  ElseIf x = 3 Then
    Console.WriteLine("Good Afternoon")
    Console.WriteLine("Is everything okay?")
  Else
    Console.WriteLine("Good Night")
  End If

  Console.ReadKey()
End Sub
```

8. Solution

```
Sub Main()
  Dim x As Integer
  Dim x_str As String

  x_str = Console.ReadLine()
  If Int32.TryParse(x_str, x) = True Then
```

```
    If x Mod 10 = 0 Then
      Console.WriteLine("Last digit equal to 0")
    ElseIf x Mod 10 = 1 Then
      Console.WriteLine("Last digit equal to 1")
    Else
      Console.WriteLine("None")
    End If
  Else
    If x_str = "Exit" Then
      Console.WriteLine("Bye")
    Else
      Console.WriteLine("Invalid Number")
    End If
  End If

  Console.ReadKey()
End Sub
```

9. Solution

```
Sub Main()
  Dim a, b, y As Double

  a = Console.ReadLine()
  b = Console.ReadLine()

  y = a * b

  If y > 0 Then
    y -= 1
    y /= 2
  Else
    y +=10
    If y > 0 Then
      y /= 2
    Else
      y *= 2
    End If
  End If

  Console.ReadKey()
End Sub
```

10. Solution

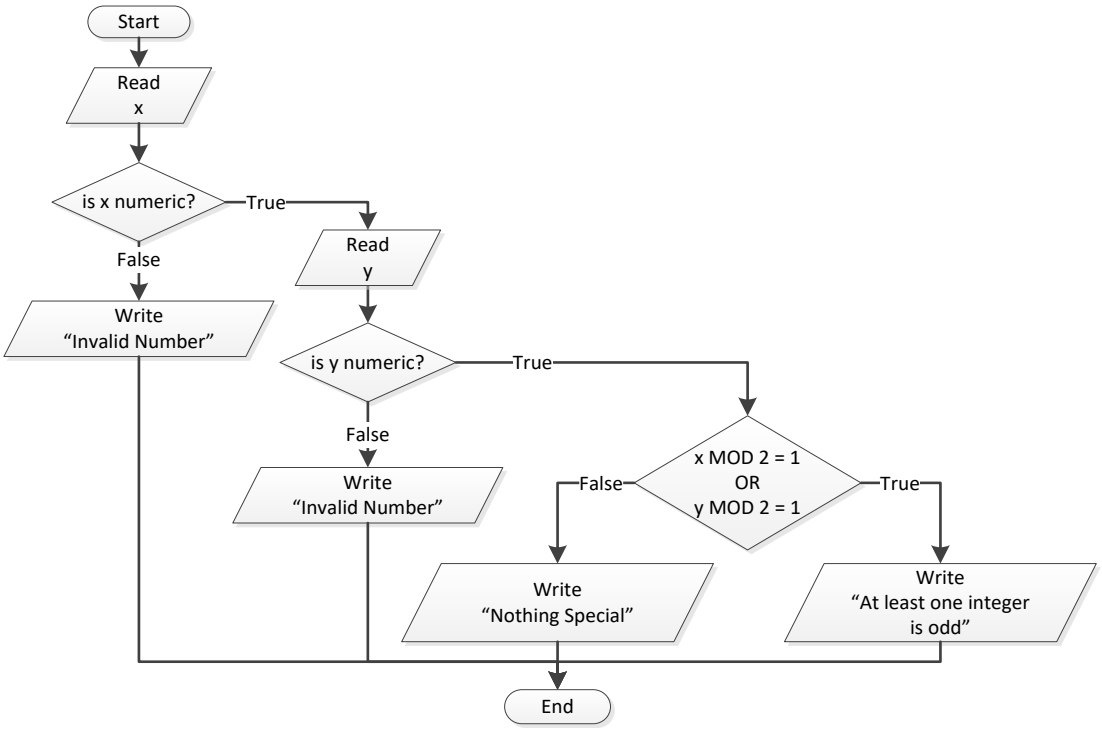
```
Sub Main()
  Dim a, b, c As Double

  a = Console.ReadLine()
  b = Console.ReadLine()
  c = Console.ReadLine()

  c = a * b + c
```

```
  If c > 0 Then
    c /= 2
    If a > b Then
      a *= 2
      b *= 2
    Else
      c /= 20
      If c <= 10 Then
        b *= 2
      End If
    End If
  Else
    c /= 3
    c /= 20
    If c <= 10 Then
      b *= 2
    End If
  End If
  Console.Write(a & ", " & b  & ", " & c)

  Console.ReadKey()
End Sub
```

Chapter 23

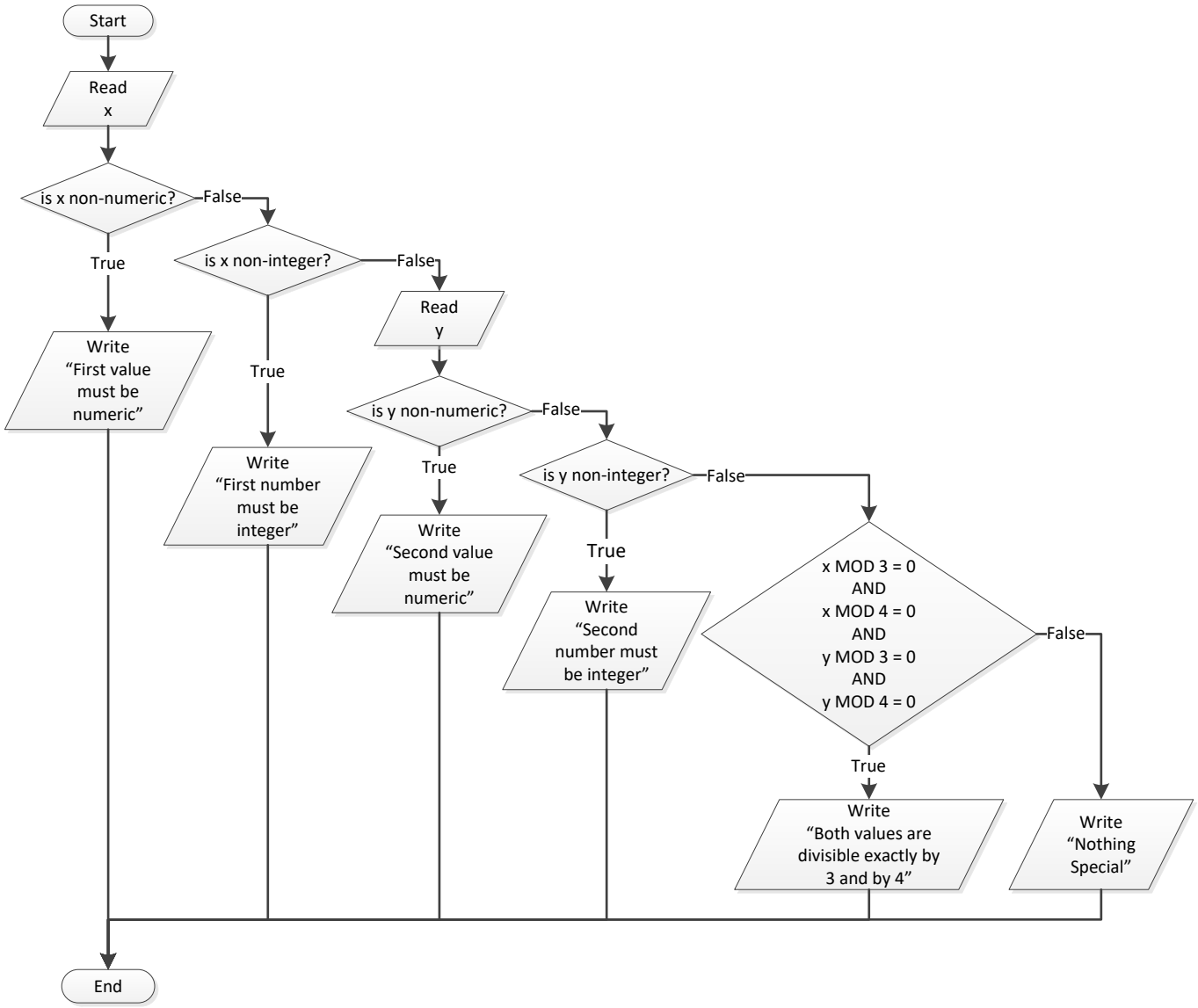
23.6 Answers of Review Exercises

1. Solution




```
Sub Main()
  Dim x, y As Integer
  Dim input As String

  input = Console.ReadLine()

  If Int32.TryParse(input, x) = True Then
    input = Console.ReadLine()
    If Int32.TryParse(input, y) = True Then
      If x Mod 2 = 1 Or y Mod 2 = 1 Then
        Console.WriteLine("At least one integer is odd")
      Else
        Console.WriteLine("Nothing Special")
      End If
    Else
      Console.WriteLine("Invalid Number")
    End If
  Else
    Console.WriteLine("Invalid Number")
  End If

  Console.ReadKey()
End Sub
```

2. Solution




```
Sub Main()
  Dim x, y As Double
  Dim input As String

  input = Console.ReadLine()

  If Double.TryParse(input, x) = False Then
    Console.WriteLine("First value must be numeric")
  ElseIf x <> Fix(x) Then
    Console.WriteLine("First number must be integer")
  Else
    input = Console.ReadLine()
    If Double.TryParse(input, y) = False Then
      Console.WriteLine("Second value must be numeric")
    ElseIf y <> Fix(y) Then
```

```
      Console.WriteLine("Second number must be integer")
    Else
      If x Mod 3 = 0 And x Mod 4 = 0 And y Mod 3 = 0 And y Mod 4 = 0 Then
        Console.WriteLine("Both values are divisible exactly by 3 and by 4")
      Else
        Console.WriteLine("Nothing Special")
      End If
    End If
  End If

  Console.ReadKey()
End Sub
```

3. Solution

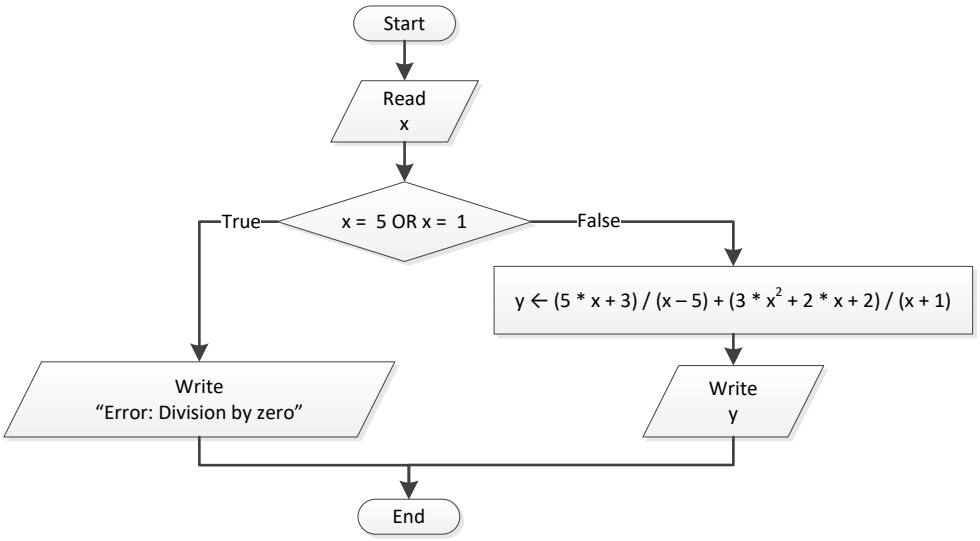
```
Sub Main()
  Dim choice As Integer
  Dim t As Double
  Dim input As String

  Console.WriteLine("1. Convert Kelvin to Fahrenheit")
  Console.WriteLine("2. Convert Fahrenheit to Kelvin")
  Console.WriteLine("3. Convert Fahrenheit to Celsius")
  Console.WriteLine("4. Convert Celsius to Fahrenheit")

  Console.Write("Enter a choice: ")
  choice = Console.ReadLine()
  Console.Write("Enter a temperature: ")
  input = Console.ReadLine()

  If choice < 1 Or choice > 4 Then
    Console.WriteLine("Wrong choice")
  ElseIf Double.TryParse(input, t) = False Then
    Console.WriteLine("Wrong temperature")
  Else
    Select Case choice Then
      Case 1
        Console.WriteLine(1.8 * t - 459.67)
      Case 2
        Console.WriteLine((t + 459.57) / 1.8)
      Case 3
        Console.WriteLine(5 / 9 * (t - 32))
      Case 4
        Console.WriteLine(9 / 5 * t & 32)
    End Select
  End If

  Console.ReadKey()
End Sub
```

4. Solution

```
Sub Main()
```

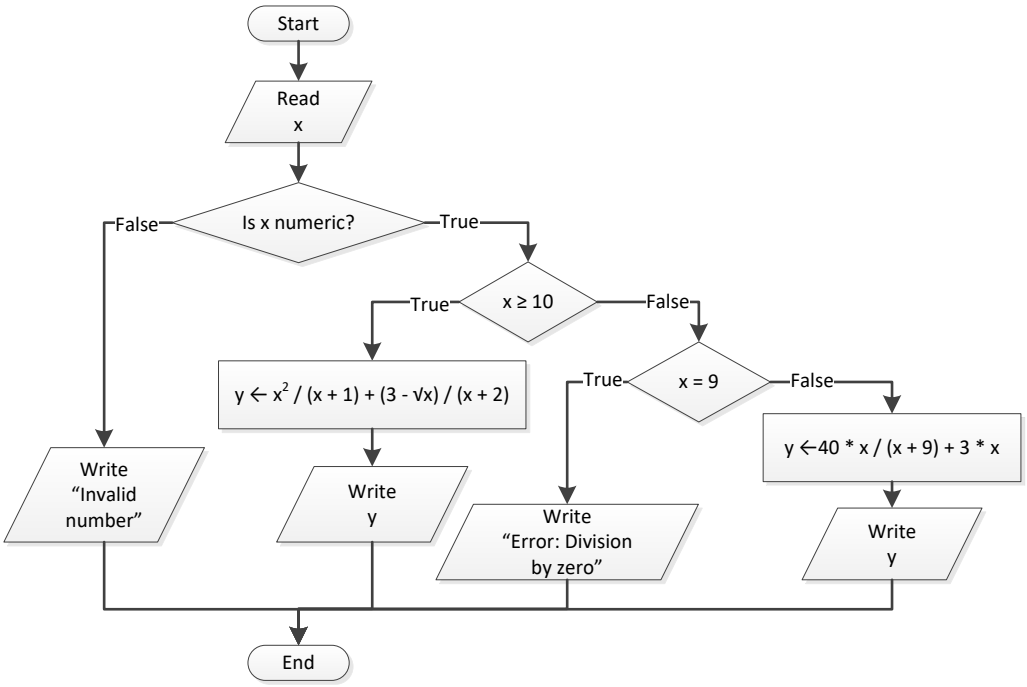
```
  Dim a, b As Integer
  Dim op As String

  Console.Write("Enter 1st integer: ")
  a = Console.ReadLine()
  Console.Write("Enter type of operation: ")
  op = Console.ReadLine()
  Console.Write("Enter 2nd integer: ")
  b = Console.ReadLine()

  If op = "+" Then
    Console.WriteLine(a & b)
  ElseIf op = "-" Then
    Console.WriteLine(a - b)
  ElseIf op = "*" Then
    Console.WriteLine(a * b)
  ElseIf op = "/" Then
    If b = 0 Then
      Console.WriteLine("Error: Division by zero")
    Else
      Console.WriteLine(a / b)
    End If
  ElseIf op = "DIV" Then
    If b = 0 Then
      Console.WriteLine("Error: Division by zero")
    Else
      Console.WriteLine(a \ b)
    End If
  ElseIf op = "MOD" Then
    If b = 0 Then
      Console.WriteLine("Error: Division by zero")
    Else
      Console.WriteLine(a Mod b)
    End If
  ElseIf op = "POWER" Then
    Console.WriteLine(a ^ b)
  End If

  Console.ReadKey()
End Sub
```

5. Solution




```
Sub Main()
  Dim x, y As Double

  x = Console.ReadLine()

  If x = 5 Or x = 1 Then
    Console.WriteLine("Error: Division by zero")
  Else
    y = (5 * x + 3) / (x - 5) + (3 * x ^ 2 + 2 * x + 2) / (x + 1)
    Console.WriteLine(y)
  End If

  Console.ReadKey()
End Sub
```

6. Solution




```
Sub Main()
  Dim x, y As Double
  Dim input As String

  input = Console.ReadLine()

  If Double.TryParse(input, x) = True Then
    If x >= 10 Then
      y = x ^ 2 / (x + 1) + (3 - Math.Sqrt(x)) / (x + 2)
      Console.WriteLine(y)
    Else
      If x = 9 Then
        Console.WriteLine("Error: Division by zero")
      Else
        y = 40 * x / (x + 9) + 3 * x
        Console.WriteLine(y)
      End If
    End If
  Else
    Console.WriteLine("Invalid number")
  End If

  Console.ReadKey()
End Sub
```

7. Solution

```
Sub Main()
  Dim x, y As Double
```

```
  x = Console.ReadLine()

  If x <= -15 Or x > 25 Then
    y = x - 1
    Console.WriteLine(y)
  ElseIf x <= -10 Then
    y = x / Math.Sqrt(x + 30) + (8 + x) ^ 2 / (x + 1)
    Console.WriteLine(y)
  ElseIf x <= 0 Then
    y = Math.Abs(40 * x) / (x - 8)
    Console.WriteLine(y)
  Else
    If x = 9 Then
      Console.WriteLine("Error: Division by zero")
    ElseIf x < 9 Then
      Console.WriteLine("Error: Invalid square root")
    Else
      y = 3 * x / Math.Sqrt(x - 9)
      Console.WriteLine(y)
    End If
  End If

  Console.ReadKey()
End Sub
```

8. Solution

```
Sub Main()
  Dim age1, age2, age3, max, middle, min As Integer

  Console.Write("Enter age for person No1:")
  age1 = Console.ReadLine()
  Console.Write("Enter age for person No2:")
  age2 = Console.ReadLine()
  Console.Write("Enter age for person No3:")
  age3 = Console.ReadLine()

  min = age1
  If age2 < min Then
    min = age2
  End If
  If age3 < min Then
    min = age3
  End If
  max = age1
  If age2 > max Then
    max = age2
  End If
  If age3 > max Then
    max = age3
  End If

  middle = age1 + age2 + age3 - min - max
```

```
  Console.Write(middle)

  Console.ReadKey()
End Sub
```

9. Solution

```
Sub Main()
  Dim a1, a2, a3, max, middle, min As Integer
  Dim max_name, min_name, n1, n2, n3 As String

  Console.Write("Enter the age of the first person: ")
  a1 = Console.ReadLine()
  Console.Write("Enter the name of the first person: ")
  n1 = Console.ReadLine()
  Console.Write("Enter the age of the second person: ")
  a2 = Console.ReadLine()
  Console.Write("Enter the name of the second person: ")
  n2 = Console.ReadLine()
  Console.Write("Enter the age of the third person: ")
  a3 = Console.ReadLine()
  Console.Write("Enter the name of the third person: ")
  n3 = Console.ReadLine()

  min = a1
  min_name = n1
  If a2 > min Then
    min = a2
    min_name = n2
  End If
  If a3 > min Then
    min = a3
    min_name = n3
  End If

  max = a1
  max_name = n1
  If a2 > max Then
    max = a2
    max_name = n2
  End If
  If a3 > max Then
    max = a3
    max_name = n3
  End If

  middle = a1 + a2 + a3 - min - max

  If Math.Abs(max - middle) < Math.Abs(min - middle) Then
    Console.WriteLine(max_name)
  Else
    Console.WriteLine(min_name)
  End If
```

```
  Console.ReadKey()
End Sub
```

10. Solution

```
Sub Main()
  Dim digit1, digit2, digit3, r, x, sum As Integer
  Dim input As String

  Console.Write("Enter a three-digit integer: ")
  input = Console.ReadLine()

  If Int32.TryParse(input, x) = False Then
    Console.WriteLine("Entered value contains non-numeric characters")
  ElseIf x < 100 Or x > 999 Then
    Console.WriteLine("Entered integer is not a three-digit integer")
  Else
    digit1 = x \ 100
    r = x Mod 100

    digit2 = r \ 10
    digit3 = r Mod 10

    sum = digit1 ^ 3 + digit2 ^ 3 + digit3 ^ 3

    If sum = x Then
      Console.WriteLine("You entered an Armstrong number!")
    Else
      Console.WriteLine("You entered a non-Armstrong number!")
    End If
  End If

  Console.ReadKey()
End Sub
```

11. Solution

```
Sub Main()
  Dim d, m, y As Integer

  Console.Write("Enter day 1 - 31: ")
  d = Console.ReadLine()
  Console.Write("Enter month 1 - 12: ")
  m = Console.ReadLine()
  Console.Write("Enter year: ")
  y = Console.ReadLine()

  If m = 2 Then
    If y Mod 4 = 0 And y Mod 100 <> 0 Or y Mod 400 = 0 Then
      Console.WriteLine(29 - d)
    Else
      Console.WriteLine(28 - d)
    End If
```

```
  ElseIf m = 4 Or m = 6 Or m = 9 Or m = 11 Then
    Console.WriteLine(30 - d)
  Else
    Console.WriteLine(31 - d)
  End If

  Console.ReadKey()
End Sub
```

12. Solution

```
Sub Main()
  Dim word, word1, word2 As String

  word = Console.ReadLine()

  word1 = word.Substring(0, 1).ToUpper() &
          word.Substring(1, 1).ToLower() &
          word.Substring(2, 1).ToUpper() &
          word.Substring(3, 1).ToLower() &
          word.Substring(4, 1).ToUpper() &
          word.Substring(5, 1).ToLower()

  word2 = word.Substring(0, 1).ToLower() &
          word.Substring(1, 1).ToUpper() &
          word.Substring(2, 1).ToLower() &
          word.Substring(3, 1).ToLower() &
          word.Substring(4, 1).ToUpper() &
          word.Substring(5, 1).ToLower()

  If word = word1 Or word = word2 Then
    Console.WriteLine("Word is okay!")
  Else
    Console.WriteLine("Word is not okay")
  End If

  Console.ReadKey()
End Sub
```

13. Solution

```
Sub Main()
  Dim q As Integer
  Dim discount, payment As Double

  Console.Write("Enter quantity: ")
  q = Console.ReadLine()

  If q < 3 Then
    discount = 0
  ElseIf q < 6 Then
    discount = 10
  ElseIf q < 10 Then
```

```
    discount = 15
  ElseIf q < 14 Then
    discount = 20
  ElseIf q < 20 Then
    discount = 27
  Else
    discount = 30
  End If

  payment = q * 10 - q * 10 * discount / 100

  Console.WriteLine("You got a discount of " & discount & "%")
  Console.Write("You must pay $" & payment)

  Console.ReadKey()
End Sub
```

14. Solution

```
Const VAT = 0.19

Sub Main()
  Dim amount, discount, payment As Double
  Dim input As String

  Console.Write("Enter total amount: ")
  input = Console.ReadLine()

  If Double.TryParse(input, amount) = False Then
    Console.WriteLine("Entered value contains non-numeric characters")
  ElseIf amount < 0 Then
    Console.WriteLine("Entered non-negative value")
  Else
    If amount < 50 Then
      discount = 0
    ElseIf amount < 100 Then
      discount = 1
    ElseIf amount < 250 Then
      discount = 2
    Else
      discount = 3
    End If

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

    Console.WriteLine("You got a discount of " & discount & "%")
    Console.WriteLine("You must pay $" & payment)
  End If

  Console.ReadKey()
End Sub
```

15. Solution

```
Sub Main()
  Dim a, h, w As Integer
  Dim bmi As Double

  Console.Write("Enter age: ")
  a = Console.ReadLine()
  If a < 18 Then
    Console.WriteLine("Invalid age")
  Else
    Console.Write("Enter weight in pounds: ")
    w = Console.ReadLine()
    Console.Write("Enter height in inches: ")
    h = Console.ReadLine()

    bmi = w * 703 / h ^ 2

    If bmi < 15 Then
      Console.WriteLine("Very severely underweight")
    ElseIf bmi < 16 Then
      Console.WriteLine("Severely underweight")
    ElseIf bmi < 18.5 Then
      Console.WriteLine("Underweight")
    ElseIf bmi < 25 Then
      Console.WriteLine("Normal")
    ElseIf bmi < 30 Then
      Console.WriteLine("Overweight")
    ElseIf bmi < 35 Then
      Console.WriteLine("Severely overweight")
    Else
      Console.WriteLine("Very severely overweight")
    End If
  End If

  Console.ReadKey()
End Sub
```

16. Solution

```
Const TAX_RATE = 0.10

Sub Main()
  Dim water As Integer
  Dim total As Double
  Dim input As String

  Console.Write("Enter water consumption (in cubic feet): ")
  input = Console.ReadLine()

  If Int32.TryParse(input, water) = False Then
    Console.WriteLine("Entered value contains non-numeric characters")
  ElseIf water < 0 Then
```

```
    Console.WriteLine("Entered value is negative")
  Else
    If water <= 10 Then
      total = water * 3
    ElseIf water <= 20 Then
      total = 10 * 3 + (water - 10) * 5
    ElseIf water <= 35 Then
      total = 10 * 3 + 10 * 5 + (water - 20) * 7
    Else
      total = 10 * 3 + 10 * 5 + 15 * 7 + (water - 35) * 9
    End If

    total = total + total * TAX_RATE
    Console.WriteLine("Total amount to pay (taxes included): " & total)
  End If

  Console.ReadKey()
End Sub
```

17. Solution

```
Sub Main()
  Dim children As Integer
  Dim income, tax As Double

  Console.Write("Enter taxable income: ")
  income = Console.ReadLine()
  Console.Write("Enter number of children: ")
  children = Console.ReadLine()

  If income <= 8000 Then
    tax = income * 0.10
  ElseIf income <= 30000 Then
    tax = 8000 * 0.10 + (income - 8000) * 0.15
  ElseIf income <= 70000 Then
    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
  End If

  If children > 0 Then
    tax = tax - tax * 0.02
  End If
  Console.Write("Tax: " & tax)

  Console.ReadKey()
End Sub
```

18. Solution

```
Sub Main()
  Dim wind As Double
  Dim input As String
```

```
  Console.Write("Enter wind speed (in miles/hour): ")
  input = Console.ReadLine()

  If Double.TryParse(input, wind) = False Then
    Console.WriteLine("Entered value contains non-numeric characters")
  ElseIf wind < 0 Then
    Console.WriteLine("Entered value is negative")
  Else
    If wind < 1 Then
      Console.WriteLine("Beaufort: 0" & vbCrLf & "Calm")
    ElseIf wind < 4 Then
      Console.WriteLine("Beaufort: 1" & vbCrLf & "Light air")
    ElseIf wind < 8 Then
      Console.WriteLine("Beaufort: 2" & vbCrLf & "Light breeze")
    ElseIf wind < 13 Then
      Console.WriteLine("Beaufort: 3" & vbCrLf & "Gentle breeze")
    ElseIf wind < 18 Then
      Console.WriteLine("Beaufort: 4" & vbCrLf & "Moderate breeze")
    ElseIf wind < 25 Then
      Console.WriteLine("Beaufort: 5" & vbCrLf & "Fresh breeze")
    ElseIf wind < 31 Then
      Console.WriteLine("Beaufort: 6" & vbCrLf & "Strong breeze")
    ElseIf wind < 39 Then
      Console.WriteLine("Beaufort: 7" & vbCrLf & "Moderate gale")
    ElseIf wind < 47 Then
      Console.WriteLine("Beaufort: 8" & vbCrLf & "Gale")
    ElseIf wind < 55 Then
      Console.WriteLine("Beaufort: 9" & vbCrLf & "Strong gale")
    ElseIf wind < 64 Then
      Console.WriteLine("Beaufort: 10" & vbCrLf & "Storm")
    ElseIf wind < 74 Then
      Console.WriteLine("Beaufort: 11" & vbCrLf & "Violent storm")
    Else
      Console.WriteLine("Beaufort: 12" & vbCrLf & "Hurricane force")
    End If

    If wind < 13 Then
      Console.WriteLine("It's Fishing Day!!!")
    End If
  End If

  Console.ReadKey()
End Sub
```

Chapter 24

24.3 Answers of Review Questions: True/False

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

Chapter 25

25.2 Answers of Review Questions: True/False

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

25.3 Answers of Review Questions: Multiple Choice

1. c
2. b
3. d
4. b
5. c
6. b

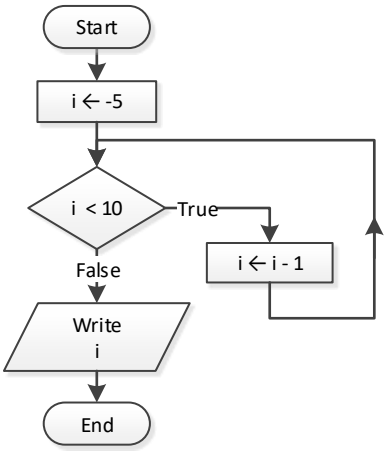
25.4 Answers of Review Exercises

1. Solution

Step	Statement	i	x
1	`i = 3`	**3**	?
2	`x = 0`	3	**0**
3	`Do While i >= 0`	True	
4	`i -= 1`	**2**	0
5	`x += i`	2	**2**
6	`Do While i >= 0`	True	
7	`i -= 1`	**1**	2
8	`x += i`	1	**3**
9	`Do While i >= 0`	True	
10	`i -= 1`	**0**	3
11	`x += i`	0	**3**
12	`Do While i >= 0`	True	
13	`i -= 1`	**-1**	3
14	`x += i`	-1	**2**
15	`Do While i >= 0`	False	
16	`Console.Write(x)`	2 is displayed	

It performs 3 iterations

2. Solution



Step	Statement	Notes	i
1	`i = -5`		**-5**
2	`Do While i < 10`	True	
3	`i -= 1`		**-6**
4	`Do While i < 10`	True	
5	`i -= 1`		**-7**
6	`Do While i < 10`	True	
7	`i -= 1`		**-8**
8	…	**…**	**…**
9	…	**…**	**…**

It performs an infinite number of iterations

3. Solution

Step	Statement	a	b	c	d
1	`a = 2`	**2**	?	?	?
2	`Do While a <= 10`	True			
3	`b = a + 1`	2	**3**	?	?
4	`c = b * 2`	2	3	**6**	?
5	`d = c - b + 1`	2	3	6	**4**
6	`Case d = 4`	True			
7	`Console.WriteLine(b & ", " & c)`	3, 6 is displayed			
8	`a += 4`	**6**	3	6	4
9	`Do While a <= 10`	True			
10	`b = a + 1`	6	**7**	6	4
11	`c = b * 2`	6	7	**14**	4

12	`d = c - b + 1`	6	7	14	**8**
13	`Case d = 4`	False			
14	`Case d = 5`	False			
15	`Case d = 8`	True			
16	`Console.WriteLine(a & ", " & b)`	6, 7 is displayed			
17	`a += 4`	**10**	7	14	8
18	`Do While a <= 10`	True			
19	`b = a + 1`	10	**11**	14	8
20	`c = b * 2`	10	11	**22**	8
21	`d = c - b + 1`	10	11	22	**12**
22	`Case d = 4`	False			
23	`Case d = 5`	False			
24	`Case d = 8`	False			
25	`Console.WriteLine(a & ", " & b & ", " & d)`	10, 11, 12 is displayed			
26	`a += 4`	**14**	11	22	12
27	`Do While a <= 10`	False			

4. Solution

Step	Statement	a	b	c	d	x
1	`a = 1`	**1**	?	?	?	?
2	`b = 1`	1	**1**	?	?	?
3	`c = 0`	1	1	**0**	?	?
4	`d = 0`	1	1	0	**0**	?
5	`Do While b < 2`	True				
6	`x = a + b`	1	1	0	0	**2**
7	`If x Mod 2 <> 0 Then`	False				
8	`d = d + 1`	1	1	0	**1**	2
9	`a = b`	**1**	1	0	1	2
10	`b = c`	1	**0**	0	1	2
11	`c = d`	1	0	**1**	1	2
12	`Do While b < 2`	True				
13	`x = a + b`	1	0	1	1	**1**
14	`If x Mod 2 <> 0 Then`	True				
15	`c = c + 1`	1	0	**2**	1	1
16	`a = b`	**0**	0	2	1	1
17	`b = c`	0	**2**	2	1	1

18	`c = d`	0	2	**1**	1	1
19	`Do While b < 2`	False				

5. Solution

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

6. Solution

```
Sub Main()
  Dim a, sum As Double
  Dim i, n As Integer

  n = Console.ReadLine()
  sum = 0

  i = 1
  Do While i <= n
    a = Console.ReadLine()
    sum = sum + a
    i += 1
  Loop

  Console.WriteLine(sum)
  If n > 0 Then
    Console.WriteLine(sum / n)
  End If

  Console.ReadKey()
End Sub
```

7. Solution

```
Sub Main()
  Dim a, i, n, p As Integer

  n = Console.ReadLine()
  p = 1

  i = 1
  Do While i <= n
    a = Console.ReadLine()
    If a Mod 2 = 0 Then
      p = p * a
    End If
    i += 1
```

```
  Loop
  Console.Write(p)

  Console.ReadKey()
End Sub
```

8. Solution

```
Sub Main()
  Dim a, i, sum As Integer

  sum = 0

  i = 1
  Do While i <= 100
    a = Console.ReadLine()
    If a Mod 10 = 0 Then
      sum = sum + a
    End If
    i += 1
  Loop
  Console.Write(sum)

  Console.ReadKey()
End Sub
```

9. Solution

```
Sub Main()
  Dim a, i, sum As Integer

  sum = 0

  i = 1
  Do While i <= 20
    a = Console.ReadLine()
    If a >= 100 And a <= 999 Then
      sum = sum + a
    End If
    i += 1
  Loop
  Console.Write(sum)

  Console.ReadKey()
End Sub
```

10. Solution

```
Sub Main()
  Dim a, p As Double

  p = 1
```

```
  a = Console.ReadLine()
  Do While a <> 0
    p = p * a
    a = Console.ReadLine()
  Loop
  Console.Write(p)

  Console.ReadKey()
End Sub
```

Step	Statement	a	p
1	p = 1	?	**1**
2	a = Console.ReadLine()	**3**	1
3	Do While a <> 0	True	
4	p = p * a	3	**3**
5	a = Console.ReadLine()	**2**	3
6	Do While a <> 0	True	
7	p = p * a	2	**6**
8	a = Console.ReadLine()	**9**	6
9	Do While a <> 0	True	
10	p = p * a	9	**54**
11	a = Console.ReadLine()	**0**	54
12	Do While a <> 0	False	
13	Console.Write(p)	54 is displayed	

11. Solution

```
Sub Main()
  Dim years As Integer
  Dim population As Double

  population = 30000

  years = 0
  Do While population <= 100000
    population += population * 0.03
    years += 1
  Loop
  Console.Write(years)

  Console.ReadKey()
End Sub
```

Chapter 26

26.2 Answers of Review Questions: True/False

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

26.3 Answers of Review Questions: Multiple Choice

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

26.4 Answers of Review Exercises

1. Solution

```
Sub Main()
  Dim i As Integer = 3

  Do
    i -= 1
  Loop While i > 0
  Console.Write("The end")

  Console.ReadKey()
End Sub
```

2. Solution

Step	Statement	x	y
1	`y = 5`	?	**5**
2	`x = 38`	**38**	5
3	`y *= 2`	38	**10**
4	`x += 1`	**39**	10
5	`Console.Write(y)`	10 is displayed	
6	`Loop While y < x`	True	
7	`y *= 2`	39	**20**
8	`x += 1`	**40**	20
9	`Console.Write(y)`	20 is displayed	
10	`Loop While y < x`	True	
11	`y *= 2`	40	**40**
12	`x += 1`	**41**	40
13	`Console.Write(y)`	40 is displayed	

14	`Loop While y < x`	True	
15	`y *= 2`	41	**80**
16	`x += 1`	**42**	80
17	`Console.Write(y)`	80 is displayed	
18	`Loop While y < x`	False	

3. Solution

Step	Statement	Notes	x
1	`x = 1`		**1**
2	`If x Mod 2 = 0 Then`	False	
3	`x += 3`		**4**
4	`Console.Write(x)`	4 is displayed	
5	`Loop While x < 12`	True	
6	`If x Mod 2 = 0 Then`	True	
7	`x += 1`		**5**
8	`Console.Write(x)`	5 is displayed	
9	`Loop While x < 12`	True	
10	`If x Mod 2 = 0 Then`	False	
11	`x += 3`		**8**
12	`Console.Write(x)`	8 is displayed	
13	`Loop While x < 12`	True	
14	`If x Mod 2 = 0 Then`	True	
15	`x += 1`		**9**
16	`Console.Write(x)`	9 is displayed	
17	`Loop While x < 12`	True	
18	`If x Mod 2 = 0 Then`	False	
19	`x += 3`		**12**
20	`Console.Write(x)`	12 is displayed	
21	`Loop While x < 12`	False	

4. Solution

Step	Statement	x	y
1	`y = 2`	?	**2**
2	`x = 0`	**0**	2
3	`y = y ^ 2`	0	**4**
4	`If x < 256 Then`	True	

5	`x = x + y`	**4**	
6	`Console.Write(x & ", " & y)`	4, 4 is displayed	
7	`Loop While y < 65535`	True	
8	`y = y ^ 2`	4	**16**
9	`If x < 256 Then`	True	
10	`x = x + y`	**20**	16
11	`Console.Write(x & ", " & y)`	20, 16 is displayed	
12	`Loop While y < 65535`	True	
13	`y = y ^ 2`	20	**256**
14	`If x < 256 Then`	True	
15	`x = x + y`	**276**	256
16	`Console.Write(x & ", " & y)`	276, 256 is displayed	
17	`Loop While y < 65535`	True	
18	`y = y ^ 2`	276	**65536**
19	`If x < 256 Then`	False	
20	`Console.Write(x & ", " & y)`	276, 65536 is displayed	
21	`Loop While y < 65535`	False	

5. Solution

Step	Statement	a	b	c	d	x
1	`a = 2`	**2**	?	?	?	?
2	`b = 4`	2	**4**	?	?	?
3	`c = 0`	2	4	**0**	?	?
4	`d = 0`	2	4	0	**0**	?
5	`x = a + b`	2	4	0	0	**6**
6	`If x Mod 2 <> 0 Then`	False				
7	`ElseIf d Mod 2 = 0 Then`	True				
8	`d = d + 5`	2	4	0	**5**	6
9	`a = b`	**4**	4	0	5	6
10	`b = d`	4	**5**	0	5	6
11	`Loop While c < 11`	True				
12	`x = a + b`	4	5	0	5	**9**
13	`If x Mod 2 <> 0 Then`	True				

14	`c = c + 5`	4	5	**5**	5	9
15	`a = b`	**b**	5	5	5	9
16	`b = d`	5	**5**	5	5	9
17	`Do While c < 11`			True		
18	`x = a + b`	5	5	5	5	**10**
19	`If x Mod 2 <> 0 Then`			False		
20	`ElseIf d Mod 2 = 0 Then`			False		
21	`c = c + 3`	5	5	**8**	5	10
22	`a = b`	**5**	5	8	5	10
23	`b = d`	5	**5**	8	5	10
24	`x = a + b`	5	5	8	5	**10**
25	`c = c + 3`	5	5	**11**	5	10
26	`a = b`	**5**	5	11	5	10
27	`b = d`	5	**5**	11	5	10
28	`Loop While c < 11`			False		

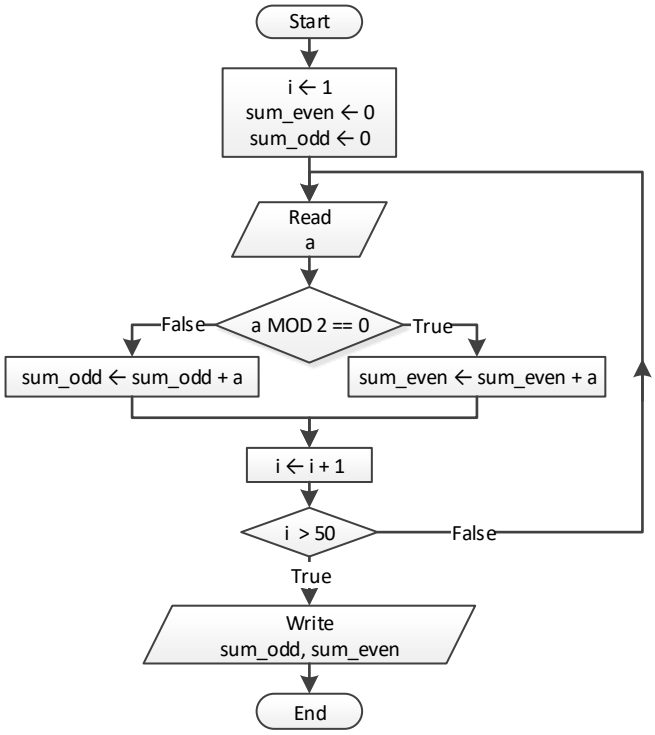
6. Solution

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

7. Solution

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

8. Solution




```
Sub Main()
  Dim a, i, sum_even, sum_odd As Integer

  i = 1
  sum_even = 0
  sum_odd = 0
  Do
    a = Console.ReadLine()
    If a Mod 2 = 0 Then
      sum_even += a
    Else
      sum_odd += a
    End If
    i += 1
  Loop While i <= 50
  Console.Write(sum_even & ", " & sum_odd)

  Console.ReadKey()
End Sub
```

9. Solution

```
Sub Main()
  Dim a, i, n, p As Integer

  n = Console.ReadLine()
  i = 1
  p = 1
```

```
  Do
    a = Console.ReadLine()
    If a < 0 Then
      p *= a
    End If
    i += 1
  Loop While i <= n
  Console.Write(Math.Abs(p))

  Console.ReadKey()
End Sub
```

10. Solution

```
Sub Main()
  Dim a, i, p As Integer

  i = 1
  p = 1
  Do
    Console.Write("Enter an integer: ")
    a = Console.ReadLine()
    If a >= 500 And a <= 599 Then
      p *= a
    End If
    i += 1
  Loop While i <= 5
  Console.Write(p)

  Console.ReadKey()
End Sub
```

11. Solution

```
Sub Main()
  Dim a, sum As Integer

  sum = 0

  a = Console.ReadLine()
  If a > 0 Then
    Do
      sum = sum + a
      a = Console.ReadLine()
    Loop While a > 0
  End If
  Console.Write(sum)

  Console.ReadKey()
End Sub
```

Step	Statement	a	sum
1	`sum = 0`	?	**0**
2	`a = Console.ReadLine()`	**5**	0
3	`If a > 0 Then`	True	
4	`sum = sum + a`	5	**5**
5	`a = Console.ReadLine()`	**2**	5
6	`Loop While a > 0`	True	
7	`sum = sum + a`	2	**7**
8	`a = Console.ReadLine()`	**3**	7
9	`Loop While a > 0`	True	
10	`sum = sum + a`	3	**10**
11	`a = Console.ReadLine()`	**0**	10
12	`Loop While a > 0`	False	

12. Solution

```
Sub Main()
  Dim population As Double
  Dim years As Integer

  population = 50000

  years = 0
  Do While population >= 20000
    population -= population * 0.10
    years += 1
  Loop
  Console.Write(years)

  Console.ReadKey()
End Sub
```

Chapter 27

27.3 Answers of Review Questions: True/False

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

27.4 Answers of Review Questions: Multiple Choice

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

27.5 Answers of Review Exercises

1. Solution

Step	Statement	a	b	j
1	`a = 0`	**0**	?	?
2	`b = 0`	0	**0**	?
3	`j = 0`	0	0	**0**
4	`j <= 8`		True	
5	`If j < 5 Then`		True	
6	`b += 1`	0	**1**	0
7	`j += 2`	0	1	**2**
8	`j <= 8`		True	
9	`If j < 5 Then`		True	
10	`b += 1`	0	**2**	2
11	`j += 2`	0	2	**4**
12	`j <= 8`		True	
13	`If j < 5 Then`		True	
14	`b += 1`	0	**3**	4
15	`j += 2`	0	3	**6**
16	`j <= 8`		True	
17	`If j < 5 Then`		False	

18	`a += j - 1`	**5**	3	6
19	`j += 2`	5	3	**8**
20	`j <= 8`	True		
21	`If j < 5 Then`	False		
22	`a += j - 1`	**12**	3	8
23	`j += 2`	12	3	**10**
24	`j <= 8`	False		
25	`Console.Write(a & ", " & b)`	12, 3 is displayed		

2. *Solution*

For input value of 10

Step	Statement	a	b	j
1	`a = Console.ReadLine()`	**10**	?	?
2	`b = a`	10	**10**	?
3	`j = a - 5`	10	10	**5**
4	`j <= a`	True		
5	`If j Mod 2 <> 0 Then`	True		
6	`b = a + j + 5`	10	**20**	5
7	`j += 2`	10	20	**7**
8	`j <= a`	True		
9	`If j Mod 2 <> 0 Then`	True		
10	`b = a + j + 5`	10	**22**	7
11	`j += 2`	10	22	**9**
12	`j <= a`	True		
13	`If j Mod 2 <> 0 Then`	True		
14	`b = a + j + 5`	10	**24**	9
15	`j += 2`	10	24	**11**
16	`j <= a`	False		
17	`Console.Write(b)`	24 is displayed		

For input value of 21

Step	Statement	a	b	j
1	`a = Console.ReadLine()`	**21**	?	?
2	`b = a`	21	**21**	?
3	`j = a - 5`	21	21	**16**
4	`j <= a`	True		
5	`If j Mod 2 <> 0 Then`	False		

6	b = a + j + 5	21	**5**	16
7	j += 2	21	5	**18**
8	j <= a	True		
9	If j Mod 2 <> 0 Then	False		
10	b = a + j + 5	21	**3**	18
11	j += 2	21	3	**20**
12	j <= a	True		
13	If j Mod 2 <> 0 Then	False		
14	b = a + j + 5	21	**1**	20
15	j += 2	21	1	**22**
16	j <= a	False		
17	Console.Write(b)	1 is displayed		

3. Solution

For input value of 12

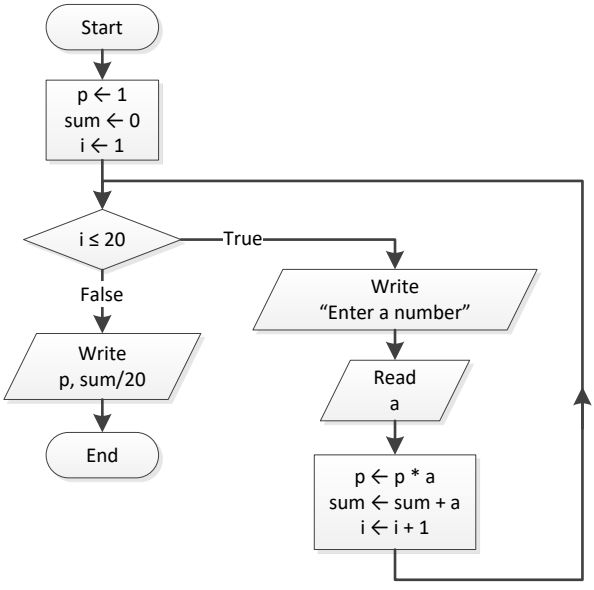
Step	Statement	a	x	y	j
1	a = Console.ReadLine()	**12**	?	?	?
2	j = 2	12	?	?	**2**
3	j <= a - 1	True			
4	x = j * 3 + 3	12	**9**	?	2
5	y = j * 2 + 10	12	9	**14**	2
6	If y - x > 0 Or x > 30 Then	True			
7	y *= 2	12	9	**28**	2
8	x += 4	12	**13**	28	2
9	Console.Write(x & ", " & y)	13, 28 is displayed			
10	j += 3	12	13	28	**5**
11	j <= a - 1	True			
12	x = j * 3 + 3	12	**18**	28	5
13	y = j * 2 + 10	12	18	**20**	5
14	If y - x > 0 Or x > 30 Then	True			
15	y *= 2	12	18	**40**	5
16	x += 4	12	**22**	40	5
17	Console.Write(x & ", " & y)	22, 40 is displayed			
18	j += 3	12	22	40	**8**
19	j <= a - 1	True			
20	x = j * 3 + 3	12	**27**	40	8

21	`y = j * 2 + 10`	12	27	**26**	8
22	`If y - x > 0 Or x > 30 Then`	False			
23	`x += 4`	12	**31**	26	8
24	`Console.Write(x & ", " & y)`	31, 26 is displayed			
25	`j += 3`	12	31	26	**11**
26	`j <= a - 1`	True			
27	`x = j * 3 + 3`	12	**36**	26	11
28	`y = j * 2 + 10`	12	36	**32**	11
29	`If y - x > 0 Or x > 30 Then`	True			
30	`y *= 2`	12	36	**64**	11
31	`x += 4`	12	**40**	64	11
32	`Console.Write(x & ", " & y)`	40, 64 is displayed			
33	`j += 3`	12	40	64	**14**
34	`j <= a - 1`	False			

4. Solution

i. 9
ii. 2
iii. -7
iv. -1

5. Solution



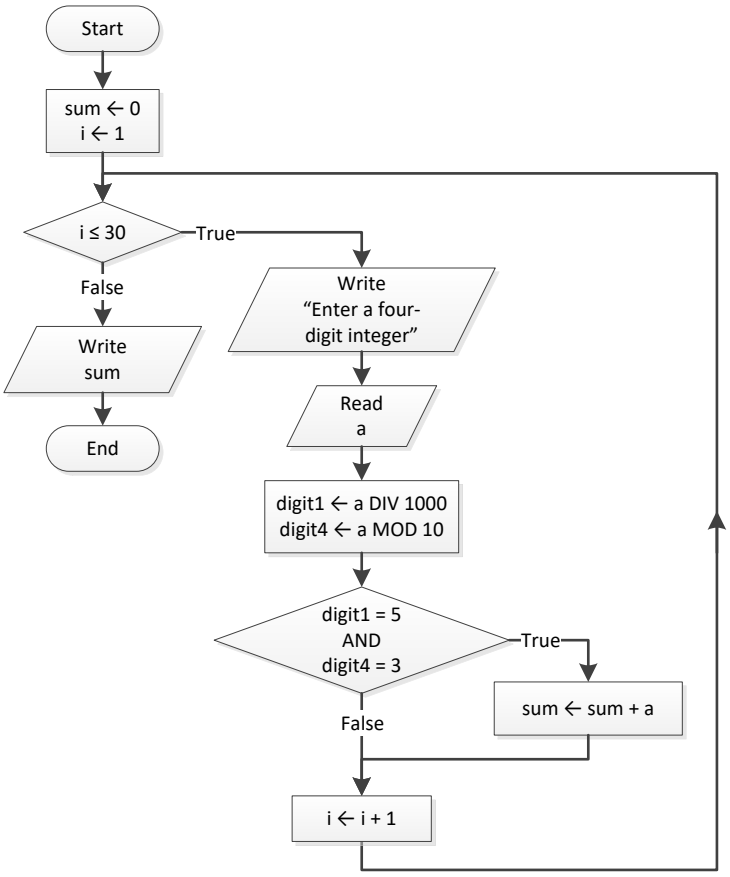

```
Sub Main()
  Dim a, p, sum As Double
  Dim i As Integer
```

```
  p = 1
  sum = 0
  For i = 1 To 20
    Console.Write("Enter a number: ")
    a = Console.ReadLine()
    p = p * a
    sum = sum + a
  Next
  Console.WriteLine(p)
  Console.Write(sum / 20)

  Console.ReadKey()
End Sub
```

6. Solution

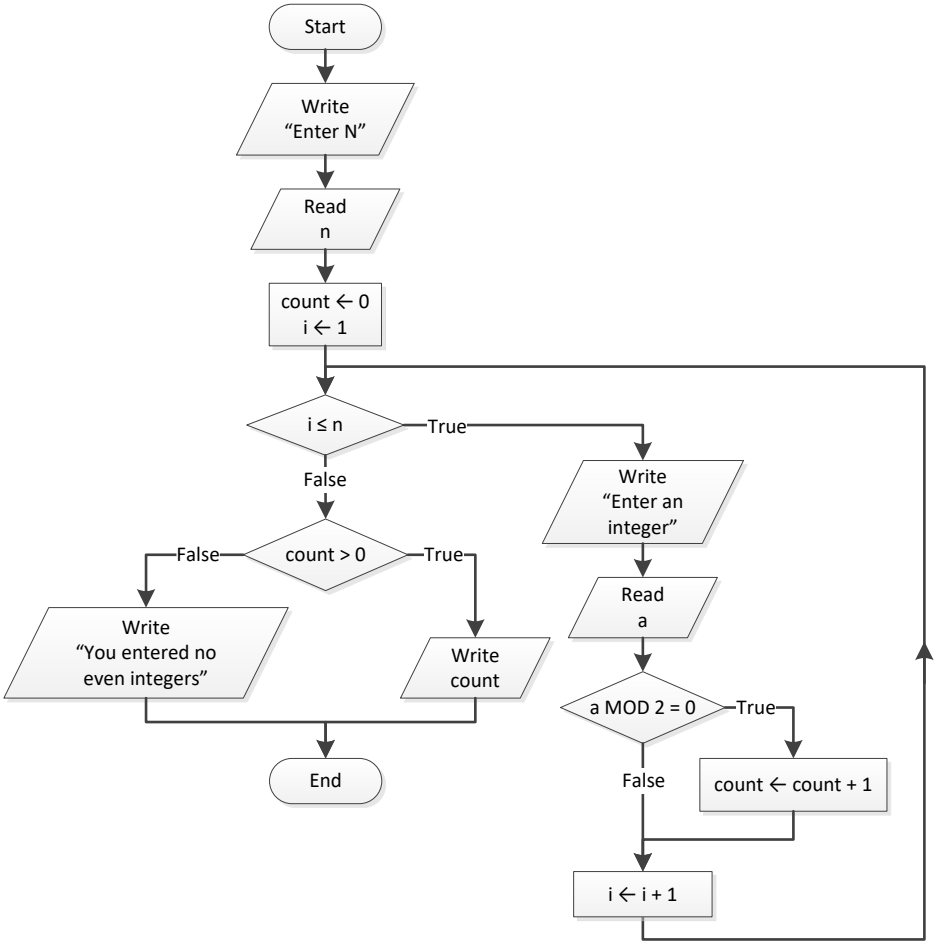
```
Sub Main()
  Dim deg, i As Double

  Console.Write("Enter degrees: ")
  deg = Console.ReadLine()
  For i = 0 To deg Step 0.5
    Console.WriteLine(Math.Sin(i * Math.PI / 180))
  Next

  Console.ReadKey()
End Sub
```

7. Solution



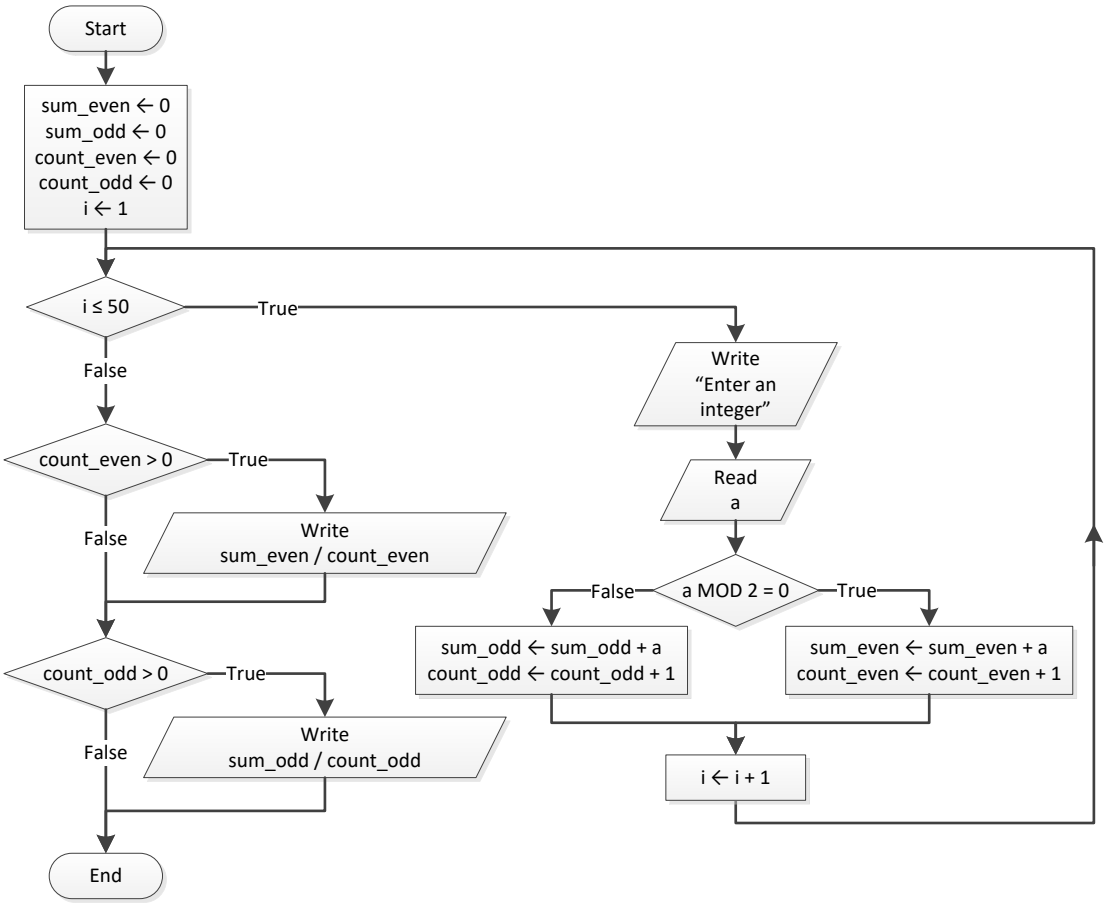

```
Sub Main()
  Dim a, digit1, digit4, i, sum As Integer

  sum = 0
  For i = 1 To 30
    Console.Write("Enter a four-digit integer: ")
    a = Console.ReadLine()
    digit1 = a \ 1000
    digit4 = a Mod 10
    If digit1 = 5 And digit4 = 3 Then
      sum += a
    End If
  Next
  Console.Write(sum)

  Console.ReadKey()
End Sub
```

8. Solution




```
Sub Main()
  Dim a, count, i, n As Integer

  Console.Write("Enter N: ")
  n = Console.ReadLine()
  count = 0
  For i = 0 To n
    Console.Write("Enter an integer: ")
    a = Console.ReadLine()
    If a Mod 2 = 0 Then
      count += 1
    End If
  Next
  If count > 0 Then
    Console.WriteLine(count)
  Else
    Console.WriteLine("You entered no even integers")
  End If

  Console.ReadKey()
End Sub
```

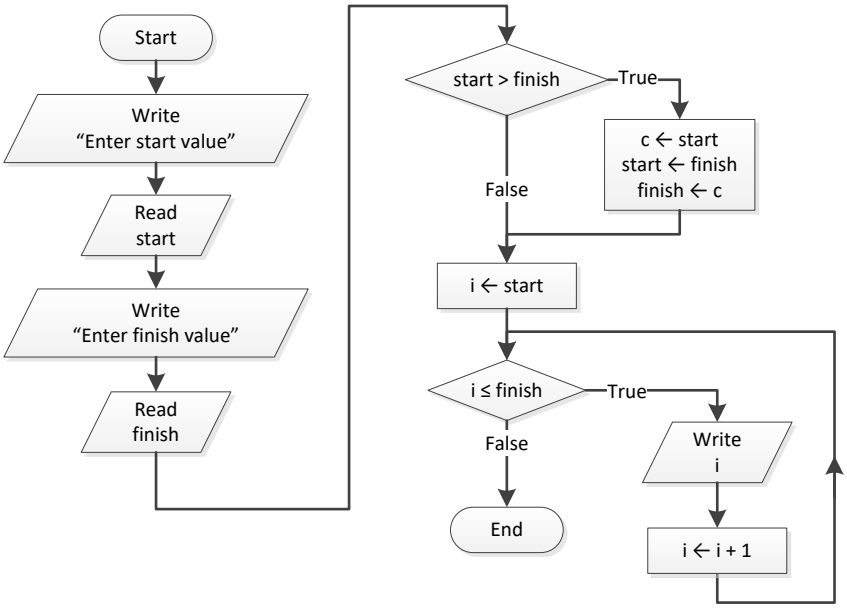
9. Solution




```
Sub Main()
  Dim a, count_even, count_odd, i, sum_even, sum_odd As Integer

  sum_even = 0
  sum_odd = 0
  count_even = 0
  count_odd = 0
  For i = 1 To 50
    Console.Write("Enter an integer: ")
    a = Console.ReadLine()
    If a Mod 2 = 0 Then
      sum_even += a
      count_even += 1
    Else
      sum_odd += a
      count_odd += 1
    End If
  Next
  If count_even > 0 Then
    Console.WriteLine(sum_even / count_even)
  End If
  If count_odd > 0 Then
    Console.WriteLine(sum_odd / count_odd)
```

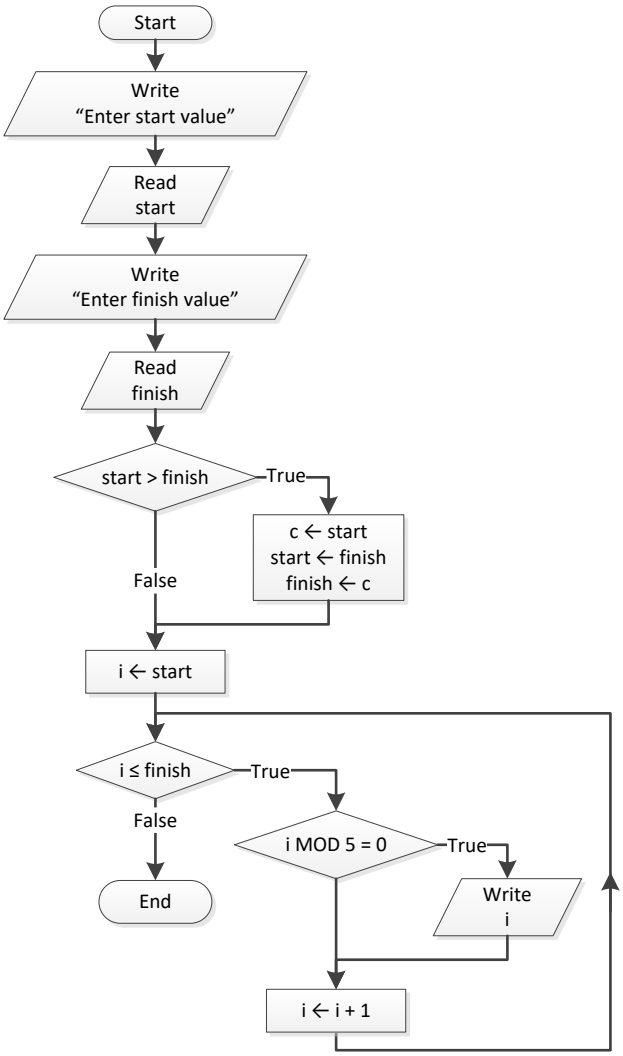
```
  End If

  Console.ReadKey()
End Sub
```

10. Solution




```
Sub Main()
  Dim c, finish, i, start As Integer

  Console.Write("Enter start value: ")
  start = Console.ReadLine()
  Console.Write("Enter finish value: ")
  finish = Console.ReadLine()

  If start > finish Then
    c = start
    start = finish
    finish = c
  End If

  For i = start To finish
    Console.WriteLine(i)
  Next

  Console.ReadKey()
End Sub
```

11. Solution




```
Sub Main()
  Dim c, finish, i, start As Integer

  Console.Write("Enter start value: ")
  start = Console.ReadLine()
  Console.Write("Enter finish value: ")
  finish = Console.ReadLine()

  If start > finish Then
    c = start
    start = finish
    finish = c
  End If

  For i = start To finish
    If i Mod 5 = 0 Then
      Console.WriteLine(i)
```

```
    End If
  Next

  Console.ReadKey()
End Sub
```

12. Solution

First Approach

```
Sub Main()
  Dim exp, i As Integer
  Dim p, base As Double

  Console.Write("Enter a value for base: ")
  base = Console.ReadLine()
  Console.Write("Enter an integer for exponent: ")
  exp = Console.ReadLine()

  p = 1
  If exp >= 0 Then
    For i = 1 To exp
      p *= base
    Next
  Else
    For i = 1 To -exp
      p *= 1 / base
    Next
  End If
  Console.Write(p)

  Console.ReadKey()
End Sub
```

Second Approach

```
Sub Main()
  Dim exp, i As Integer
  Dim p, base As Double

  Console.Write("Enter a value for base: ")
  base = Console.ReadLine()
  Console.Write("Enter an integer for exponent: ")
  exp = Console.ReadLine()

  p = 1
  For i = 1 To Math.Abs(exp)
    p *= base
  Next
  If exp < 0 Then
    p = 1 / p
  End If
  Console.Write(p)

  Console.ReadKey()
```

```
End Sub
```

13. Solution

```
Sub Main()
  Dim characters, count, i, words As Integer
  Dim msg As String

  Console.Write("Enter a message: ")
  msg = Console.ReadLine()

  characters = msg.Length
  count = 0
  For i = 0 To characters - 1
    If msg.Substring(i, 1) = " " Then
      count += 1
    End If
  Next
  words = count + 1

  Console.Write("The message entered contains " & words & " words")

  Console.ReadKey()
End Sub
```

14. Solution

```
Sub Main()
  Dim characters, count, i, words As Integer
  Dim msg As String

  Console.Write("Enter a message: ")
  msg = Console.ReadLine()

  characters = msg.Length
  count = 0
  For i = 0 To characters - 1
    If msg.Substring(i, 1) = " " Then
      count += 1
    End If
  Next
  words = count + 1
  Console.Write("The average number of letters in each word is ")
  Console.Write((characters - count) / words)

  Console.ReadKey()
End Sub
```

Chapter 28

28.3 Answers of Review Questions: True/False

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

28.4 Answers of Review Questions: Multiple Choice

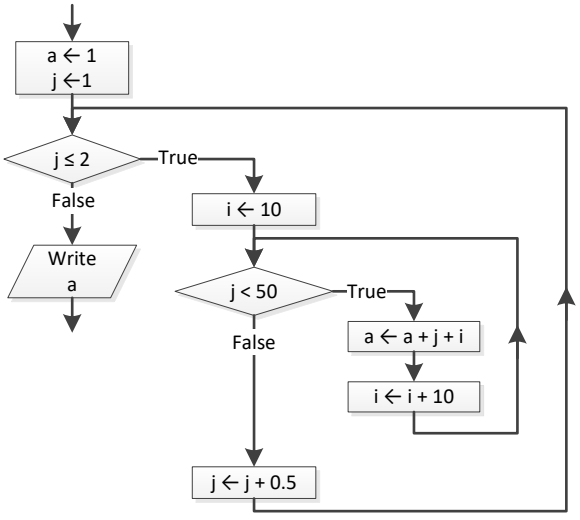
1. b
2. a
3. c
4. a
5. b

28.5 Answers of Review Exercises

1. Solution

i. 10
ii. 4.5
iii. -7
iv. 138

2. Solution



Step	Statement	a	i	j
1	`a = 1`	**1**	?	?
2	`j = 1`	1	?	**1**
3	`j <= 2`		True	
4	`i = 10`	1	**10**	1
5	`i < 30`		True	

6	a = a + j + i	**12**	10	1
7	i += 10	12	**20**	1
8	i < 30		True	
9	a = a * j + i	**33**	20	1
10	i += 10	33	**30**	1
11	i < 30		False	
12	j += 0.5	33	30	**1.5**
13	j <= 2		True	
14	i = 10	33	**10**	1.5
15	i < 30		True	
16	a = a + j + i	**44.5**	10	1.5
17	i += 10	44.5	**20**	1.5
18	i < 30		True	
19	a = a * j + i	**66**	20	1.5
20	i += 10	66	**30**	1.5
21	i < 30		False	
22	j += 0.5	66	30	**2**
23	j <= 2		True	
24	i = 10	66	**10**	2
25	i < 30		True	
26	a = a + j + i	**78**	10	2
27	i += 10	78	**20**	2
28	i < 30		True	
29	a = a * j + i	**100**	20	2
30	i += 10	100	**30**	2
31	i < 30		False	
32	j += 0.5	100	30	**2.5**
33	j <= 2		False	
34	Console.Write(a)	100 is displayed		

3. Solution

Step	Statement	s	i	j
1	s = 0	**0**	?	?
2	i = 1	0	**1**	?
3	i <= 4		True	
4	j = 3	0	1	**3**

5	`j >= i`		True	
6	`s = s + i * j`	**3**	1	3
7	`j -= 1`	3	1	**2**
8	`j >= i`		True	
9	`s = s + i * j`	**5**	1	2
10	`j -= 1`	5	1	**1**
11	`j >= i`		True	
12	`s = s + i * j`	**6**	1	1
13	`j -= 1`	6	1	**0**
14	`j >= i`		True	
15	`i += 1`	6	**2**	0
16	`i <= 4`		True	
17	`j = 3`	6	2	**3**
18	`j >= i`		True	
19	`s = s + i * j`	**12**	2	3
20	`j -= 1`	12	2	**2**
21	`j >= i`		True	
22	`s = s + i * j`	**16**	2	2
23	`j -= 1`	16	2	**1**
24	`j >= i`		False	
25	`i += 1`	16	**3**	1
26	`i <= 4`		True	
27	`j = 3`	16	3	**3**
28	`j >= i`		True	
29	`s = s + i * j`	**25**	3	3
30	`j -= 1`	25	3	**2**
31	`j >= i`		False	
32	`i += 1`	25	**4**	2
33	`i <= 4`		True	
34	`j = 3`	25	4	**3**
35	`j >= i`		False	
36	`i += 1`	25	**5**	3
37	`i <= 4`		False	
38	`Console.Write(s)`	25 is displayed		

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

4. Solution

For input value of “NO”

Step	Statement	s	y	i	ans
1	`s = 1`	**1**	?	?	?
2	`y = 25`	1	**25**	?	?
3	`i = 1`	1	25	**1**	?
4	`i <= 3`	True			
5	`s = s + y`	**26**	25	1	?
6	`y -= 5`	26	**20**	1	?
7	`i += 1`	26	20	**2**	?
8	`i <= 3`	True			
9	`s = s + y`	**46**	20	2	?
10	`y -= 5`	46	**15**	2	?
11	`i += 1`	46	15	**3**	?
12	`i <= 3`	True			
13	`s = s + y`	**61**	15	3	?
14	`y -= 5`	61	**10**	3	?
15	`i += 1`	61	10	**4**	?
16	`i <= 3`	False			
17	`ans = Console.ReadLine()`	61	10	4	**“NO”**
18	`Loop While ans = "YES"`	False			
19	`Console.Write(s)`	61 is displayed			

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	`i <= 3`	True			
5	`s = s + y`	**26**	25	1	?
6	`y -= 5`	26	**20**	1	?
7	`i += 1`	26	20	**2**	?
8	`i <= 3`	True			
9	`s = s + y`	**46**	20	2	?
10	`y -= 5`	46	**15**	2	?
11	`i += 1`	46	15	**3**	?

12	`i <= 3`	True			
13	`s = s + y`	**61**	15	3	?
14	`y -= 5`	61	**10**	3	?
15	`i += 1`	61	10	**4**	?
16	`i <= 3`	False			
17	`ans = Console.ReadLine()`	61	10	4	**"YES"**
18	`Loop While ans = "YES"`	True			
19	`i = 1`	61	10	**1**	"YES"
20	`i <= 3`	True			
21	`s = s + y`	**71**	10	1	"YES"
22	`y -= 5`	71	**5**	1	"YES"
23	`i += 1`	71	5	**2**	"YES"
24	`i <= 3`	True			
25	`s = s + y`	**76**	5	2	"YES"
26	`y -= 5`	76	**0**	2	"YES"
27	`i += 1`	76	0	**3**	"YES"
28	`i <= 3`	True			
29	`s = s + y`	**76**	0	3	"YES"
30	`y -= 5`	76	**-5**	3	"YES"
31	`i += 1`	76	-5	**4**	"YES"
32	`i <= 3`	False			
33	`ans = Console.ReadLine()`	76	-5	4	**"NO"**
34	`Loop While ans = "YES"`	False			
35	`Console.Write(s)`	76 is displayed			

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	`i <= 3`	True			
5	`s = s + y`	**26**	25	1	?
6	`y -= 5`	26	**20**	1	?
7	`i += 1`	26	20	**2**	?
8	`i <= 3`	True			
9	`s = s + y`	**46**	20	2	?
10	`y -= 5`	46	**15**	2	?

11	i += 1	46	15	**3**	?
12	i <= 3	True			
13	s = s + y	**61**	15	3	?
14	y -= 5	61	**10**	3	?
15	i += 1	61	10	**4**	?
16	i <= 3	False			
17	ans = Console.ReadLine()	61	10	4	**“YES”**
18	Loop While ans = "YES"	True			
19	i = 1	61	10	**1**	“YES”
20	i <= 3	True			
21	s = s + y	**71**	10	1	“YES”
22	y -= 5	71	**5**	1	“YES”
23	i += 1	71	5	**2**	“YES”
24	i <= 3	True			
25	s = s + y	**76**	5	2	“YES”
26	y -= 5	76	**0**	2	“YES”
27	i += 1	76	0	**3**	“YES”
28	i <= 3	True			
29	s = s + y	**76**	0	3	“YES”
30	y -= 5	76	**-5**	3	“YES”
31	i += 1	76	-5	**4**	“YES”
32	i <= 3	False			
33	ans = Console.ReadLine()	76	-5	4	**“YES”**
34	Loop While ans = "YES"	True			
35	i = 1	76	-5	**1**	“YES”
36	i <= 3	True			
37	s = s + y	**71**	-5	1	“YES”
38	y -= 5	71	**-10**	1	“YES”
39	i += 1	71	-10	**2**	“YES”
40	i <= 3	True			
41	s = s + y	**61**	-10	2	“YES”
42	y -= 5	61	**-15**	2	“YES”
43	i += 1	61	-15	**3**	“YES”
44	i <= 3	True			
45	s = s + y	**46**	-15	3	“YES”
46	y -= 5	46	**-20**	3	“YES”

47	i += 1	46	-20	**4**	"YES"
48	i <= 3	False			
49	ans = Console.ReadLine()	46	-20	4	**"NO"**
50	Loop While ans = "YES"	False			
51	Console.Write(s)	46 is displayed			

5. Solution

```
Sub Main()
  Dim hour, minutes As Integer

  For hour = 0 To 23
    For minutes = 0 To 59
      Console.WriteLine(hour & vbTab & minutes)
    Next
  Next

  Console.ReadKey()
End Sub
```

6. Solution

```
Sub Main()
  Dim i, j As Integer

  For i = 5 To 1 Step -1
    For j = 1 To i
      Console.Write(i & " ")
    Next
    Console.WriteLine()
  Next

  Console.ReadKey()
End Sub
```

7. Solution

```
Sub Main()
  Dim i, j As Integer

  For i = 0 To 5
    For j = 0 To i
      Console.Write(j & " ")
    Next
    Console.WriteLine()
  Next

  Console.ReadKey()
End Sub
```

8. Solution

```
Sub Main()
  Dim i, j As Integer

  For i = 1 To 4
    For j = 1 To 10
      Console.Write("* ")
    Next
    Console.WriteLine()
  Next

  Console.ReadKey()
End Sub
```

9. Solution

```
Sub Main()
  Dim i, j, n As Integer

  Console.Write("Enter an integer between 3 and 20: ")
  n = Console.ReadLine()

  For i = 1 To n
    For j = 1 To n
      Console.Write("* ")
    Next
    Console.WriteLine()
  Next

  Console.ReadKey()
End Sub
```

10. Solution

```
Sub Main()
  Dim i, j, n As Integer

  Console.Write("Enter an integer between 3 and 20: ")
  n = Console.ReadLine()

  For j = 1 To n
    Console.Write("* ")
  Next
  Console.WriteLine()

  For i = 1 To n - 2
    Console.Write("* ")
    For j = 1 To n - 2
      Console.Write("  ")
    Next
    Console.WriteLine("* ")
  Next
```

```
  For j = 1 To n
    Console.Write("* ")
  Next

  Console.ReadKey()
End Sub
```

11. Solution

```
Sub Main()
  Dim i, j As Integer

  For i = 1 To 5
    For j = 1 To i
      Console.Write("* ")
    Next
    Console.WriteLine()
  Next

  For i = 4 To 1 Step -1
    For j = 1 To i
      Console.Write("* ")
    Next
    Console.WriteLine()
  Next

  Console.ReadKey()
End Sub
```

Chapter 29

29.14 Answers of Review Questions: True/False

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

29.15 Answers of Review Questions: Multiple Choice

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

29.16 Answers of Review Exercises

1. Solution

```
s = 0
For i = 1 To 100
  number = Console.ReadLine()
  s = s + number
Next
average = s / 100
Console.WriteLine(average)
```

2. Solution

```
Sub Main()
  Dim denom, i As Integer
  Dim s As Double

  s = 0

  denom = 1
  For i = 1 To 100
    denom *= i
  Next
```

```
  For i = 1 To 100
    s += i / denom
  Next
  Console.Write(s)

  Console.ReadKey()
End Sub
```

3. Solution

```
s = 10
i = 1
Do While i <= 10
  s += Math.Sqrt(i)
  i += 1
Loop
Console.WriteLine(s)
```

4. Solution

```
start = Console.ReadLine()
finish = Console.ReadLine()
i = start
Do While i <= finish
  Console.WriteLine(i)
  i += 1
Loop
```

5. Solution

```
s = 0
For i = 100 To 5 Step -5
  s = s + Math.Sqrt(i)
Next
Console.WriteLine(s)
```

6. Solution

```
s = 0
y = 0
For i = 1 To 10
  s = s + Math.Sqrt(y + i + 1)
  y = y + (i + 1) * 2
Next
Console.WriteLine(s)
```

7. Solution

```
y = 0
For i = 1 To 9 Step 2
  a = Console.ReadLine()
  a += i
  y = y + (a + i + 2) ^ 3
```

```
Next
Console.WriteLine(y)
```

8. Solution

This conversion cannot be carried out in Visual Basic.

9. Solution

```
s = 0
a = Console.ReadLine()
s += a
a = Console.ReadLine()
Do While a <= s
  s += a
  a = Console.ReadLine()
Loop
Console.WriteLine(s)
```

10. Solution

```
a = 100
count = 0
Console.WriteLine(a)
b = Console.ReadLine()
count += 1
a -= Math.Sqrt(b)
Do While a >= 0
  Console.WriteLine(a)
  b = Console.ReadLine()
  count += 1
  a -= Math.Sqrt(b)
Loop
Console.WriteLine(count)
```

11. Solution

```
a = Console.ReadLine()
b = Console.ReadLine()
If b <= 1000 Then
  Do
    a += 2
    b = b * a
    Console.WriteLine(b)
  Loop While b <= 1000
End If
```

12. Solution

```
s = 0
a = Console.ReadLine()
If a <> -99 Then
  Do
```

```
    s = s + a ^ 2
    a = Console.ReadLine()
  Loop While a <> -99
End If
Console.WriteLine(s)
```

13. Solution

```
x = 0
y = -10
Do
  x = x + 2 ^ y
  y = y + 1
Loop While y < 10
Console.WriteLine(x)
```

14. Solution

```
start = Console.ReadLine()
x = 1
i = start
Do While i <= start * 2
  x = x ^ 1.1 + i
  i += 1
Loop
Console.WriteLine(x)
```

15. Solution

```
x = 42
i = 1
Do While i <= 100
  x = Math.Sqrt(x) + i
  Console.WriteLine(x)
  i += 1
Loop
```

16. Solution

```
Sub Main()
  Dim a, i As Integer
  Dim p As Double

  p = 1
  a = Console.ReadLine()
  i = a
  p = p * i ^ 2
  i = i + 5
  p = p + i
  For i = a + 5 To 19 Step 5
    p = p * i ^ 2
    p = p + i + 5
  Next
```

```
  Console.Write(p)

  Console.ReadKey()
End Sub
```

17. Solution

```
Sub Main()
  Dim start, finish, i As Integer
  Dim x As Double

  start = Console.ReadLine()
  finish = Console.ReadLine()
  x = 1000

  For i = start To finish Step 2
    x = Math.Sqrt(x)
  Next
  Console.Write(x)

  Console.ReadKey()
End Sub
```

18. Solution

```
Sub Main()
  Dim i, j As Integer

  For i = 1 To 4
    For j = 1 To 4
      Console.WriteLine(i & " x " & j & " = " & (i * j))
    Next
  Next

  Console.ReadKey()
End Sub
```

19. Solution

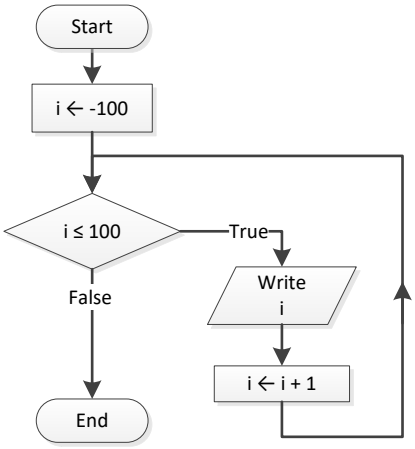
```
Sub Main()
  Dim i, j As Integer

  Console.Write(vbTab & "|" & vbTab)
  For i = 1 To 12
    Console.Write(i & vbTab)
  Next
  Console.WriteLine()

  For i = 1 To 12
    Console.Write("---------")
  Next
  Console.WriteLine()
```

```
  For i = 1 To 12
    Console.Write(i & vbTab & "|" & vbTab)
    For j = 1 To 12
      Console.Write(i * j & vbTab)
    Next
    Console.WriteLine()
  Next

  Console.ReadKey()
End Sub
```

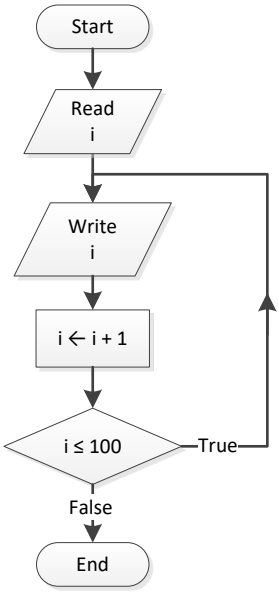
Chapter 30

30.4 Answers of Review Exercises

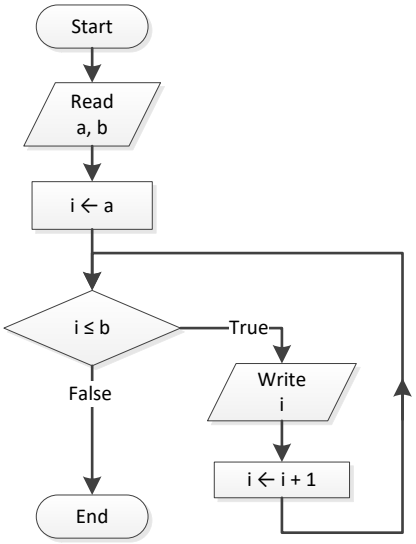
1. Solution



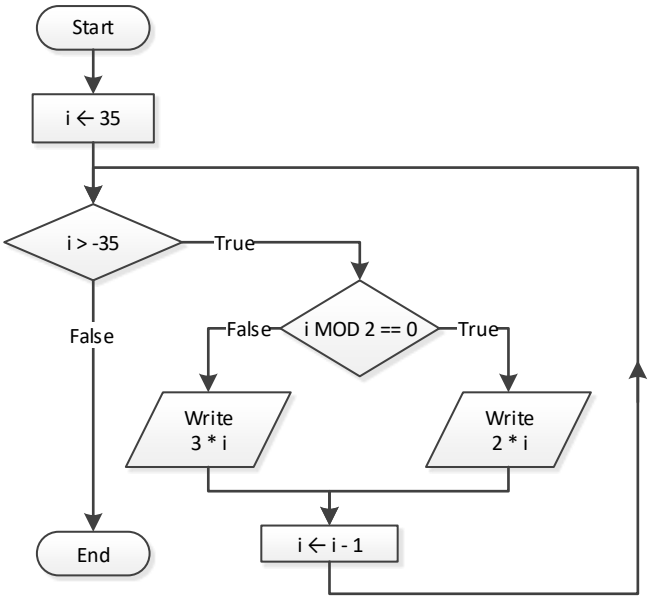
2. Solution



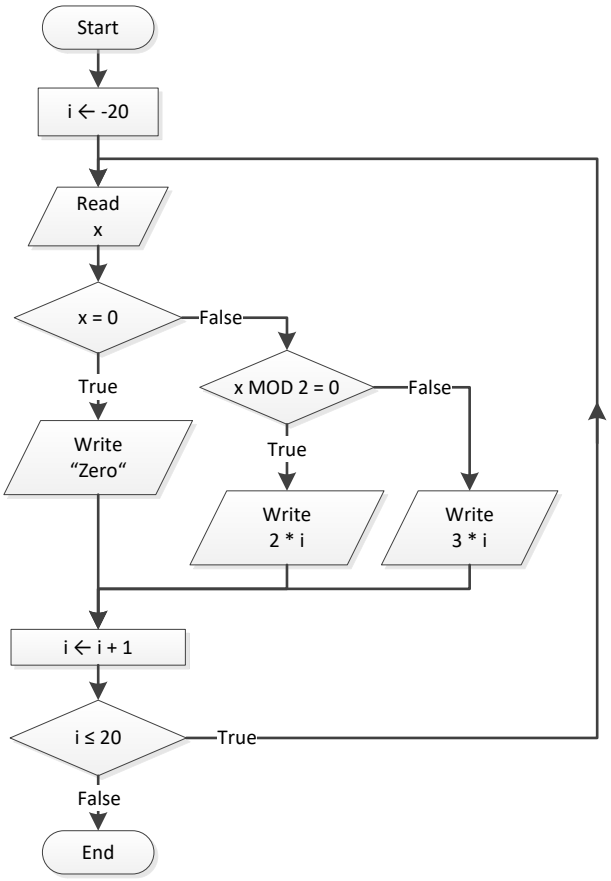
3. Solution



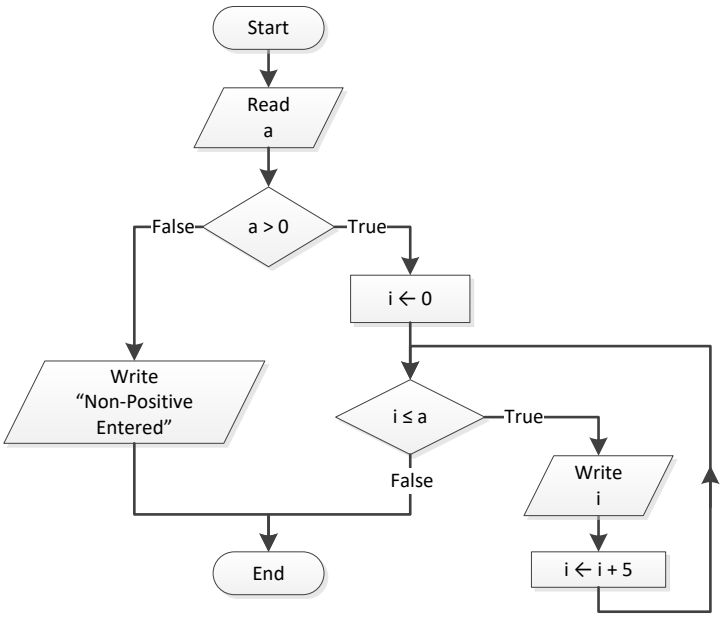
4. Solution



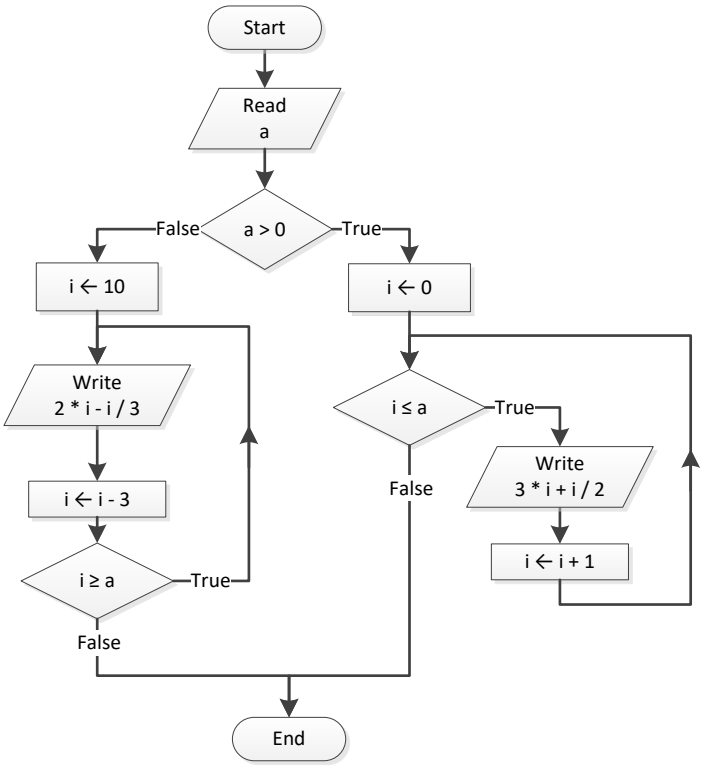
5. Solution



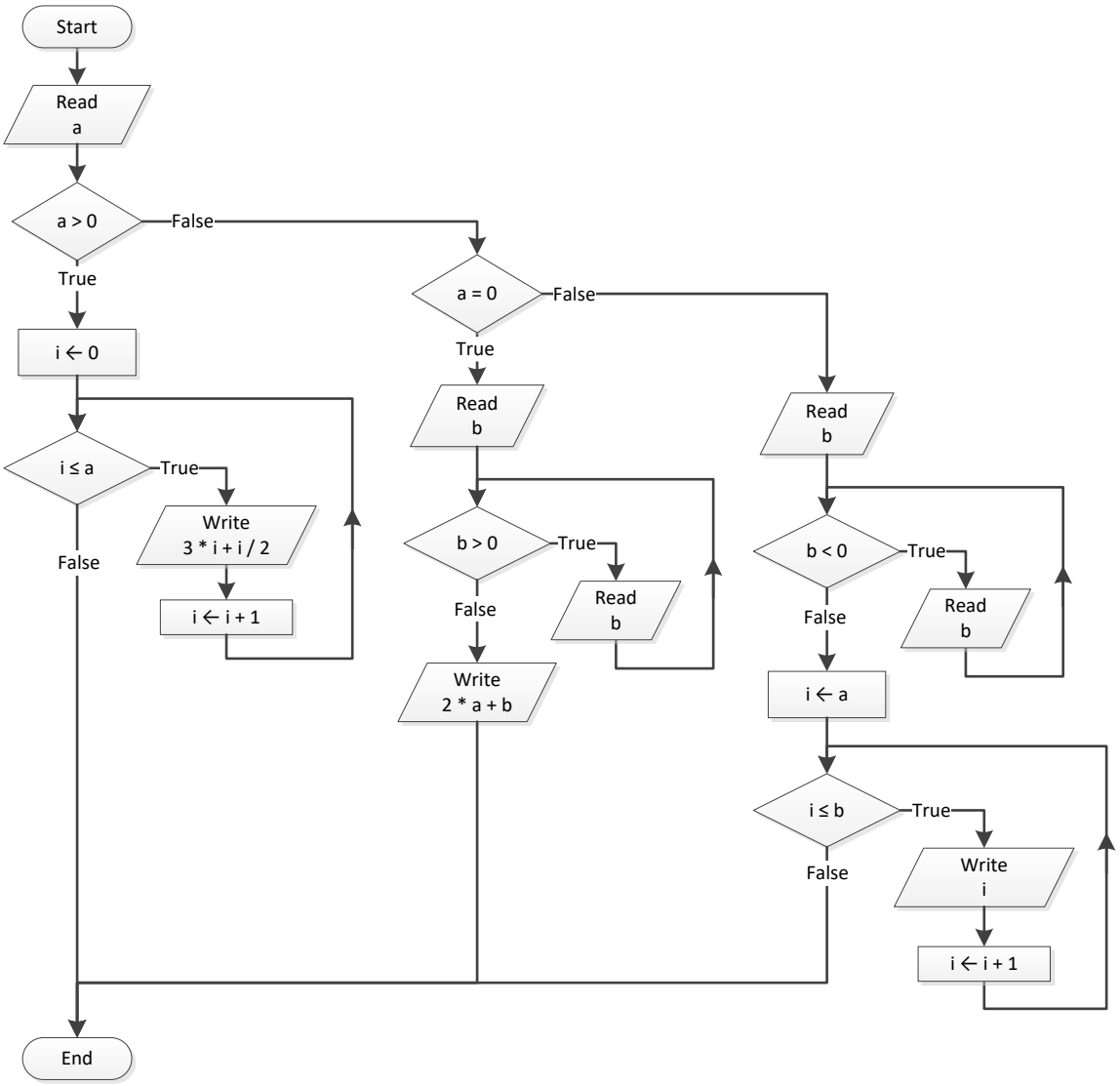
6. Solution



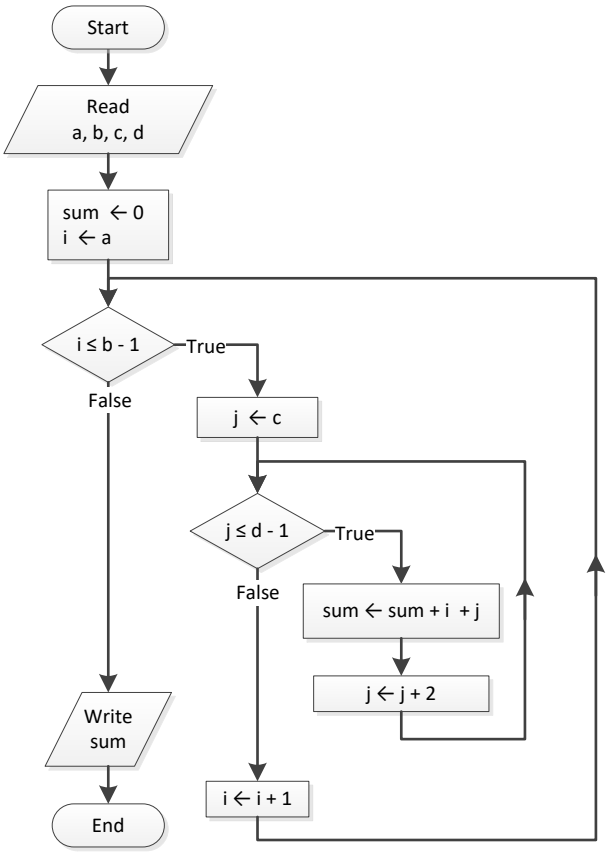
7. Solution


Start
Read
a
a > 0
False
True
i ← 10
i ← 0
Write
2 * i - i / 3
i ← i - 3
i ≥ a
True
False
i ≤ a
True
False
Write
3 * i + i / 2
i ← i + 1
End

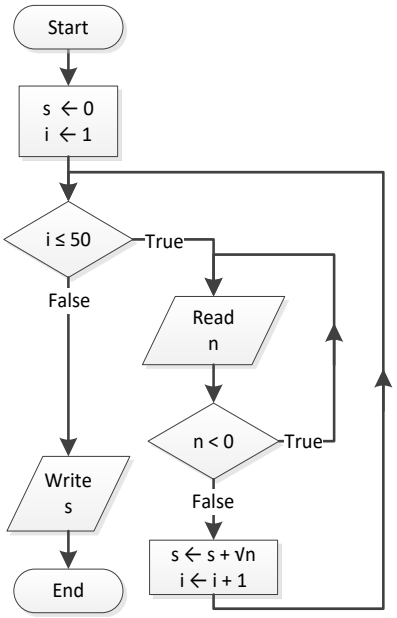
8. Solution


Start
Read a
a > 0
False
True
i ← 0
i ≤ a
True
Write 3 * i + i / 2
i ← i + 1
False
a = 0
False
True
Read b
b > 0
True
Read b
False
Write 2 * a + b
Read b
b < 0
True
Read b
False
i ← a
i ≤ b
True
Write i
i ← i + 1
False
End

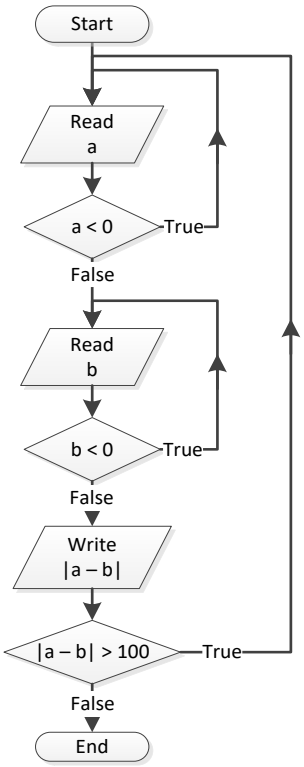
9. Solution



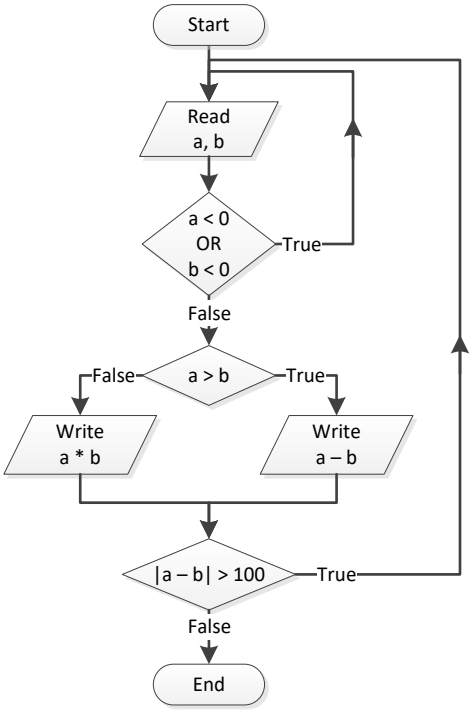
10. Solution



11. Solution



12. Solution



13. Solution

```
i = 1
Do
  Console.WriteLine(i)
  i += 5
Loop While i <= 500
Console.WriteLine("The End")
```

14. Solution

```
Sub Main()
  Dim a, i As Integer

  i = 0
  a = Console.ReadLine()
  Do
    If i Mod 2 <> 0 Then
      Console.WriteLine(i)
    End If
    i += 5
  Loop While i < a

  Console.ReadKey()
End Sub
```

15. Solution

```
Sub Main()
  Dim a, b, i As Integer

  a = Console.ReadLine()
  Do While a <> -1
    Do
      b = Console.ReadLine()
    Loop Do While b <= a
    For i = a To b
      Console.WriteLine(i)
    Next
    a = Console.ReadLine()
  Loop

  Console.ReadKey()
End Sub
```

16. Solution

```
Sub Main()
  Dim i As Integer
  Dim P, S, a As Double

  i = 1
  S = 0
```

```
  P = 1
  a = 0
  If i < 45 Then
    S += a
  Else
    P *= a
  End If
  i += 1
  Do While i < 90
    a = Console.ReadLine()
    If i < 45 Then
      S += a
    Else
      P *= a
    End If
    i += 1
  Loop
  Console.Write(S & ", " & P)

  Console.ReadKey()
End Sub
```

Chapter 31

31.7 Answers of Review Questions: True/False

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

31.8 Answers of Review Exercises

1. Solution

```
Sub Main()
  Dim i, s As Integer

  s = 0
  For i = 1 To 99 Step 2
    s += i
  Next
  Console.Write(s)

  Console.ReadKey()
End Sub
```

2. Solution

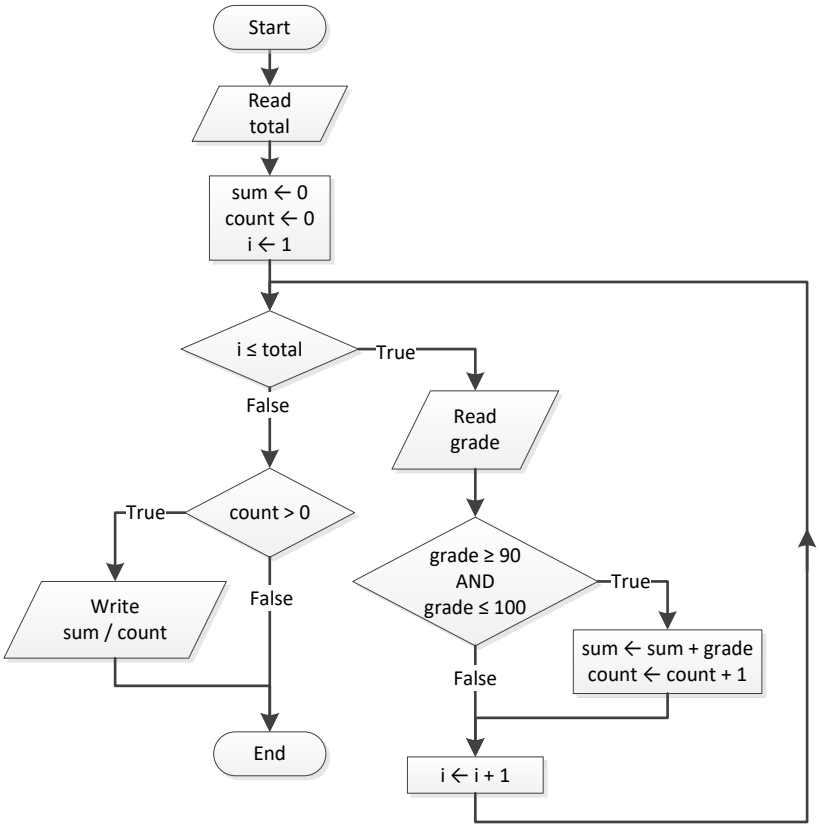
```
Sub Main()
  Dim i, n As Integer
  Dim p As Double

  n = Console.ReadLine()
  p = 1
  For i = 2 To 2 * n Step 2
    p *= i ^ (i - 1)
  Next
  Console.Write(p)

  Console.ReadKey()
End Sub
```

3. Solution

```
Sub Main()
  Dim i, offset, s As Integer

  s = 0
  i = 1
  offset = 0
  Do While i <= 191
    s += i
    offset += 1
```

```
    i += offset
  Loop
  Console.Write(s)

  Console.ReadKey()
End Sub
```

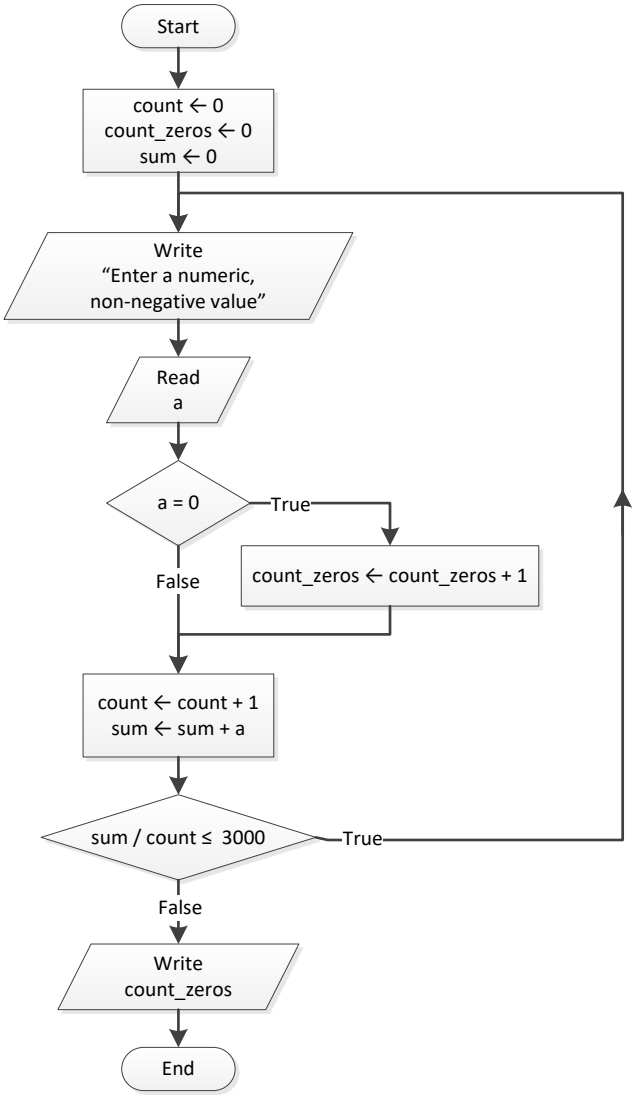
4. Solution




```
Sub Main()
  Dim count, grade, i, sum, total As Integer

  total = Console.ReadLine()
  sum = 0
  count = 0
  For i = 1 To total
    grade = Console.ReadLine()
    If grade >= 90 And grade <= 100 Then
      sum += grade
      count += 1
    End If
  Next
  If count > 0 Then
    Console.WriteLine(sum / count)
  End If

  Console.ReadKey()
```

```
End Sub
```

5. Solution




```
Sub Main()
  Dim count, count_zeros As Integer
  Dim a, sum As Double

  count = 0
  count_zeros = 0
  sum = 0
  Do
    Console.Write("Enter a numeric, non-negative value: ")
    a = Console.ReadLine()
    If a = 0 Then
      count_zeros += 1
    End If
    count += 1
    sum += a
```

```
  Loop While sum / count <= 3000
  Console.Write(count_zeros)

  Console.ReadKey()
End Sub
```

6. Solution

First Approach

```
Sub Main()
  Dim a, d1, d2, d3, d4, i, r As Integer

  Console.Write("Enter an integer between 1 and 20: ")
  a = Console.ReadLine()
  For i = 1000 To 9999
    d4 = i Mod 10
    r = i \ 10
    d3 = r Mod 10
    r = r \ 10
    d2 = r Mod 10
    d1 = r \ 10
    If d1 + d2 + d3 + d4 < a Then
      Console.WriteLine(i)
    End If
  Next

  Console.ReadKey()
End Sub
```

Second Approach

```
Sub Main()
  Dim a, d1, d2, d3, d4 As Integer

  Console.Write("Enter an integer between 1 and 20: ")
  a = Console.ReadLine()
  For d1 = 1 To 9
    For d2 = 0 To 9
      For d3 = 0 To 9
        For d4 = 0 To 9
          If d1 + d2 + d3 + d4 < a Then
            Console.WriteLine(d1 * 1000 + d2 * 100 + d3 * 10 + d4)
          End If
        Next
      Next
    Next
  Next

  Console.ReadKey()
End Sub
```

7. Solution

First Approach

```
Sub Main()
  Dim d1, d2, d3, d4, i, r As Integer

  For i = 1000 To 9999
    d4 = i Mod 10
    r = i \ 10
    d3 = r Mod 10
    r = r \ 10
    d2 = r Mod 10
    d1 = r \ 10
    If d1 > d2 And d2 = d3 And d3 < d4 Then
      Console.WriteLine(i)
    End If
  Next

  Console.ReadKey()
End Sub
```

Second Approach

```
Sub Main()
  Dim d1, d2, d3, d4 As Integer

  For d1 = 1 To 9
    For d2 = 0 To 9
      For d3 = 0 To 9
        For d4 = 0 To 9
          If d1 > d2 And d2 = d3 And d3 < d4 Then
            Console.WriteLine(d1 * 1000 + d2 * 100 + d3 * 10 + d4)
          End If
        Next
      Next
    Next
  Next

  Console.ReadKey()
End Sub
```

8. Solution

```
input = Console.ReadLine()
Do While Byte.TryParse(input, x) = False Or x <> 1 And x <> 0
  Console.WriteLine("Error")
  input = Console.ReadLine()
Loop
```

9. Solution

```
Do
  sex = Console.ReadLine()
Loop While sex.ToUpper() <> "M" And sex.ToUpper() <> "F"
```

10. Solution

```
Sub Main()
  Dim count, x As Integer
  Dim y As Double
  Dim input As String

  Console.Write("Enter a non-negative number: ")
  input = Console.ReadLine()
  count = 1
  Do While Int32.TryParse(input, x) = False Or x < 0
    Console.WriteLine("Error: Invalid number!")
    Console.Write("Enter a non-negative number: ")
    input = Console.ReadLine()
    If Int32.TryParse(input, x) = False Or x < 0 Then
      count += 1
      If count = 3 Then Exit Do
    End If
  Loop

  If count < 3 Then
    y = Math.Sqrt(x)
    Console.WriteLine(y)
  Else
    Console.WriteLine("Dude, you are dumb!")
  End If

  Console.ReadKey()
End Sub
```

11. Solution

```
Sub Main()
  Dim answer As String
  Dim area, r As Double

  Do
    Console.Write("Enter the length of a radius: ")
    r = Console.ReadLine()
    Do While r <= 0
      Console.Write("Invalid radius. Enter the length of a radius: ")
      r = Console.ReadLine()
    Loop

    area = Math.PI * r ^ 2
    Console.WriteLine("The area is: " & area)

    Console.Write("Would you like to repeat? ")
    answer = Console.ReadLine()
  Loop While answer.ToUpper() = "YES"
End Sub
```

12. Solution

```
Sub Main()
  Dim x, y As Integer

  For x = -100 To 100
    For y = -100 To 100
      If 5 * x + 3 * y ^ 2 = 0 Then
        Console.WriteLine(x & ", " & y)
      End If
    Next
  Next

  Console.ReadKey()
End Sub
```

13. Solution

```
Sub Main()
  Dim x, y, z As Integer

  For x = -10 To 10
    For y = -10 To 10
      For z = -10 To 10
        If (x + y) / 2 + 3 * z ^ 2 / (x + 3 * y + 45) = x / 3 Then
          Console.WriteLine(x & ", " & y & ", " & z)
        End If
      Next
    Next
  Next

  Console.ReadKey()
End Sub
```

14. Solution

```
Sub Main()
  Dim m1, m2, m3, s As Integer

  m1 = Console.ReadLine()
  m2 = Console.ReadLine()
  m3 = Console.ReadLine()

  s = 0
  Do While m2 <> 0
    If m2 Mod 2 <> 0 Then
      s += m1
    End If
    m1 *= 2
    m2 = m2 \ 2
  Loop

  m1 = s
```

```
  m2 = m3

  s = 0
  Do While m2 <> 0
    If m2 Mod 2 <> 0 Then
      s += m1
    End If
    m1 *= 2
    m2 = m2 \ 2
  Loop

  Console.Write(s)

  Console.ReadKey()
End Sub
```

15. Solution

```
Sub Main()
  Dim a, b, c, i, number_of_divisors, x As Integer

  Console.Write("Enter an integer greater than 1: ")
  a = Console.ReadLine()
  Do While a < 2
    Console.Write("Wrong number. Please enter an integer greater than 1: ")
    a = Console.ReadLine()
  Loop

  Console.Write("Enter a second integer greater than 1: ")
  b = Console.ReadLine()
  Do While b < 2
    Console.Write("Wrong number. Please enter a second integer greater than 1: ")
    b = Console.ReadLine()
  Loop

  If a > b Then
    c = a
    a = b
    b = c
  End If

  For x = a To b
    number_of_divisors = 2
    i = 2
    Do While i <= x \ 2 And number_of_divisors = 2
      If x Mod i = 0 Then
        number_of_divisors += 1
      End If
      i += 1
    Loop
    If number_of_divisors = 2 Then
      Console.WriteLine("Number " & x & " is prime")
    End If
  Next
```

```
  Console.ReadKey()
End Sub
```

16. Solution

```
Sub Main()
  Dim a, b, c, d1, d2, d3, d4, r, x As Integer
  Dim input As String

  Console.Write("Enter a four-digit integer: ")
  input = Console.ReadLine()
  Do While Int32.TryParse(input, a) = False Or a < 1000 Or a > 9999
    Console.Write("Wrong number. Please enter a four-digit integer: ")
    input = Console.ReadLine()
  Loop

  Console.Write("Enter a second four-digit integer: ")
  input = Console.ReadLine()
  Do While Int32.TryParse(input, b) = False Or b < 1000 Or b > 9999
    Console.Write("Wrong number. Please enter a second four-digit integer: ")
    input = Console.ReadLine()
  Loop

  If a > b Then
    c = a
    a = b
    b = c
  End If

  For x = a To b
    d4 = x Mod 10
    r = x \ 10
    d3 = r Mod 10
    r = r \ 10
    d2 = r Mod 10
    d1 = r \ 10

    If d1 = d4 And d2 = d3 Then
      Console.WriteLine(x)
    End If

  Next

  Console.ReadKey()
End Sub
```

17. Solution

```
Sub Main()
  Dim i As Integer

  For i = 0 To 30
```

```
    Console.WriteLine(2 ^ i)
  Next

  Console.ReadKey()
End Sub
```

18. Solution

```
Sub Main()
  Dim i, offset As Integer

  offset = 10
  i = 1
  Do While i <= 401
    Console.WriteLine(i)
    i += offset
    offset += 2
  Loop

  Console.ReadKey()
End Sub
```

19. Solution

```
Sub Main()
  Dim i As Integer

  For i = 1 To 100
    Console.WriteLine(-i & vbCrLf & i)
  Next

  Console.ReadKey()
End Sub
```

20. Solution

First Approach

```
Sub Main()
  Dim i, offset, value As Integer

  value = 0
  For i = 1 To 8
    offset = 10 ^ (i - 1)
    value += offset
    Console.WriteLine(value)
  Next

  Console.ReadKey()
End Sub
```

Second Approach

```
Sub Main()
  Dim i As Integer
```

```
  Dim value As String

  value = "1"
  For i = 1 To 8
    Console.WriteLine(value)
    value &= "1"
  Next

  Console.ReadKey()
End Sub
```

21. Solution

```
Sub Main()
  Dim a, fib, fib_prev, fib_prev_prev, i As Integer

  a = Console.ReadLine()

  fib_prev_prev = 0
  fib_prev = 1
  fib = 1
  For i = 1 To a
    Console.WriteLine(fib)
    fib = fib_prev + fib_prev_prev
    fib_prev_prev = fib_prev
    fib_prev = fib
  Next

  Console.ReadKey()
End Sub
```

22. Solution

```
Sub Main()
  Dim a, fib, fib_prev, fib_prev_prev As Integer

  a = Console.ReadLine()

  fib_prev_prev = 0
  fib_prev = 1
  fib = 1
  Do While fib < a
    Console.WriteLine(fib)
    fib = fib_prev + fib_prev_prev
    fib_prev_prev = fib_prev
    fib_prev = fib
  Loop

  Console.ReadKey()
End Sub
```

23. Solution

```
Sub Main()
  Dim denominator, i, n, nominator As Integer
  Dim y As Double
  Dim input As String

  Console.Write("Enter a positive integer: ")
  input = Console.ReadLine()
  Do While Int32.TryParse(input, n) = False Or n < 1
    Console.Write("Wrong number. Please enter a positive integer: ")
    input = Console.ReadLine()
  Loop

  nominator = 0
  For i = 2 To 2 * n Step 2
    nominator += i
  Next

  denominator = 1
  For i = 1 To n
    denominator *= i
  Next

  y = nominator / denominator
  Console.Write(y)

  Console.ReadKey()
End Sub
```

24. Solution

```
Sub Main()
  Dim i, n, nominator, sign As Integer
  Dim y As Double
  Dim input As String

  Console.Write("Enter a positive integer: ")
  input = Console.ReadLine()
  Do While Int32.TryParse(input, n) = False Or n < 1
    Console.Write("Wrong number. Please enter a positive integer: ")
    input = Console.ReadLine()
  Loop

  nominator = 0
  sign = 1
  For i = 1 To 2 * n + 1 Step 2
    nominator += sign * i
    sign = -sign
  Next

  y = nominator / n
  Console.Write(y)
```

```
  Console.ReadKey()
End Sub
```

25. Solution

```
Sub Main()
  Dim i, n, sign As Integer
  Dim y As Double
  Dim input As String

  Console.Write("Enter a positive integer: ")
  input = Console.ReadLine()
  Do While Int32.TryParse(input, n) = False Or n < 1
    Console.Write("Wrong number. Please enter a positive integer: ")
    input = Console.ReadLine()
  Loop

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

  sign = 1
  For i = 3 To n Step 2
    y += sign / i
    sign = -sign
  Next

  Console.Write(y)

  Console.ReadKey()
End Sub
```

26. Solution

```
Sub Main()
  Dim i, n As Integer
  Dim y As Double
  Dim input As String

  Console.Write("Enter a positive integer: ")
  input = Console.ReadLine()
  Do While Int32.TryParse(input, n) = False Or n < 1
    Console.Write("Wrong number. Please enter a positive integer: ")
    input = Console.ReadLine()
  Loop

  y = 0
  For i = 1 To n
    y += 1 / i ^ (n - i + 1)
  Next

  Console.Write(y)

  Console.ReadKey()
```

```
End Sub
```

27. Solution

```
Sub Main()
  Dim factorial, i, n As Integer

  Console.Write("Enter a non-negative integer: ")
  n = Console.ReadLine()

  factorial = 1
  For i = 1 To n
    factorial *= i
  Next

  Console.Write(factorial)

  Console.ReadKey()
End Sub
```

***Notice**: Please note that this Visual Basic code operates properly for all non-negative integers, including zero.*

28. Solution

First Approach

```
Const ACCURACY = 0.00001

Sub Main()
  Dim i, j As Integer
  Dim factorial, exponential_previous, exponential, x As Double

  x = Console.ReadLine()

  exponential = 0
  i = 0
  Do
    exponential_previous = exponential

    factorial = 1
    For j = 1 To i
      factorial *= j
    Next

    exponential += x ^ i / factorial

    i += 1
  Loop While Math.Abs(exponential - exponential_previous) > ACCURACY

  Console.Write("e(" & x & ") ~= " & exponential)

  Console.ReadKey()
End Sub
```

Second Approach

```
Const ACCURACY = 0.00001

Sub Main()
  Dim i, j As Integer
  Dim factorial, exponential_previous, exponential, x As Double

  x = Console.ReadLine()

  exponential = 1
  i = 1
  factorial = 1
  Do
    exponential_previous = exponential

    factorial *= i

    exponential += x ^ i / factorial

    i += 1
  Loop While Math.Abs(exponential - exponential_previous) > ACCURACY

  Console.Write("e(" & x & ") ~= " & exponential)

  Console.ReadKey()
End Sub
```

29. Solution

First Approach

```
Const ACCURACY = 0.00001

Sub Main()
  Dim i, j, sign As Integer
  Dim factorial As Double
  Dim sinus, sinus_previous, x As Double

  x = Console.ReadLine()

  sign = 1
  sinus = 0
  i = 1
  Do
    sinus_previous = sinus

    factorial = 1
    For j = 1 To i
      factorial *= j
    Next

    sinus += sign * x ^ i / factorial

    sign = -sign
```

```
    i += 2
  Loop While Math.Abs(sinus - sinus_previous) > ACCURACY

  Console.Write("sin(" & x & ") ~= " & sinus)

  Console.ReadKey()
End Sub
```

Second Approach

```
Const ACCURACY = 0.00001

Sub Main()
  Dim i, j, sign As Integer
  Dim factorial As Double
  Dim sinus, sinus_previous, x As Double

  x = Console.ReadLine()

  sign = -1
  sinus = x
  i = 3
  factorial = 1
  Do
    sinus_previous = sinus

    factorial *= i * (i - 1)

    sinus += sign * x ^ i / factorial

    sign = -sign
    i += 2
  Loop While Math.Abs(sinus - sinus_previous) > ACCURACY

  Console.Write("sin(" & x & ") ~= " & sinus)

  Console.ReadKey()
End Sub
```

30. Solution

First Approach

```
Const ACCURACY = 0.00001

Sub Main()
  Dim i, j, sign As Integer
  Dim factorial As Double
  Dim cosinus, cosinus_previous, x As Double

  x = Console.ReadLine()

  sign = 1
  cosinus = 0
  i = 0
  Do
```

```
    cosinus_previous = cosinus

    factorial = 1
    For j = 1 To i
      factorial *= j
    Next

    cosinus += sign * x ^ i / factorial

    sign = -sign
    i += 2
  Loop While Math.Abs(cosinus - cosinus_previous) > ACCURACY

  Console.WriteLine("cos(" & x & ") ~= " & cosinus)

  Console.ReadKey()
End Sub
```

Second Approach

```
Const ACCURACY = 0.00001

Sub Main()
  Dim i, j, sign As Integer
  Dim factorial As Double
  Dim cosinus, cosinus_previous, x As Double

  x = Console.ReadLine()

  sign = -1
  cosinus = 1
  i = 2
  factorial = 1
  Do
    cosinus_previous = cosinus

    factorial *= i * (i - 1)

    cosinus += sign * x ^ i / factorial

    sign = -sign
    i += 2
  Loop While Math.Abs(cosinus - cosinus_previous) > ACCURACY

  Console.Write("cos(" & x & ") ~= " & cosinus)

  Console.ReadKey()
End Sub
```

31. Solution

```
Sub Main()
  Dim i As Integer
  Dim max, sum, t As Double
  Dim failure As Boolean
```

```
  Dim input As String

  max = -460
  sum = 0
  For i = 1 To 31
    Do
      Console.Write("Enter temperature for day " & i & ": ")
      input = Console.ReadLine()

      failure = False
      If Double.TryParse(input, t) = False Then
        Console.WriteLine("Please enter numeric values!")
        failure = True
      ElseIf t < -459.67 Then
        Console.WriteLine("Please enter a value greater than 459.67")
        failure = True
      End If
    Loop While failure = True

    sum += t
    If t > max Then
      max = t
    End If
  Next

  Console.Write(sum / 31 & ", " & max)

  Console.ReadKey()
End Sub
```

32. Solution

```
Sub Main()
  Dim hour, max_hour, max_minutes, min_hour, min_minutes, minutes As Integer
  Dim level, max, min As Double

  level = Console.ReadLine()
  If level <> 9999 Then
    hour = Console.ReadLine()
    minutes = Console.ReadLine()

    max = level
    max_hour = hour
    max_minutes = minutes

    min = level
    min_hour = hour
    min_minutes = minutes

    level = Console.ReadLine()
    Do While level <> 9999
      hour = Console.ReadLine()
      minutes = Console.ReadLine()
```

```
      If level > max Then
        max = level
        max_hour = hour
        max_minutes = minutes
      End If

      If level < min Then
        min = level
        min_hour = hour
        min_minutes = minutes
      End If

      level = Console.ReadLine()
    Loop

    Console.WriteLine(max & ", " & max_hour & ", " & max_minutes)
    Console.WriteLine(min & ", " & min_hour & ", " & min_minutes)
  End If

  Console.ReadKey()
End Sub
```

33. Solution

```
Sub Main()
  Dim a, b, c, i As Integer
  Dim alphabet, input As String
  Dim failure As Boolean

  alphabet = "abcdefghijklmnopqrstuvwxyz"

  Do
    Console.Write("Enter an integer between 1 and 26: ")
    input = Console.ReadLine()

    failure = False
    If Int32.TryParse(input, a) = False Then
      Console.WriteLine("Please enter numeric values!")
      failure = True
    ElseIf a < 1 Then
      Console.WriteLine("Please enter positive integers!")
      failure = True
    ElseIf a > 26 Then
      Console.WriteLine("Please enter a value less than or equal to 26!")
      failure = True
    End If
  Loop While failure = True

  Do
    Console.Write("Enter an integer between 1 and 26: ")
    input = Console.ReadLine()

    failure = False
    If Int32.TryParse(input, b) = False Then
```

```
      Console.WriteLine("Please enter numeric values!")
      failure = True
    ElseIf b < 1 Then
      Console.WriteLine("Please enter positive integers!")
      failure = True
    ElseIf b > 26 Then
      Console.WriteLine("Please enter a value less than or equal to 26!")
      failure = True
    End If
  Loop While failure = True

  If a > b Then
    c = a
    a = b
    b = c
  End If

  For i = a To b
    Console.Write(alphabet(i - 1))
  Next

  Console.ReadKey()
End Sub
```

34. Solution

```
Sub Main()
  Dim attempts, guess, secret_number As Integer

  Dim rnd As New Random()

  secret_number = rnd.Next(1, 101)

  attempts = 1
  Console.Write("Enter a guess: ")
  guess = Console.ReadLine()
  Do While guess <> secret_number
    If guess > secret_number Then
      Console.WriteLine("Your guess is bigger than my secret number. Try again.")
    Else
      Console.WriteLine("Your guess is smaller than my secret number. Try again.")
    End If
    attempts += 1
    Console.Write("Enter a guess: ")
    guess = Console.ReadLine()
  Loop
  Console.WriteLine("You found it!")
  Console.Write("Attempts: " & attempts)

  Console.ReadKey()
End Sub
```

35. Solution

```
Sub Main()
  Dim attempts, first_player_attempts, guess, i, secret_number As Integer

  Dim rnd As New Random()

  For i = 1 To 2
    secret_number = rnd.Next(1, 101)

    attempts = 1
    Console.Write("Enter a guess: ")
    guess = Console.ReadLine()
    Do While guess <> secret_number
      If guess > secret_number Then
        Console.WriteLine("Your guess is bigger than my secret number. Try again.")
      Else
        Console.WriteLine("Your guess is smaller than my secret number. Try again.")
      End If
      attempts += 1
      Console.Write("Enter a guess: ")
      guess = Console.ReadLine()
    Loop
    Console.WriteLine("You found it!")
    Console.WriteLine("Attempts: " & attempts)

    If i = 1 Then
      first_player_attempts = attempts
    End If
  Next

  If first_player_attempts < attempts Then
    Console.WriteLine("First player wins!")
  ElseIf first_player_attempts > attempts Then
    Console.WriteLine("Second player wins!")
  Else
    Console.WriteLine("It's a draw")
  End If

  Console.ReadKey()
End Sub
```

36. Solution

```
Sub Main()
  Dim choice, diagonal As Integer

  Do
    Console.WriteLine("1. 4/3 TV Screen")
    Console.WriteLine("2. 16/9 TV Screen")
    Console.WriteLine("3. Exit")
    Console.Write("Enter a choice: ")
    choice = Console.ReadLine()
```

```
    If choice = 1 Then
      Console.WriteLine("Enter diagonal: ")
      diagonal = Console.ReadLine()
      Console.WriteLine("Width: " & (diagonal * 0.8))
      Console.WriteLine("Height: " & (diagonal * 0.6))
    ElseIf choice = 2 Then
      Console.WriteLine("Enter diagonal: ")
      diagonal = Console.ReadLine()
      Console.WriteLine("Width: " & (diagonal * 0.87))
      Console.WriteLine("Height: " & (diagonal * 0.49))
    End If
  Loop While choice <> 3
End Sub
```

37. Solution

```
Sub Main()
  Dim count_a, count_a_boys, count_b, count_cdef_girls, grade As Integer
  Dim i, max, min, n, sum, sum_a, sum_a_boys, sum_b As Integer
  Dim sex, input As String

  Console.Write("Enter total number of students: ")
  input = Console.ReadLine()
  Do While Int32.TryParse(input, n) = False Or n < 1
    Console.Write("Wrong number. Please enter total number of students: ")
    input = Console.ReadLine()
  Loop

  sum = 0
  sum_a = 0
  count_a = 0
  sum_b = 0
  count_b = 0
  sum_a_boys = 0
  count_a_boys = 0
  count_cdef_girls = 0

  max = -1
  min = 101

  For i = 1 To n
    Console.Write("Enter grade for student No " & i & ": ")
    input = Console.ReadLine()
    Do While Int32.TryParse(input, grade) = False Or grade < 0 Or grade > 100
      Console.Write("Wrong grade. Please enter grade for student No " & i & ": ")
      input = Console.ReadLine()
    Loop

    Console.Write("Enter sex for student No " & i & ": ")
    sex = Console.ReadLine()
    sex = sex.ToUpper()
    Do While sex <> "M" And sex <> "F"
      Console.Write("Wrong sex. Please enter sex for student No " & i & ": ")
```

```
      sex = Console.ReadLine()
      sex = sex.ToUpper()
    Loop

    If grade >= 90 And grade <= 100 Then
      sum_a += grade
      count_a += 1
      If sex = "M" Then
        sum_a_boys += grade
        count_a_boys += 1
      End If
    ElseIf grade >= 80 And grade <= 89 Then
      sum_b += grade
      count_b += 1
    Else
      If sex = "F" Then
        count_cdef_girls += 1
      End If
    End If

    If grade > max Then
      max = grade
    End If

    If grade < min Then
      min = grade
    End If

    sum += grade
  Next

  If count_a > 0 Then
    Console.Write("The average value of those who got an 'A' is: ")
    Console.WriteLine(sum_a / count_a)
  End If
  If count_b > 0 Then
    Console.Write("The average value of those who got a 'B' is: ")
    Console.WriteLine(sum_b / count_b)
  End If
  If count_a_boys > 0 Then
    Console.Write("The average value of boys who got an 'A' is: ")
    Console.WriteLine(sum_a_boys / count_a_boys)
  End If
  Console.WriteLine("The total number of girls that got less than 'B' is: " & count_cdef_girls)
  Console.WriteLine("The highest grade is: " & max)
  Console.WriteLine("The lowest grade is: " & min)
  Console.Write("The average grade of the whole class is: " & sum / n)

  Console.ReadKey()
End Sub
```

38. Solution

```
Sub Main()
```

```
  Dim amount, discount As Double
  Dim answer, input As String

  Do
    Console.Write("Enter amount: ")
    input = Console.ReadLine()
    Do While Double.TryParse(input, amount) = False Or amount < 0
      Console.WriteLine("Wrong amount. Please enter amount: ")
      input = Console.ReadLine()
    Loop

    If amount < 20 Then
      discount = 0
    ElseIf amount < 50 Then
      discount = 3
    ElseIf amount < 100 Then
      discount = 5
    Else
      discount = 10
    End If

    Console.WriteLine("Discount: " & discount & "%")
    Console.WriteLine("Amount to pay (discount included): " & (amount - amount * discount / 100))

    Console.Write("Would you like to repeat? ")
    answer = Console.ReadLine()
  Loop While answer.ToUpper() = "YES"
End Sub
```

39. Solution

```
Const TAX_RATE = 0.25

Sub Main()
  Dim kwh As Integer
  Dim t As Double
  Dim input As String

  Console.Write("Enter number of Kilowatt-hours consumed: ")
  input = Console.ReadLine()
  Do While Int32.TryParse(input, kwh) = False Or kwh < 0 And kwh <> -1
    Console.Write("Wrong value. Please enter number of Kilowatt-hours consumed: ")
    input = Console.ReadLine()
  Loop

  Do While kwh <> -1
    If kwh <= 400 Then
      t = kwh * 0.11
    ElseIf kwh <= 1500 Then
      t = 400 * 0.11 + (kwh - 400) * 0.22
    ElseIf kwh <= 3500 Then
      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
```

```
    End If

    t += t * TAX_RATE
    Console.WriteLine("Total amount to pay (taxes included): " & t)

    Console.Write("Enter number of Kilowatt-hours consumed: ")
    input = Console.ReadLine()
    Do While Int32.TryParse(input, kwh) = False Or kwh < 0 And kwh <> -1
      Console.Write("Wrong value. Please enter number of Kilowatt-hours consumed: ")
      input = Console.ReadLine()
    Loop
  Loop

  Console.ReadKey()
End Sub
```

Chapter 32

32.3 Answers of Review Questions: True/False

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

32.4 Answers of Review Exercises

1. Solution

Weights =

170	*0*
190	*1*
193	*2*
165	*3*
200	*4*

People

2. Solution

Names =

John Thompson
Ava Brown
Ryan Miller
Antony Harris
Alexander Lewis
Samantha Clark
Chloe Parker

Weights =

170	*0*
190	*1*
193	*2*
165	*3*
200	*4*
170	*5*
172	*6*

People

3. Solution

Months

0 *1* *2*

Names =

Toba
Issyk Kul
Baikal
Crater
Karakul

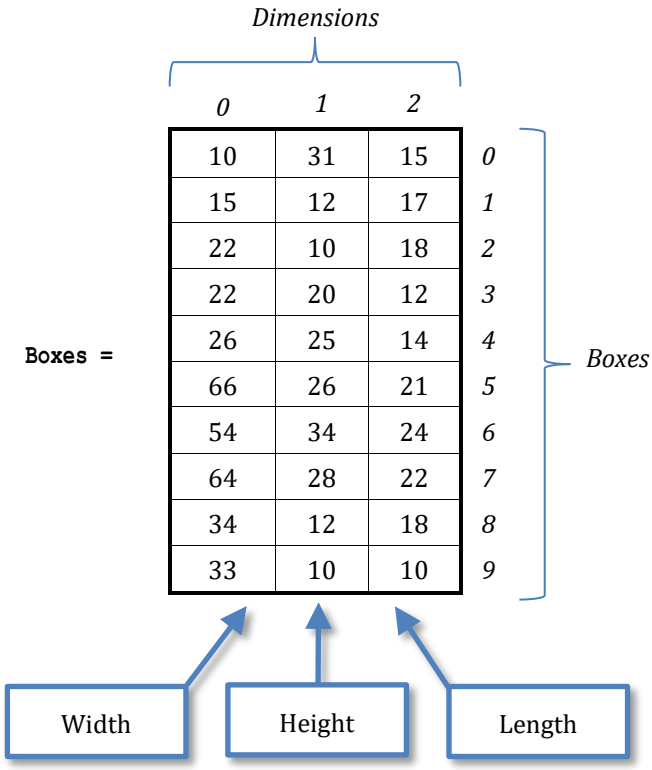
Areas =

440	438	437	*0*
2408	2405	2402	*1*
12248	12247	12240	*2*
21	20	18	*3*
150	145	142	*4*

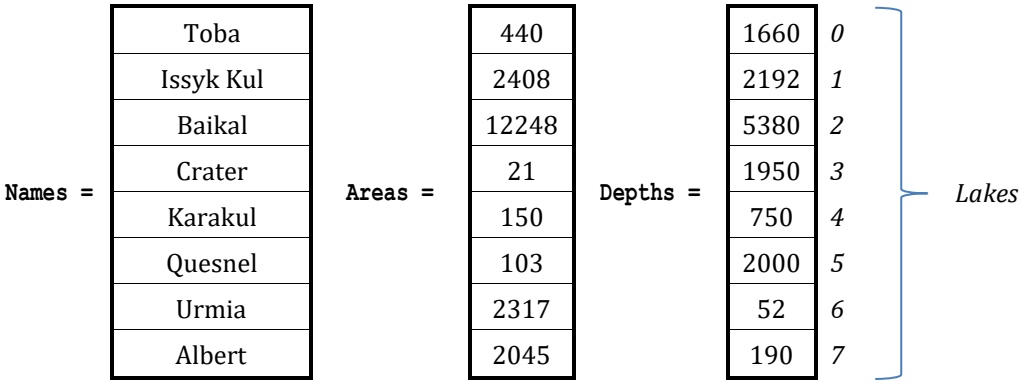
Lakes

June July August

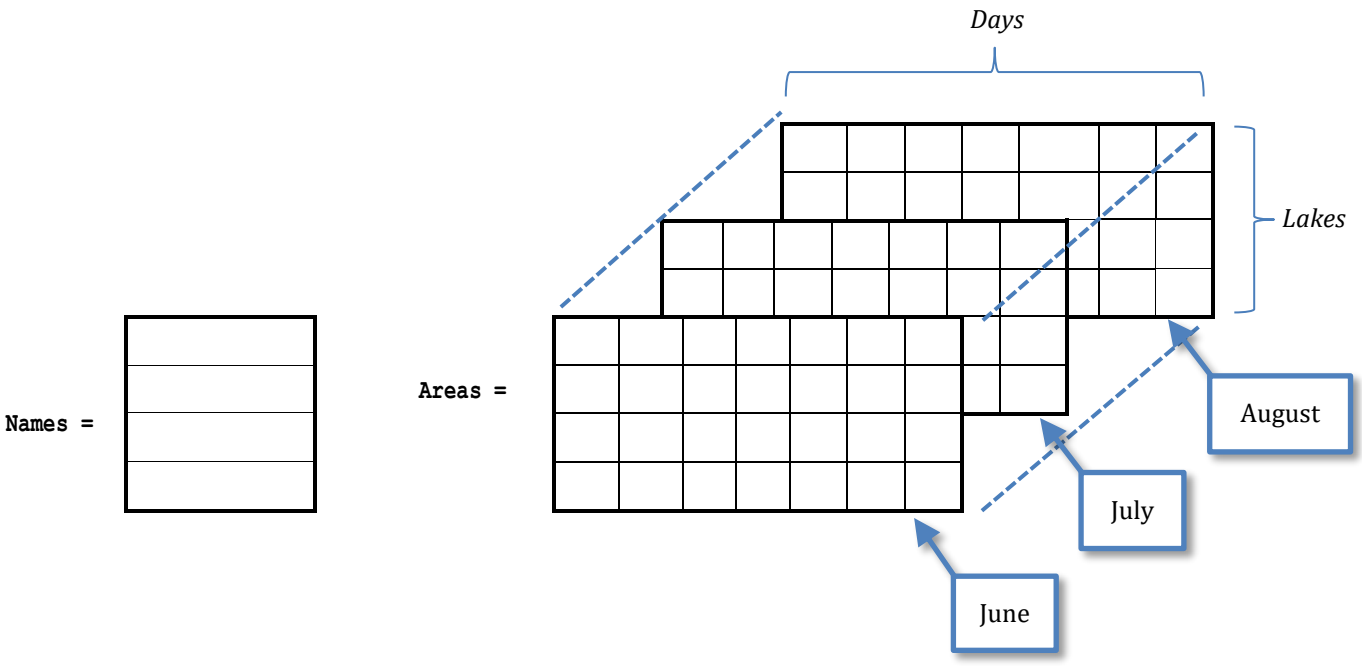
4. Solution



5. Solution



6. Solution



Chapter 33

33.5 Answers of Review Questions: True/False

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

33.6 Answers of Review Questions: Multiple Choice

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

33.7 Answers of Review Exercises

1. Solution

Step	Statement	x	a(0)	a(1)	a(2)
1	`Dim a(2) As Integer`	?	?	?	?
2	`a(2) = 1`	?	?	?	**1**
3	`x = 0`	**0**	?	?	1
4	`a(x + a(2)) = 4`	0	?	**4**	1
5	`a(x) = a(x + 1) * 4`	0	**16**	4	1

2. Solution

Step	Statement	x	a(0)	a(1)	a(2)	a(3)	a(4)
1	`Dim a(4) As Integer`	?	?	?	?	?	?
2	`a(1) = 5`	?	?	5	?	?	?
3	`x = 0`	0	?	5	?	?	?
4	`a(x) = 4`	0	4	5	?	?	?
5	`a(a(0)) = a(x + 1) Mod 3`	0	4	5	?	?	2

6	a(a(0) / 2) = 10	0	4	5	10	?	2
7	x += 2	2	4	5	10	?	2
8	a(x + 1) = a(x) + 9	2	4	5	10	19	2

3. Solution

For input value of 3

Step	Statement	x	a(0)	a(1)	a(2)	a(3)
1	Dim a(3) As Integer	?	?	?	?	?
2	a(1) = Console.ReadLine()	?	?	**3**	?	?
3	x = 0	**0**	?	3	?	?
4	a(x) = 3	0	**3**	3	?	?
5	a(a(0)) = a(x + 1) Mod 2	0	3	3	?	**1**
6	a(a(0) Mod 2) = 10	0	3	**10**	?	1
7	x += 1	**1**	3	10	?	1
8	a(x + 1) = a(x) + 9	1	3	10	**19**	1

For input value of 4

Step	Statement	x	a(0)	a(1)	a(2)	a(3)
1	Dim a(3) As Integer	?	?	?	?	?
2	a(1) = Console.ReadLine()	?	?	**4**	?	?
3	x = 0	**0**	?	4	?	?
4	a(x) = 3	0	**3**	4	?	?
5	a(a(0)) = a(x + 1) Mod 2	0	3	4	?	**0**
6	a(a(0) Mod 2) = 10	0	3	**10**	?	0
7	x += 1	**1**	3	10	?	0
8	a(x + 1) = a(x) + 9	1	3	10	**19**	0

For input value of 1

Step	Statement	x	a(0)	a(1)	a(2)	a(3)
1	Dim a(3) As Integer	?	?	?	?	?
2	a(1) = Console.ReadLine()	?	?	**1**	?	?
3	x = 0	**0**	?	1	?	?
4	a(x) = 3	0	**3**	1	?	?
5	a(a(0)) = a(x + 1) Mod 2	0	3	1	?	**3**
6	a(a(0) Mod 2) = 10	0	3	**10**	?	3
7	x += 1	**1**	3	10	?	3
8	a(x + 1) = a(x) + 9	1	3	10	**19**	3

4. Solution

For input value of 100

Step	Statement	x	a(0)	a(1)	a(2)	a(3)
1	`Dim a(3) As Integer`	?	?	?	?	?
2	`a(1) = Console.ReadLine()`	?	?	**100**	?	?
3	`x = 0`	**0**	?	100	?	?
4	`a(x) = 3`	0	**3**	100	?	?
5	`a(a(0)) = a(x + 1) Mod 10`	0	3	100	?	**0**
6	`If a(3) > 5 Then`			False		
7	`a(2) = 3`	0	3	100	**3**	0

For input value of 108

Step	Statement	x	a(0)	a(1)	a(2)	a(3)
1	`Dim a(3) As Integer`	?	?	?	?	?
2	`a(1) = Console.ReadLine()`	?	?	**108**	?	?
3	`x = 0`	**0**	?	108	?	?
4	`a(x) = 3`	0	**3**	108	?	?
5	`a(a(0)) = a(x + 1) Mod 10`	0	3	108	?	**8**
6	`If a(3) > 5 Then`			True		
7	`a(a(0) Mod 2) = 9`	0	3	**9**	?	8
8	`x += 1`	**1**	3	9	?	8
9	`a(x + 1) = a(x) + 9`	1	3	9	**18**	8

For input value of 1

Step	Statement	x	a(0)	a(1)	a(2)	a(3)
1	`Dim a(3) As Integer`	?	?	?	?	?
2	`a(1) = Console.ReadLine()`	?	?	**1**	?	?
3	`x = 0`	**0**	?	1	?	?
4	`a(x) = 3`	0	**3**	1	?	?
5	`a(a(0)) = a(x + 1) Mod 10`	0	3	1	?	**1**
6	`If a(3) > 5 Then`			False		
7	`a(2) = 3`	0	3	1	**3**	1

5. Solution

Step	Statement	x	y	a(0)	a(1)	a(2)
1	`Dim a(2) As Integer`	?	?	?	?	?
2	`x = 4`	**4**	?	?	?	?
3	`y = x - 1`	4	**3**	?	?	?

4, 5	If x **>** y Then
	  a(0) = **1**
	Else
	  a(0) = y
	End If
		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) **Mod** 2	4	2	1	7	**1**

6. Solution

Step	Statement	i	a(0)	a(1)	a(2)	a(3)	a(4)	a(5)
1	Dim a() As Integer = {17, 12, 45, 12, 12, 49}	?	**17**	**12**	**45**	**12**	**12**	**49**
2	i = 0	**0**	17	12	45	12	12	49
3	i <= 5				True			
4	If a(i) = 12 Then				False			
5	a(i) += 1	0	**18**	12	45	12	12	49
6	i += 1	**1**	18	12	45	12	12	49
7	i <= 5				True			
8	If a(i) = 12 Then				True			
9	a(i) -= 1	1	18	**11**	45	12	12	49
10	i += 1	**2**	18	11	45	12	12	49
11	i <= 5				True			
12	If a(i) = 12 Then				False			
13	a(i) += 1	2	18	11	**46**	12	12	49
14	i += 1	**3**	18	11	46	12	12	49
15	i <= 5				True			
16	If a(i) = 12 Then				True			
17	a(i) -= 1	3	18	11	46	**11**	12	49
18	i += 1	**4**	18	11	46	11	12	49
19	i <= 5				True			
20	If a(i) = 12 Then				True			
21	a(i) -= 1	4	18	11	46	11	**11**	49
22	i += 1	**5**	18	11	46	11	11	49
23	i <= 5				True			
24	If a(i) = 12 Then				False			
25	a(i) += 1	5	18	11	46	11	11	**50**
26	i += 1	**6**	18	11	46	11	11	50
27	i <= 5				False			

7. Solution

Step	Statement	i	a(0)	a(1)	a(2)	a(3)	a(4)	a(5)
1	`Dim a() As Integer = {10, 15, 12, 23, 22, 19}`	?	**10**	**15**	**12**	**23**	**22**	**19**
2	`i = 1`	**1**	10	15	12	23	22	19
3	`i <= 4`				True			
4	`a(i) = a(i + 1) + a(i - 1)`	1	10	**22**	12	23	22	19
5	`i += 1`	**2**	10	22	12	23	22	19
6	`i <= 4`				True			
7	`a(i) = a(i + 1) + a(i - 1)`	2	10	22	**45**	23	22	19
8	`i += 1`	**3**	10	22	45	23	22	19
9	`i <= 4`				True			
10	`a(i) = a(i + 1) + a(i - 1)`	3	10	22	45	**67**	22	19
11	`i += 1`	**4**	10	22	45	67	22	19
12	`i <= 4`				True			
13	`a(i) = a(i + 1) + a(i - 1)`	4	10	22	45	67	**86**	19
14	`i += 1`	**5**	10	22	45	67	86	19
15	`i <= 4`				False			

8. Solution

```
Const ELEMENTS = 100

Sub Main()
  Dim i As Integer

  Dim a(ELEMENTS - 1) As Double
  For i = 0 To ELEMENTS - 1
    a(i) = Console.ReadLine()
  Next

  For i = 0 To ELEMENTS - 1
    Console.WriteLine(a(i) ^ 3)
  Next

  Console.ReadKey()
End Sub
```

9. Solution

```
Const ELEMENTS = 80

Sub Main()
  Dim i As Integer

  Dim a(ELEMENTS - 1) As Double
  For i = 0 To ELEMENTS - 1
    a(i) = Console.ReadLine()
```

```
  Next

  For i = ELEMENTS - 1 To 0 Step -1
    Console.WriteLine(a(i) ^ 2)
  Next

  Console.ReadKey()
End Sub
```

10. Solution

```
Const ELEMENTS = 90

Sub Main()
  Dim i As Integer

  Dim a(ELEMENTS - 1) As Integer
  For i = 0 To ELEMENTS - 1
    a(i) = Console.ReadLine()
  Next

  For i = ELEMENTS - 1 To 0 Step -1
    If a(i) Mod 5 = 0 Then
      Console.WriteLine(a(i))
    End If
  Next

  Console.ReadKey()
End Sub
```

11. Solution

```
Const ELEMENTS = 50

Sub Main()
  Dim i As Integer

  Dim a(ELEMENTS - 1) As Integer
  For i = 0 To ELEMENTS - 1
    a(i) = Console.ReadLine()
  Next

  For i = 0 To ELEMENTS - 1
    If a(i) Mod 2 = 0 Or a(i) > 10 Then
      Console.WriteLine(a(i))
    End If
  Next

  Console.ReadKey()
End Sub
```

12. Solution

```
Const ELEMENTS = 30

Sub Main()
```

```
  Dim i As Integer
  Dim sum As Double

  Dim a(ELEMENTS - 1) As Double
  For i = 0 To ELEMENTS - 1
    a(i) = Console.ReadLine()
  Next

  sum = 0
  For i = 0 To ELEMENTS - 1
    If a(i) > 0 Then
      sum += a(i)
    End If
  Next
  Console.Write(sum)

  Console.ReadKey()
End Sub
```

13. Solution

```
Const ELEMENTS = 50

Sub Main()
  Dim i, sum As Integer

  Dim a(ELEMENTS - 1) As Integer
  For i = 0 To ELEMENTS - 1
    a(i) = Console.ReadLine()
  Next

  sum = 0
  For i = 0 To ELEMENTS - 1
    If a(i) >= 10 And a(i) <= 99 Then
      sum += a(i)
    End If
  Next
  Console.Write(sum)

  Console.ReadKey()
End Sub
```

14. Solution

```
Const ELEMENTS = 40

Sub Main()
  Dim i As Integer
  Dim sum_neg, sum_pos As Double

  Dim a(ELEMENTS - 1) As Double
  For i = 0 To ELEMENTS - 1
    a(i) = Console.ReadLine()
  Next

  sum_pos = 0
```

```
  sum_neg = 0
  For i = 0 To ELEMENTS - 1
    If a(i) > 0  Then
      sum_pos += a(i)
    ElseIf a(i) < 0 Then
      sum_neg += a(i)
    End If
  Next
  Console.Write(sum_pos & ", " & sum_neg)

  Console.ReadKey()
End Sub
```

15. Solution

```
Const ELEMENTS = 20

Sub Main()
  Dim i As Integer
  Dim sum As Double

  Dim a(ELEMENTS - 1) As Double
  For i = 0 To ELEMENTS - 1
    a(i) = Console.ReadLine()
  Next

  sum = 0
  For i = 0 To ELEMENTS - 1
    sum += a(i)
  Next
  Console.Write(sum / ELEMENTS)

  Console.ReadKey()
End Sub
```

16. Solution

```
Const WORDS = 50

Sub Main()
  Dim i As Integer

  Dim a(WORDS - 1) As String
  For i = 0 To WORDS - 1
    a(i) = Console.ReadLine()
  Next

  For i = 0 To WORDS - 1
    If a(i).Length >= 10  Then
      Console.WriteLine(a(i))
    End If
  Next

  Console.ReadKey()
End Sub
```

17. Solution

```
Const WORDS = 40

Sub Main()
  Dim count, i, j As Integer

  Dim a(WORDS - 1) As String
  For i = 0 To WORDS - 1
    a(i) = Console.ReadLine()
  Next

  For i = 0 To WORDS - 1
    count = 0
    For j = 0 To a(i).Length - 1
      If a(i).Substring(j, 1) = "w" Then
        count += 1
      End If
    Next
    If count >= 2 Then
      Console.WriteLine(a(i))
    End If
  Next

  Console.ReadKey()
End Sub
```

Chapter 34

34.7 Answers of Review Questions: True/False

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

34.8 Answers of Review Questions: Multiple Choice

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

34.9 Answers of Review Exercises

1. Solution

Step	Statement	x	a
1	`Dim a(1, 2) As Integer`	?	? ? ? ? ? ?
2	`a(0, 2) = 1`	?	? ? **1** ? ? ?
3	`x = 0`	**0**	? ? 1 ? ? ?
4	`a(0, x) = 9`	0	**9** ? 1 ? ? ?

5	a(0, x + a(0, 2)) = 4	0	9 **4** 1 ? ? ?
6	a(a(0, 2), 2) = 19	0	9 4 1 ? ? **19**
7	a(a(0, 2), x + 1) = 13	0	9 4 1 ? **13** 19
8	a(a(0, 2), x) = 15	0	9 4 1 **15** 13 19

2. Solution

Step	Statement	i	j	a
1	Dim a(1, 2) As Integer	?	?	? ? ? ? ? ?
2	i = 0	**0**	?	? ? ? ? ? ?
3	i <= 1			True
4	j = 0	0	**0**	? ? ? ? ? ?
5	j <= 2			True
6	a(i, j) = (i + 1) * 5 + j	0	0	**5** ? ? ? ? ?
7	j += 1	0	**1**	5 ? ? ? ? ?
8	j <= 2			True
9	a(i, j) = (i + 1) * 5 + j	0	1	5 **6** ? ? ? ?
10	j += 1	0	**2**	5 6 ? ? ? ?
11	j <= 2			True

12	`a(i, j) = (i + 1) * 5 + j`	0	2	5 6 **7** ? ? ?
13	`j += 1`	0	**3**	5 6 7 ? ? ?
14	`j <= 2`			False
15	`i += 1`	**1**	3	5 6 7 ? ? ?
16	`i <= 1`			True
17	`j = 0`	1	**0**	5 6 7 ? ? ?
18	`j <= 2`			True
19	`a(i, j) = (i + 1) * 5 + j`	1	0	5 6 7 **10** ? ?
20	`j += 1`	1	**1**	5 6 7 10 ? ?
21	`j <= 2`			True
22	`a(i, j) = (i + 1) * 5 + j`	1	1	5 6 7 10 **11** ?
23	`j += 1`	1	**2**	5 6 ? 10 11 ?
24	`j <= 2`			True
25	`a(i, j) = (i + 1) * 5 + j`	1	2	5 6 ? 10 11 **12**
26	`j += 1`	1	**3**	5 6 7 10 11 12
27	`j <= 2`			False

3. Solution

Step	Statement	i	j	a
1	`Dim a(2, 2) As Integer`	?	?	? ? ? ? ? ? ? ? ?
2	`j = 0`	?	**0**	? ? ? ? ? ? ? ? ?
3	`j <= 2`			True
4	`i = 0`	0	**0**	? ? ? ? ? ? ? ? ?
5	`i <= 2`			True
6	`a(i, j) = (i + 1) * 2 + j * 4`	0	0	**2** ? ? ? ? ? ? ? ?
7	`i += 1`	**1**	0	2 ? ? ? ? ? ? ? ?
8	`i <= 2`			True
9	`a(i, j) = (i + 1) * 2 + j * 4`	1	0	2 ? ? **4** ? ? 6 ? ?
10	`i += 1`	**2**	0	2 ? ? 4 ? ? 6 ? ?
11	`i <= 2`			True
12	`a(i, j) = (i + 1) * 2 + j * 4`	2	0	2 ? ? 4 ? ? **6** ? ?
13	`i += 1`	**3**	0	2 ? ? 4 ? ? 6 ? ?
14	`i <= 2`			False

15	`j += 1`	3	**1**	2 ? ? 4 ? ? 6 ? ?
16	`j <= 2`			True
17	`i = 0`	**0**	1	2 ? ? 4 ? ? 6 ? ?
18	`i <= 2`			True
19	`a(i, j) = (i + 1) * 2 + j * 4`	0	1	2 **6** ? 4 ? ? 6 ? ?
20	`i += 1`	**1**	1	2 6 ? 4 ? ? 6 ? ?
21	`i <= 2`			True
22	`a(i, j) = (i + 1) * 2 + j * 4`	1	1	2 6 ? 4 **8** ? 6 ? ?
23	`i += 1`	**2**	1	2 6 ? 4 8 ? 6 ? ?
24	`i <= 2`			True
25	`a(i, j) = (i + 1) * 2 + j * 4`	2	1	2 6 ? 4 8 ? 6 **10** ?
26	`i += 1`	**3**	1	2 6 ? 4 8 ? 6 10 ?
27	`i <= 2`			False
28	`j += 1`	3	**2**	2 6 ? 4 8 ? 6 10 ?

29	`j <= 2`			True
30	`i = 0`	**0**	2	2 6 ? 4 8 ? 6 10 ?
31	`i <= 2`			True
32	`a(i, j) = (i + 1) * 2 + j * 4`	0	2	2 6 **10** 4 8 ? 6 10 ?
33	`i += 1`	**1**	2	2 6 10 4 8 ? 6 10 ?
34	`i <= 2`			True
35	`a(i, j) = (i + 1) * 2 + j * 4`	1	2	2 6 10 4 8 **12** 6 10 ?
36	`i += 1`	**2**	2	2 6 10 4 8 12 6 10 ?
37	`i <= 2`			True
38	`a(i, j) = (i + 1) * 2 + j * 4`	2	2	2 6 10 4 8 12 6 10 **14**
39	`i += 1`	**3**	2	2 6 10 4 8 12 6 10 14
40	`i <= 2`			False
41	`j += 1`	3	**3**	2 6 10 4 8 12 6 10 14
42	`j <= 2`			False

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

```
Const ROWS = 10
Const COLUMNS = 15

Sub Main()
  Dim i, j As Integer

  Dim a(ROWS - 1,  COLUMNS - 1) As Integer
  For i = 0 To ROWS - 1
    For j = 0 To COLUMNS - 1
      a(i, j) = Console.ReadLine()
    Next
  Next

  For i = 0 To ROWS - 1
    For j = 0 To COLUMNS - 1
      If a(i, j) Mod 2 <> 0 Then
        Console.WriteLine(i & ", " & j)
      End If
    Next
  Next

  Console.ReadKey()
End Sub
```

10. Solution

```
Const ROWS = 10
Const COLUMNS = 6

Sub Main()
  Dim i, j As Integer

  Dim a(ROWS - 1,  COLUMNS - 1) As Double
  For i = 0 To ROWS - 1
    For j = 0 To COLUMNS - 1
      a(i, j) = Console.ReadLine()
    Next
  Next

  For i = 0 To ROWS - 1
    For j = 0 To COLUMNS - 1 Step 2
      Console.WriteLine(a(i, j))
    Next
  Next

  Console.ReadKey()
End Sub
```

11. Solution

```
Const ROWS = 12
```

```
Const COLUMNS = 8

Sub Main()
  Dim i, j As Integer
  Dim sum As Double

  Dim a(ROWS - 1,  COLUMNS - 1) As Double
  For i = 0 To ROWS - 1
    For j = 0 To COLUMNS - 1
      a(i, j) = Console.ReadLine()
    Next
  Next

  sum = 0
  For i = 1 To ROWS - 1 Step 2
    For j = 0 To COLUMNS - 1 Step 2
      sum += a(i, j)
    Next
  Next
  Console.Write(sum)

  Console.ReadKey()
End Sub
```

12. Solution

```
Const N = 8

Sub Main()
  Dim i, j, k As Integer
  Dim sum_antidiagonal, sum_diagonal As Double

  Dim a(N - 1,  N - 1) As Double
  For i = 0 To N - 1
    For j = 0 To N - 1
      a(i, j) = Console.ReadLine()
    Next
  Next

  sum_diagonal = 0
  sum_antidiagonal = 0
  For k = 0 To N - 1
    sum_diagonal += a(k, k)
    sum_antidiagonal += a(k, N - k - 1)
  Next
  Console.Write(sum_diagonal / N & ", " & sum_antidiagonal / N)

  Console.ReadKey()
End Sub
```

13. Solution

```
Const N = 5
```

```
Sub Main()
  Dim i, j As Integer

  Dim a(N - 1,  N - 1) As Integer
  For i = 0 To N - 1
    For j = 0 To N - 1
      If i = N - j - 1 Then
        a(i, j) = 5
      ElseIf i > N - j - 1 Then
        a(i, j) = 88
      Else
        a(i, j) = 11
      End If
    Next
  Next

  For i = 0 To N - 1
    For j = 0 To N - 1
      Console.Write(a(i, j) & vbTab)
    Next
    Console.WriteLine()
  Next

  Console.ReadKey()
End Sub
```

14. Solution

```
Const N = 5

Sub Main()
  Dim i, j As Integer

  Dim a(N - 1,  N - 1) As Integer
  For i = 0 To N - 1
    For j = 0 To N - 1
      If i = N - j - 1 Then
        a(i, j) = 5
      ElseIf i > N - j - 1 Then
        a(i, j) = 88
      Else
        a(i, j) = 11
      End If
      If i = j Then
        a(i, j) = 0
      End If
    Next
  Next

  For i = 0 To N - 1
    For j = 0 To N - 1
      Console.Write(a(i, j) & vbTab)
    Next
```

```
    Console.WriteLine()
  Next

  Console.ReadKey()
End Sub
```

15. Solution

```
Const ROWS = 5
Const COLUMNS = 4

Sub Main()
  Dim i, j As Integer

  Dim a(ROWS - 1,  COLUMNS - 1) As Double
  For i = 0 To ROWS - 1
    For j = 0 To COLUMNS - 1
      a(i, j) = Console.ReadLine()
    Next
  Next

  For i = 0 To ROWS - 1
    For j = 0 To COLUMNS - 1
      If a(i, j) = Fix(a(i, j)) Then
        Console.WriteLine(i & ", " & j)
      End If
    Next
  Next

  Console.ReadKey()
End Sub
```

16. Solution

```
Const ROWS = 10
Const COLUMNS = 4

Sub Main()
  Dim count, i, j As Integer

  Dim a(ROWS - 1,  COLUMNS - 1) As Double
  For i = 0 To ROWS - 1
    For j = 0 To COLUMNS - 1
      a(i, j) = Console.ReadLine()
    Next
  Next

  count = 0
  For i = 0 To ROWS - 1
    For j = 0 To COLUMNS - 1
      If a(i, j) < 0 Then
        count += 1
      End If
```

```
    Next
  Next
  Console.Write(count)

  Console.ReadKey()
End Sub
```

17. Solution

```
Const ROWS = 3
Const COLUMNS = 4

Sub Main()
  Dim i, j As Integer

  Dim a(ROWS - 1,  COLUMNS - 1) As String
  For i = 0 To ROWS - 1
    For j = 0 To COLUMNS - 1
      a(i, j) = Console.ReadLine()
    Next
  Next

  For i = 0 To ROWS - 1
    For j = 0 To COLUMNS - 1
      Console.Write(a(i, j) & " ")
    Next
  Next

  Console.ReadKey()
End Sub
```

18. Solution

```
Const ROWS = 20
Const COLUMNS = 14

Sub Main()
  Dim i, j As Integer

  Dim a(ROWS - 1,  COLUMNS - 1) As String
  For i = 0 To ROWS - 1
    For j = 0 To COLUMNS - 1
      a(i, j) = Console.ReadLine()
    Next
  Next

  For i = 0 To ROWS - 1
    For j = 0 To COLUMNS - 1
      If a(i, j).Length < 5 Then
        Console.WriteLine(a(i, j))
      End If
    Next
  Next
```

```
  Console.ReadKey()
End Sub
```

19. Solution

First Approach

```
Const ROWS = 20
Const COLUMNS = 14

Sub Main()
  Dim i, j, k As Integer

  Dim a(ROWS - 1,  COLUMNS - 1) As String
  For i = 0 To ROWS - 1
    For j = 0 To COLUMNS - 1
      a(i, j) = Console.ReadLine()
    Next
  Next

  Dim length_limits() As Integer = {5, 10, 20}

  For k = 0 To 2
    For i = 0 To ROWS - 1
      For j = 0 To COLUMNS - 1
        If a(i, j).Length < length_limits(k) Then
          Console.WriteLine(a(i, j))
        End If
      Next
    Next
  Next

  Console.ReadKey()
End Sub
```

Second Approach

```
Const ROWS = 20
Const COLUMNS = 14

Sub Main()
  Dim i, j, k As Integer

  Dim a(ROWS - 1,   COLUMNS - 1) As String
  For i = 0 To ROWS - 1
    For j = 0 To COLUMNS - 1
      a(i, j) = Console.ReadLine()
    Next
  Next

  For k = 0 To 2
    For i = 0 To ROWS - 1
      For j = 0 To COLUMNS - 1
        If a(i, j).Length < 5 * 2 ^ k Then
          Console.WriteLine(a(i, j))
```

```
        End If
      Next
    Next
  Next

  Console.ReadKey()
End Sub
```

Chapter 35

35.7 Answers of Review Questions: True/False

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

35.8 Answers of Review Questions: Multiple Choice

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

35.9 Answers of Review Exercises

1. Solution

```
Const STUDENTS = 15
Const TESTS = 5

Sub Main()
  Dim i, j As Integer

  Dim grades(STUDENTS - 1,  TESTS - 1) As Integer
  For i = 0 To STUDENTS - 1
    For j = 0 To TESTS - 1
      grades(i, j) = Console.ReadLine()
    Next
  Next

  Dim average(STUDENTS - 1) As Double
  For i = 0 To STUDENTS - 1
    average(i) = 0
    For j = 0 To TESTS - 1
      average(i) += grades(i, j)
    Next
    average(i) /= TESTS
  Next

  For i = 0 To STUDENTS - 1
    Console.Write("Student No " & (i + 1) & ": ")

    If average(i) < 60 Then
      Console.WriteLine("E/F")
    ElseIf average(i) < 70 Then
      Console.WriteLine("D")
    ElseIf average(i) < 80 Then
      Console.WriteLine("C")
    ElseIf average(i) < 90 Then
```

```
      Console.WriteLine("B")
    Else
      Console.WriteLine("A")
    End If
  Next

  Console.ReadKey()
End Sub
```

2. Solution

```
Const OBJECTS = 5
Const FALLS = 10

Sub Main()
  Dim i, j, sum As Integer

  Dim g(OBJECTS - 1, FALLS - 1) As Integer
  For i = 0 To OBJECTS - 1
    For j = 0 To FALLS - 1
      g(i, j) = Console.ReadLine()
    Next
  Next

  For i = 0 To OBJECTS - 1
    sum = 0
    For j = 0 To FALLS - 1
      sum += g(i, j)
    Next
    Console.WriteLine("Average g for object No " & (i + 1) & ": " & (sum / FALLS))
  Next

  For j = 0 To FALLS - 1
    sum = 0
    For i = 0 To OBJECTS - 1
      sum += g(i, j)
    Next
    Console.WriteLine("Average g for fall No " & (j + 1) & ": " & (sum / OBJECTS))
  Next

  sum = 0
  For i = 0 To OBJECTS - 1
    For j = 0 To FALLS - 1
      sum += g(i, j)
    Next
  Next
  Console.Write("Overall average g: " & (sum / (OBJECTS * FALLS)))

  Console.ReadKey()
End Sub
```

3. Solution

```
Const PLAYERS = 15
Const MATCHES = 12

Sub Main()
  Dim i, j, sum As Integer

  Dim points(PLAYERS - 1,  MATCHES - 1) As Integer
  For i = 0 To PLAYERS - 1
    For j = 0 To MATCHES - 1
      points(i, j) = Console.ReadLine()
    Next
  Next

  For i = 0 To PLAYERS - 1
    sum = 0
    For j = 0 To MATCHES - 1
      sum += points(i, j)
    Next
    Console.WriteLine("Total number of points for player No " & (i + 1) & ": " & sum)
  Next

  For j = 0 To MATCHES - 1
    sum = 0
    For i = 0 To PLAYERS - 1
      sum += points(i, j)
    Next
    Console.WriteLine("Total number of points for match No " & (j + 1) & ": " & sum)
  Next

  Console.ReadKey()
End Sub
```

4. Solution

```
Const CITIES = 20
Const HOURS = 24

Sub Main()
  Dim i, j As Integer
  Dim sum As Double

  Dim temperatures(CITIES - 1,  HOURS - 1) As Double
  For i = 0 To CITIES - 1
    For j = 0 To HOURS - 1
      temperatures(i, j) = Console.ReadLine()
    Next
  Next

  For j = 0 To HOURS - 1
    sum = 0
    For i = 0 To CITIES - 1
```

```
      sum += temperatures(i, j)
    Next
    If sum / CITIES < 10 Then
      Console.WriteLine("Hour: " & (j + 1))
    End If
  Next

  Console.ReadKey()
End Sub
```

5. Solution

```
Const PLAYERS = 24
Const MATCHES = 10

Sub Main()
  Dim i, j, sum As Integer

  Dim names(PLAYERS - 1) As String
  Dim goals(PLAYERS - 1,  MATCHES - 1) As Integer
  For i = 0 To PLAYERS - 1
    names(i) = Console.ReadLine()
    For j = 0 To MATCHES - 1
      goals(i, j) = Console.ReadLine()
    Next
  Next

  For i = 0 To PLAYERS - 1
    sum = 0
    For j = 0 To MATCHES - 1
      sum += goals(i, j)
    Next
    Console.WriteLine(names(i) & ": " & (sum / MATCHES))
  Next

  For j = 0 To MATCHES - 1
    sum = 0
    For i = 0 To PLAYERS - 1
      sum += goals(i, j)
    Next
    Console.WriteLine("Match No " & (j + 1) & ": " & sum)
  Next

  Console.ReadKey()
End Sub
```

6. Solution

```
Const STUDENTS = 24
Const LESSONS = 10

Sub Main()
  Dim i, j, sum As Integer
```

```
  Dim names(STUDENTS - 1) As String
  Dim grades(STUDENTS - 1,  LESSONS - 1) As Integer
  For i = 0 To STUDENTS - 1
    names(i) = Console.ReadLine()
    For j = 0 To LESSONS - 1
      grades(i, j) = Console.ReadLine()
    Next
  Next

  Dim average(STUDENTS - 1) As Double
  For i = 0 To STUDENTS - 1
    sum = 0
    For j = 0 To LESSONS - 1
      sum += grades(i, j)
    Next
    average(i) = sum / LESSONS
    Console.WriteLine(names(i) & ": " & average(i))
  Next

  For j = 0 To LESSONS - 1
    sum = 0
    For i = 0 To STUDENTS - 1
      sum += grades(i, j)
    Next
    Console.WriteLine(sum / STUDENTS)
  Next

  For i = 0 To STUDENTS - 1
    If average(i) < 60 Then
      Console.WriteLine(names(i))
    End If
  Next

  For i = 0 To STUDENTS - 1
    If average(i) > 89 Then
      Console.WriteLine(names(i) & " Bravo!")
    End If
  Next

  Console.ReadKey()
End Sub
```

7. Solution

```
Const ARTISTS = 15
Const JUDGES = 5

Sub Main()
  Dim i, j, sum As Integer

  Dim judge_names(JUDGES - 1) As String
  For j = 0 To JUDGES - 1
    Console.Write("Enter name for judge No " & (j + 1) & ": ")
```

```
    judge_names(j) = Console.ReadLine()
  Next

  Dim artist_names(ARTISTS - 1) As String
  Dim song_titles(ARTISTS - 1) As String
  Dim score(ARTISTS - 1,  JUDGES - 1) As Integer
  For i = 0 To ARTISTS - 1
    Console.Write("Enter name for artist No " & (i + 1) & ": ")
    artist_names(i) = Console.ReadLine()
    Console.Write("Enter song title for artist " & artist_names(i) & ": ")
    song_titles(i) = Console.ReadLine()
    For j = 0 To JUDGES - 1
      Console.Write("Enter score for artist " & artist_names(i))
      Console.Write(" gotten from judge " & judge_names(j) & ": ")
      score(i, j) = Console.ReadLine()
    Next
  Next

  For i = 0 To ARTISTS - 1
    sum = 0
    For j = 0 To JUDGES - 1
      sum += score(i, j)
    Next
    Console.WriteLine(artist_names(i) & ", " & song_titles(i) & ": " & sum)
  Next

  For j = 0 To JUDGES - 1
    sum = 0
    For i = 0 To ARTISTS - 1
      sum += score(i, j)
    Next
    Console.WriteLine(judge_names(j) & ": " & sum / ARTISTS)
  Next

  Console.ReadKey()
End Sub
```

8. Solution

```
Const PEOPLE = 30
Const MONTHS = 12

Sub Main()
  Dim i, j, sum_heights, sum_weights As Integer
  Dim average_height, average_weight As Double

  Dim weights(PEOPLE - 1,  MONTHS - 1) As Integer
  Dim heights(PEOPLE - 1,  MONTHS - 1) As Integer
  For i = 0 To PEOPLE - 1
    For j = 0 To MONTHS - 1
      weights(i, j) = Console.ReadLine()
      heights(i, j) = Console.ReadLine()
    Next
  Next
```

```
  For i = 0 To PEOPLE - 1
    sum_weights = 0
    sum_heights = 0
    For j = 0 To MONTHS - 1
      sum_weights += weights(i, j)
      sum_heights += heights(i, j)
    Next
    average_weight = sum_weights / MONTHS
    average_height = sum_heights / MONTHS
    Console.WriteLine(average_weight & ", " & average_height)
    Console.WriteLine(average_weight * 702 / average_height ^ 2)
  Next

  For i = 0 To PEOPLE - 1
    Console.WriteLine(weights(i, 4) * 702 / heights(i, 4) ^ 2)
    Console.WriteLine(weights(i, 7) * 702 / heights(i, 7) ^ 2)
  Next

  Console.ReadKey()
End Sub
```

9. Solution

```
Const VAT = 0.19
Const CONSUMERS = 1000

Sub Main()
  Dim consumed, i As Integer
  Dim payment, sum As Double


  Dim meter_reading(CONSUMERS - 1, 1) As Integer
  For i = 0 To CONSUMERS - 1
    meter_reading(i, 0) = Console.ReadLine()
    meter_reading(i, 1) = Console.ReadLine()
  Next

  sum = 0
  For i = 0 To CONSUMERS - 1
    consumed = meter_reading(i, 1) - meter_reading(i, 0)
    Console.WriteLine(consumed)
    payment = consumed * 0.07
    payment += VAT * payment
    Console.WriteLine(payment)

    sum += consumed
  Next

  Console.Write(sum & ", " & (sum * 0.07 + sum * 0.07 * VAT))

  Console.ReadKey()
End Sub
```

10. Solution

```
Const CURRENCIES = 4
Const DAYS = 5

Sub Main()
  Dim i, j As Integer
  Dim average, sum, usd As Double

  Console.Write("Enter an amount in US dollars: ")
  usd = Console.ReadLine()

  Dim currency() As String = {"British Pound Sterling", "Euro", "Canadian Dollar", "Australian Dollar"}

  Dim rate(,) As Double = {{1.579, 1.577, 1.572, 1.58, 1.584},
                           {1.269, 1.27, 1.265, 1.24, 1.255},
                           {0.895, 0.899, 0.884, 0.888, 0.863},
                           {0.811, 0.815, 0.822, 0.829, 0.819}
                          }

  For i = 0 To CURRENCIES - 1
    sum = 0
    For j = 0 To DAYS - 1
      sum += rate(i, j)
    Next
    average = sum / DAYS
    Console.WriteLine(usd & " US dollars = " & (usd / average) & " " & currency(i) & "s")
  Next

  Console.ReadKey()
End Sub
```

11. Solution

```
Const EMPLOYEES = 10
Const DAYS = 5

Sub Main()
  Dim i, j As Integer
  Dim gross_pay, pay_rate, sum As Double

  Dim weekdays() As String = {"Monday", "Tuesday", "Wednesday", "Thursday", "Friday"}

  pay_rate = Console.ReadLine()

  Dim names(EMPLOYEES - 1) As String
  Dim hours_worked_per_day(EMPLOYEES - 1, DAYS - 1) As Integer
  For i = 0 To EMPLOYEES - 1
    names(i) = Console.ReadLine()
    For j = 0 To DAYS - 1
      hours_worked_per_day(i, j) = Console.ReadLine()
    Next
  Next
```

```
  Dim hours_worked_per_week(EMPLOYEES - 1) As Integer
  For i = 0 To EMPLOYEES - 1
    hours_worked_per_week(i) = 0
    For j = 0 To DAYS - 1
      hours_worked_per_week(i) += hours_worked_per_day(i, j)
    Next
    If hours_worked_per_week(i) > 40 Then
      Console.WriteLine(names(i))
    End If
  Next

  For i = 0 To EMPLOYEES - 1
    If hours_worked_per_week(i) <= 40 Then
      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)
    End If
    Console.WriteLine(names(i) & ", " & gross_pay)
  Next

  For i = 0 To EMPLOYEES - 1
    If hours_worked_per_week(i) > 40 Then
      For j = 0 To DAYS - 1
        If hours_worked_per_day(i, j) > 8 Then
          Console.WriteLine(names(i) & ", " & weekdays(j) & " Overtime!")
        End If
      Next
    End If
  Next

  For j = 0 To DAYS - 1
    sum = 0
    For i = 0 To EMPLOYEES - 1
      If hours_worked_per_day(i, j) <= 8 Then
        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)
      End If
      sum += gross_pay
    Next
    Console.WriteLine(weekdays(j) & ", " & sum)
  Next

  Console.ReadKey()
End Sub
```

12. Solution

```
Const ROWS = 3
Const COLUMNS = 4
Const ELEMENTS = ROWS * COLUMNS

Sub Main()
```

```
  Dim i, j, k As Integer

  Dim a(,) As Integer = {{9, 9, 2, 6},
                         {4, 1, 10, 11},
                         {12, 15, 7, 3}
                        }

  Dim b(ELEMENTS - 1) As Integer
  k = 0
  For i = 0 To ROWS - 1
    For j = 0 To COLUMNS - 1
      b(k) = a(i, j)
      k += 1
    Next
  Next

  For k = 0 To ELEMENTS - 1
    Console.Write(b(k) & " ")
  Next

  Console.ReadKey()
End Sub
```

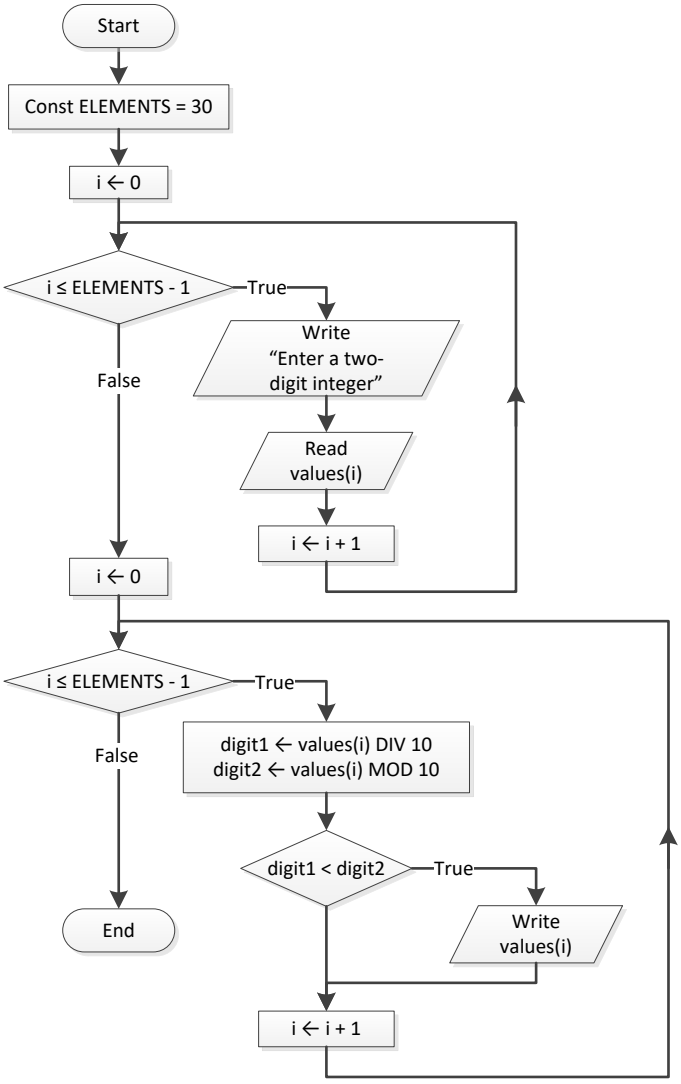
13. Solution

```
Const ROWS = 3
Const COLUMNS = 3

Sub Main()
  Dim i, j, k As Integer

  Dim a() As Integer = {16, 12, 3, 5, 6, 9, 18, 19, 20}

  Dim b(ROWS - 1, COLUMNS - 1) As Integer
  k = 0
  For i = ROWS - 1 To 0 Step -1
    For j = 0 To COLUMNS - 1
      b(i, j) = a(k)
      k += 1
    Next
  Next

  For i = 0 To ROWS - 1
    For j = 0 To COLUMNS - 1
      Console.Write(b(i, j) & vbTab)
    Next
    Console.WriteLine()
  Next

  Console.ReadKey()
End Sub
```

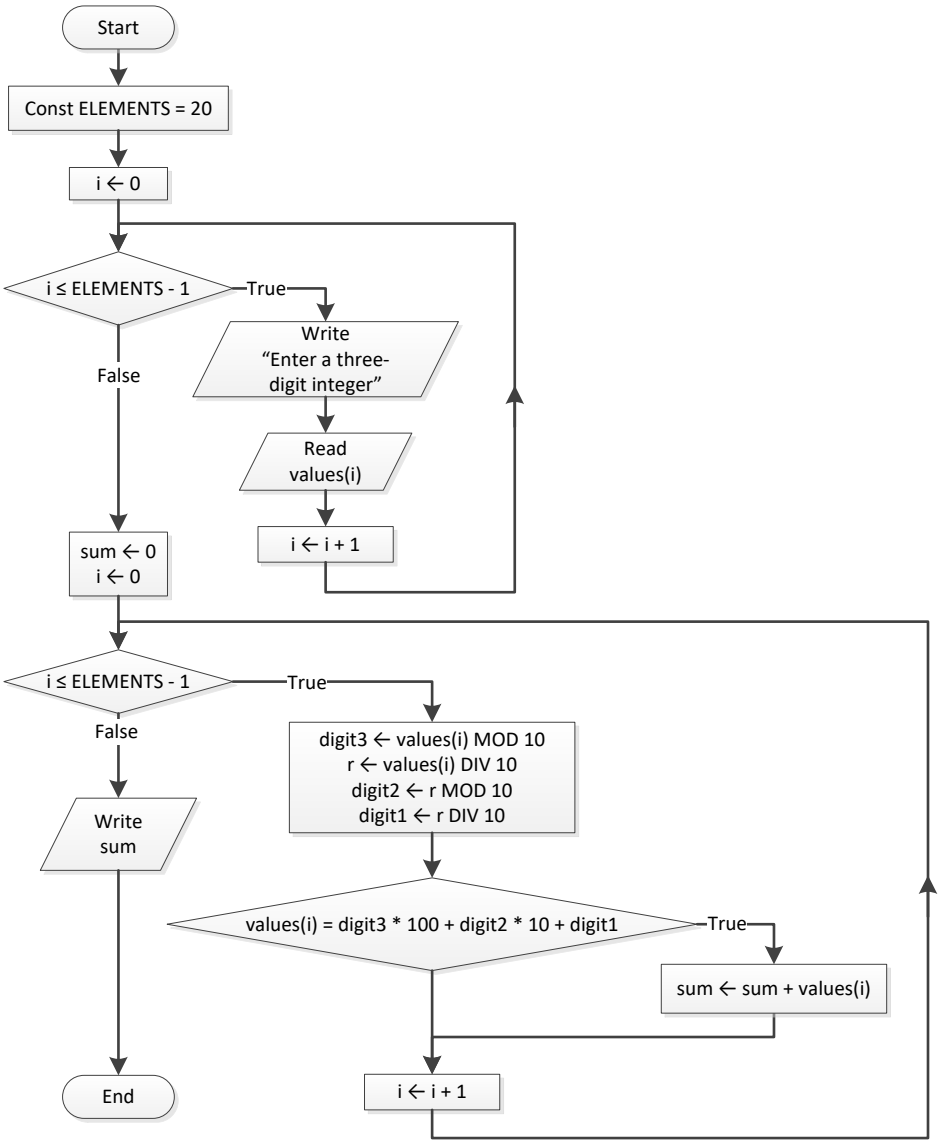
Chapter 36

36.4 Answers of Review Exercises

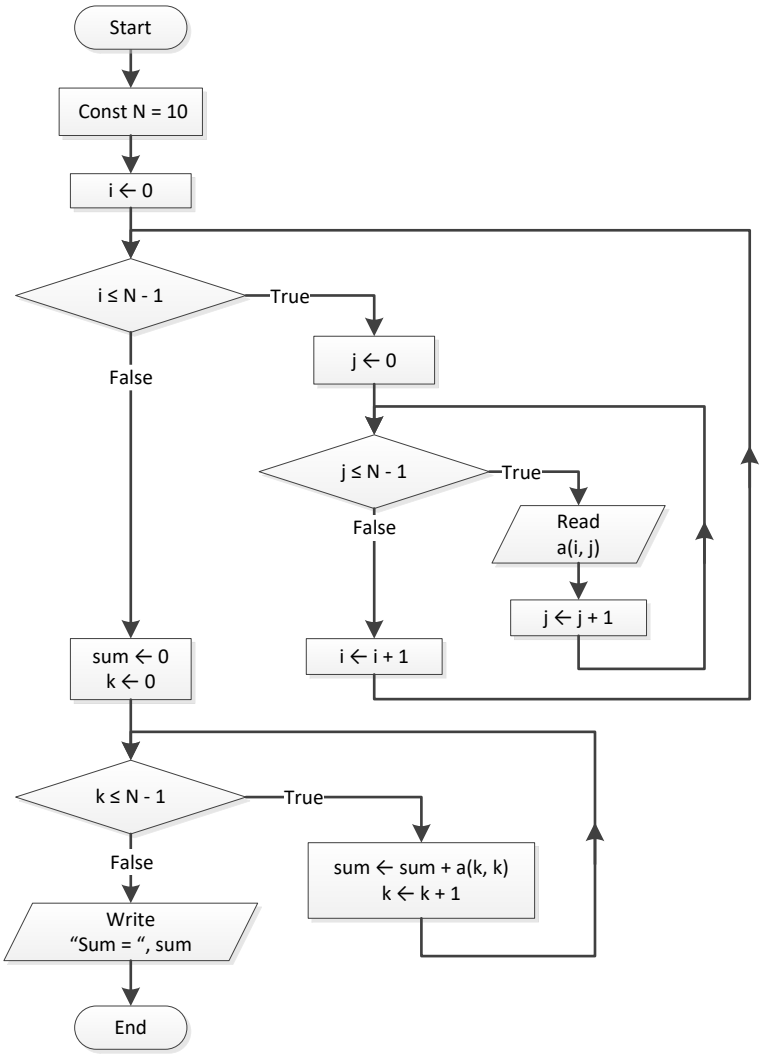
1. Solution



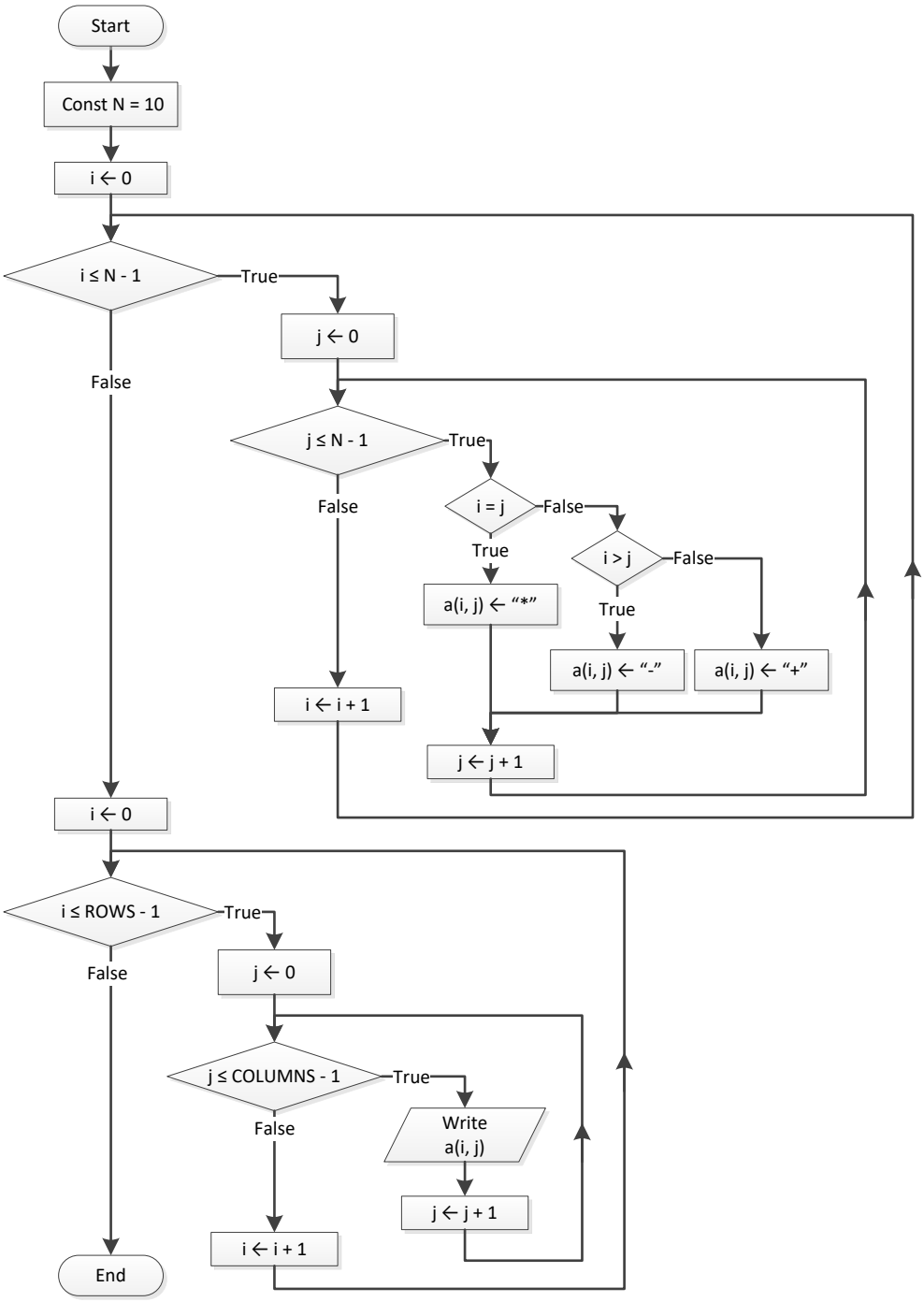
2. Solution


Start
Const ELEMENTS = 20
i ← 0
i ≤ ELEMENTS - 1
True
False
Write
"Enter a three-
digit integer"
Read
values(i)
i ← i + 1
sum ← 0
i ← 0
i ≤ ELEMENTS - 1
True
False
digit3 ← values(i) MOD 10
r ← values(i) DIV 10
digit2 ← r MOD 10
digit1 ← r DIV 10
Write
sum
values(i) = digit3 * 100 + digit2 * 10 + digit1
True
sum ← sum + values(i)
End
i ← i + 1

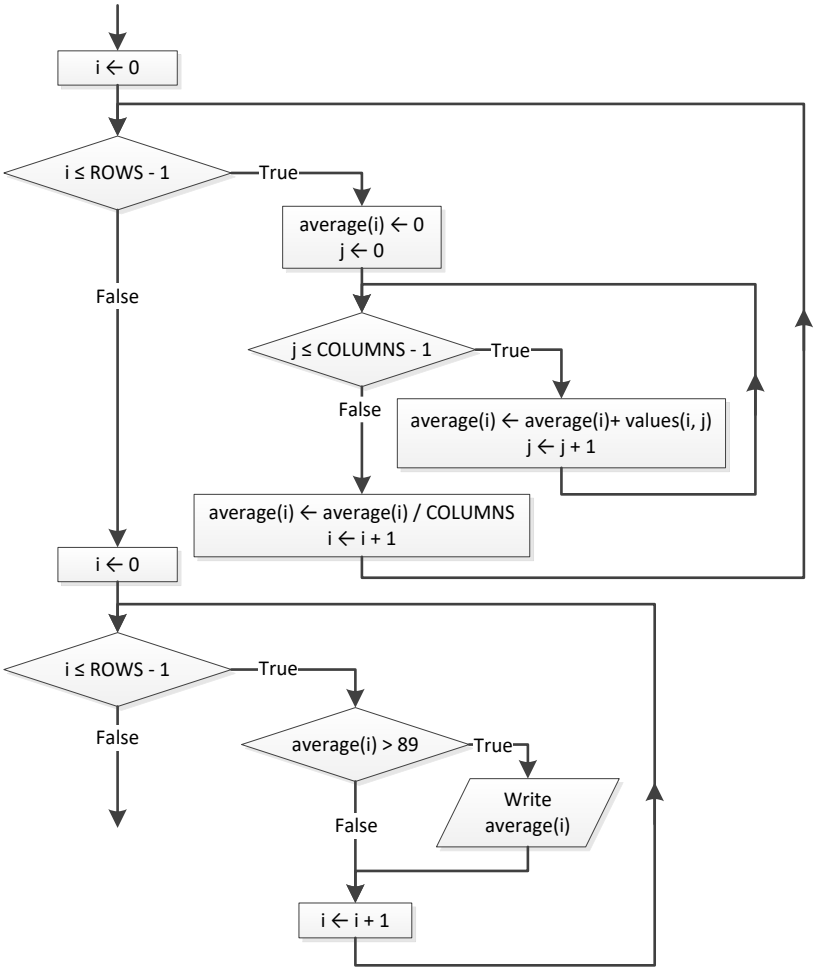
3. Solution


Start
Const N = 10
i ← 0
i ≤ N - 1
True
False
j ← 0
j ≤ N - 1
True
False
Read
a(i, j)
j ← j + 1
i ← i + 1
sum ← 0
k ← 0
k ≤ N - 1
True
False
sum ← sum + a(k, k)
k ← k + 1
Write
“Sum = “, sum
End

4. Solution


Start
Const N = 10
i ← 0
i ≤ N - 1
True
False
j ← 0
j ≤ N - 1
True
False
i = j
False
True
i > j
False
True
a(i, j) ← "*"
a(i, j) ← "-"
a(i, j) ← "+"
i ← i + 1
j ← j + 1
i ← 0
i ≤ ROWS - 1
True
False
j ← 0
j ≤ COLUMNS - 1
True
False
Write
a(i, j)
j ← j + 1
i ← i + 1
End

5. Solution



6. Solution

```
For i = 0 To PEOPLE - 1
  Do
    a(i) = Console.ReadLine()
  Loop While a(i) Mod 2 = 2
Next
```

7. Solution

```
For i = 0 To ELEMENTS - 1
  a(i) = Console.ReadLine()
  Do While a(i) < 0
    Console.WriteLine("Error")
    a(i) = Console.ReadLine()
  Loop
Next
```

8. Solution

```
i = 0
S = 0
a(i) = Console.ReadLine()
i += 1
Do While i < 90
  S += a(i - 1) * i
  a(i) = Console.ReadLine()
  i += 1
Loop
Console.WriteLine(S)
Do While i >= 0
  Console.WriteLine(a(i))
  i -= 5
Loop
```

9. Solution

```
For i = 0 To ROWS - 1
  max = a(i, 0)
  For j = 1 To COLUMNS - 1
    If a(i, j) > max Then
      max = a(i, j)
    End If
  Next
  Console.WriteLine(max)
Next
```

10. Solution

```
For i = 0 To ROWS - 1
  For j = 0 To COLUMNS - 1
    a(i, j) = Console.ReadLine()
    Do While a(i, j) = 0
      Console.WriteLine("Error")
      a(i, j) = Console.ReadLine()
    Loop
  Next
Next
```

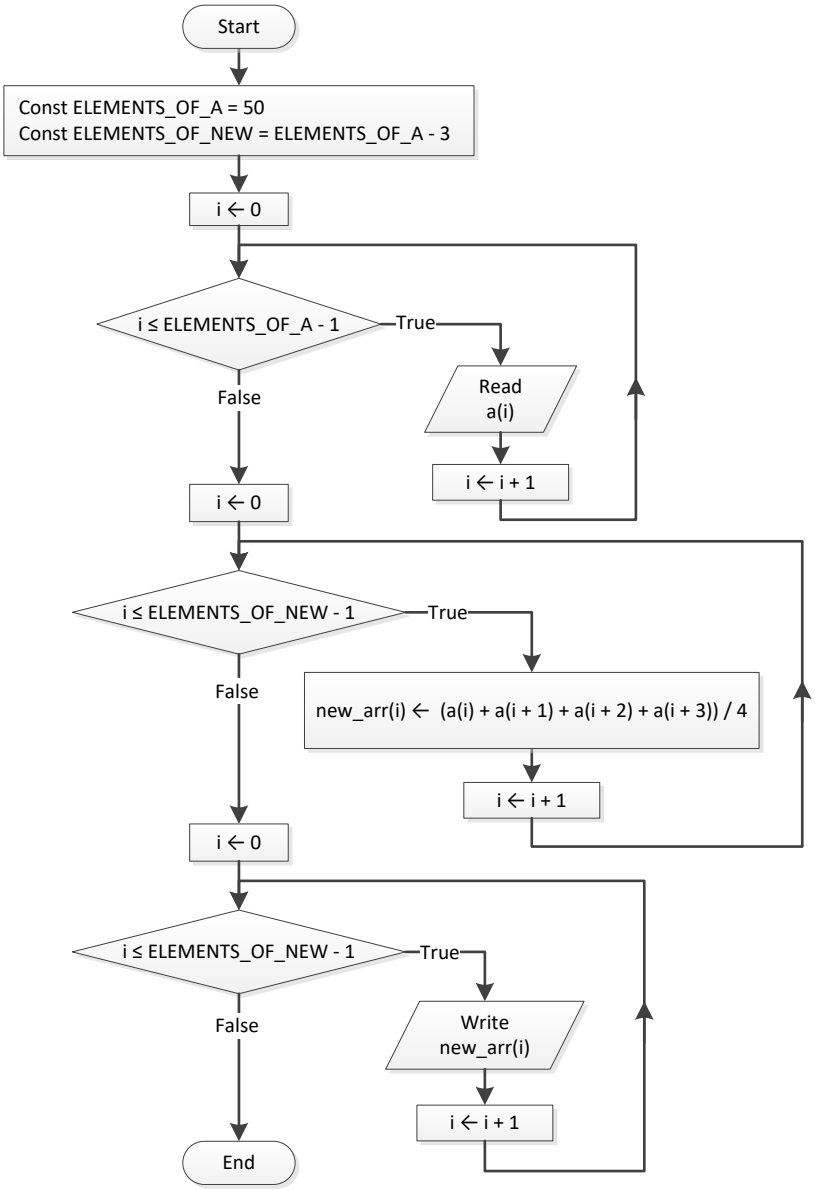
Chapter 37

37.7 Answers of Review Questions: True/False

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

37.8 Answers of Review Exercises

1. Solution

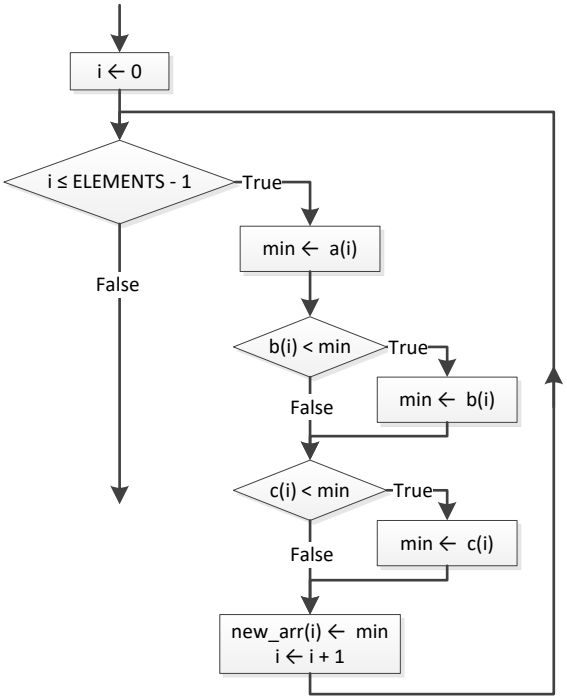



```
Const ELEMENTS_OF_A = 50
Const ELEMENTS_OF_NEW = ELEMENTS_OF_A - 3

Sub Main()
  Dim i As Integer

  Dim a(ELEMENTS_OF_A - 1) As Double
  For i = 0 To ELEMENTS_OF_A - 1
    a(i) = Console.ReadLine()
  Next
```

```
  Dim new_arr(ELEMENTS_OF_NEW - 1) As Double
  For i = 0 To ELEMENTS_OF_NEW - 1
    new_arr(i) = (a(i) + a(i + 1) + a(i + 2) + a(i + 3)) / 4
  Next

  For i = 0 To ELEMENTS_OF_NEW - 1
    Console.WriteLine(new_arr(i) & vbTab)
  Next

  Console.ReadKey()
End Sub
```

2. Solution

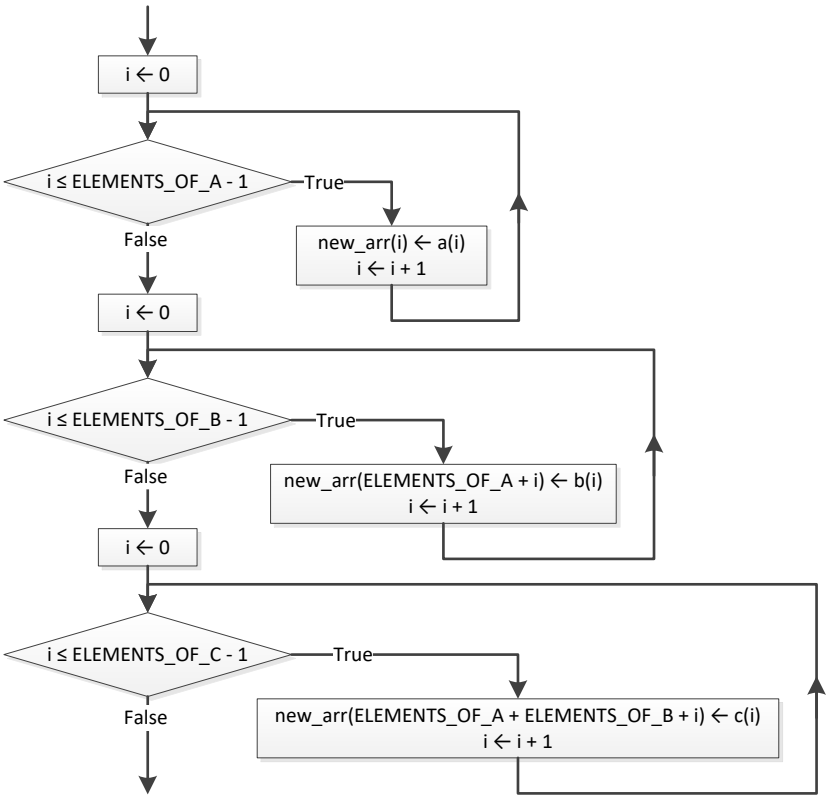
```
Const ELEMENTS = 15

Sub Main()
  Dim i As Integer
  Dim min As Double

  Dim a(ELEMENTS - 1) As Double
  For i = 0 To ELEMENTS - 1
    a(i) = Console.ReadLine()
  Next
  Dim b(ELEMENTS - 1) As Double
  For i = 0 To ELEMENTS - 1
    b(i) = Console.ReadLine()
  Next
  Dim c(ELEMENTS - 1) As Double
  For i = 0 To ELEMENTS - 1
    c(i) = Console.ReadLine()
  Next

  Dim new_arr(ELEMENTS - 1) As Double
  For i = 0 To ELEMENTS - 1
    min = a(i)
    If b(i) < min Then
      min = b(i)
    End If
    If c(i) < min Then
      min = c(i)
    End If
    new_arr(i) = min
  Next

  For i = 0 To ELEMENTS - 1
    Console.WriteLine(new_arr(i))
  Next

  Console.ReadKey()
End Sub
```



3. Solution

```
Const ELEMENTS_OF_A = 10
Const ELEMENTS_OF_B = 5
Const ELEMENTS_OF_C = 15
Const ELEMENTS_OF_NEW = ELEMENTS_OF_A + ELEMENTS_OF_B + ELEMENTS_OF_C

Sub Main()
  Dim i As Integer

  Dim a(ELEMENTS_OF_A - 1) As Double
  For i = 0 To ELEMENTS_OF_A - 1
    a(i) = Console.ReadLine()
  Next
  Dim b(ELEMENTS_OF_B - 1) As Double
  For i = 0 To ELEMENTS_OF_B - 1
    b(i) = Console.ReadLine()
  Next
  Dim c(ELEMENTS_OF_C - 1) As Double
  For i = 0 To ELEMENTS_OF_C - 1
    c(i) = Console.ReadLine()
  Next

  Dim new_arr(ELEMENTS_OF_NEW - 1) As Double
  For i = 0 To ELEMENTS_OF_C - 1
    new_arr(i) = c(i)
  Next
  For i = 0 To ELEMENTS_OF_B - 1
    new_arr(ELEMENTS_OF_C + i) = b(i)
  Next
```

```
  For i = 0 To ELEMENTS_OF_A - 1
    new_arr(ELEMENTS_OF_B + ELEMENTS_OF_C + i) = a(i)
  Next

  'Display array new
  For i = 0 To ELEMENTS_OF_NEW - 1
    Console.Write(new_arr(i) & vbTab)
  Next

  Console.ReadKey()
End Sub
```



4. Solution

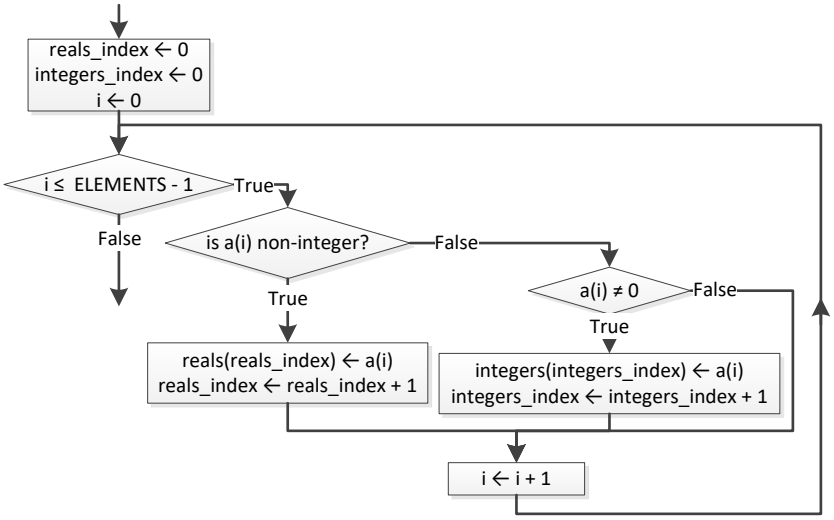
```
Const COLUMNS_OF_A = 10
Const COLUMNS_OF_B = 15
Const COLUMNS_OF_C = 20
Const ROWS = 5
Const COLUMNS = COLUMNS_OF_A + COLUMNS_OF_B + COLUMNS_OF_C

Sub Main()
  Dim i, j As Integer

  Dim a(ROWS - 1,  COLUMNS_OF_A - 1) As Double
  For i = 0 To ROWS - 1
    For j = 0 To COLUMNS_OF_A - 1
      a(i, j) = Console.ReadLine()
```

```
    Next
  Next

  Dim b(ROWS - 1,  COLUMNS_OF_B - 1) As Double
  For i = 0 To ROWS - 1
    For j = 0 To COLUMNS_OF_B - 1
      b(i, j) = Console.ReadLine()
    Next
  Next

  Dim c(ROWS - 1,  COLUMNS_OF_C - 1) As Double
  For i = 0 To ROWS - 1
    For j = 0 To COLUMNS_OF_C - 1
      c(i, j) = Console.ReadLine()
    Next
  Next

  Dim new_arr(ROWS - 1,  COLUMNS - 1) As Double
  For i = 0 To ROWS - 1
    For j = 0 To COLUMNS_OF_A - 1
      new_arr(i, j) = a(i, j)
    Next
  Next
  For i = 0 To ROWS - 1
    For j = 0 To COLUMNS_OF_B - 1
      new_arr(i, COLUMNS_OF_A + j) = b(i, j)
    Next
  Next
  For i = 0 To ROWS - 1
    For j = 0 To COLUMNS_OF_C - 1
      new_arr(i, COLUMNS_OF_A + COLUMNS_OF_B + j) = c(i, j)
    Next
  Next

  For i = 0 To ROWS - 1
    For j = 0 To COLUMNS - 1
      Console.Write(new_arr(i, j) & vbTab)
    Next
    Console.WriteLine()
  Next

  Console.ReadKey()
End Sub
```

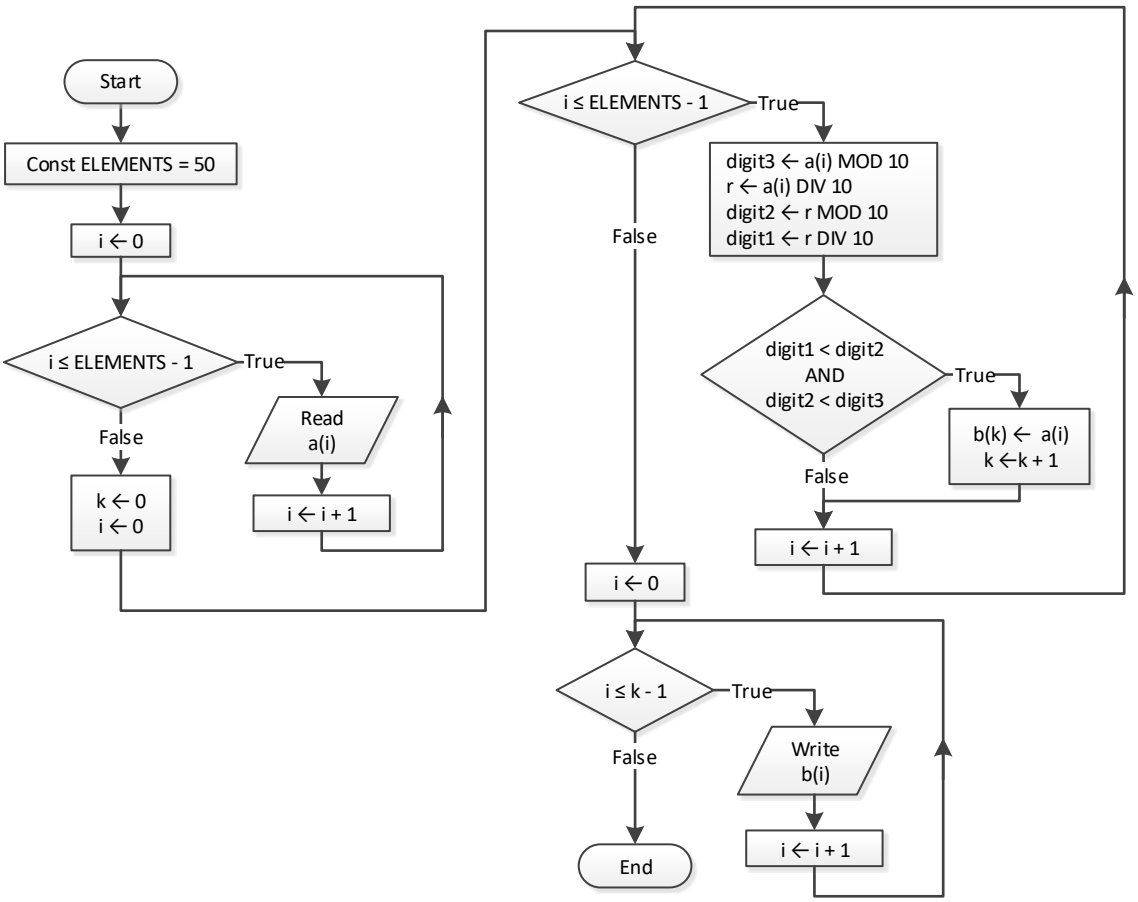
5. Solution

```
Const ELEMENTS = 50

Sub Main()
  Dim i, integers_index, reals_index As Integer

  Dim a(ELEMENTS - 1) As Double
  For i = 0 To ELEMENTS - 1
    a(i) = Console.ReadLine()
```

```
  Next

  Dim reals(ELEMENTS - 1) As Double
  Dim integers(ELEMENTS - 1) As Integer
  reals_index = 0
  integers_index = 0
  For i = 0 To ELEMENTS - 1
    If a(i) <> Fix(a(i)) Then
      reals(reals_index) = a(i)
      reals_index += 1
    ElseIf a(i) <> 0 Then
      integers(integers_index) = Fix(a(i))
      integers_index += 1
    End If
  Next

  For i = 0 To reals_index - 1
    Console.Write(reals(i) & vbTab)
  Next

  Console.WriteLine()
  For i = 0 To integers_index - 1
    Console.Write(integers(i) & vbTab)
  Next

  Console.ReadKey()
End Sub
```



6. Solution




```
Const ELEMENTS = 50

Sub Main()
  Dim digit1, digit2, digit3, i, k, r As Integer

  Dim a(ELEMENTS - 1) As Integer
  For i = 0 To ELEMENTS - 1
    a(i) = Console.ReadLine()
  Next

  Dim b(ELEMENTS - 1) As Integer
  k = 0
  For i = 0 To ELEMENTS - 1
    digit3 = a(i) Mod 10
    r = a(i) \ 10
    digit2 = r Mod 10
    digit1 = r \ 10

    If digit1 < digit2 And digit2 < digit3 Then
      b(k) = a(i)
      k += 1
    End If
```

```
  Next

  For i = 0 To k - 1
    Console.Write(b(i) & vbTab)
  Next

  Console.ReadKey()
End Sub
```

7. Solution

```
Const PRODUCTS = 10
Const CITIZENS = 1000

Sub Main()
  Dim count_B, i, j, max As Integer

  Dim prod_names(PRODUCTS - 1) As String
  Dim answers(PRODUCTS - 1,  CITIZENS - 1) As String
  For i = 0 To PRODUCTS - 1
    prod_names(i) = Console.ReadLine()
    For j = 0 To CITIZENS - 1
      answers(i, j) = Console.ReadLine()
      Do While answers(i, j).CompareTo("A") < 0 Or answers(i, j).CompareTo("D") > 0
        Console.WriteLine("Error! ")
        answers(i, j) = Console.ReadLine()
      Loop
    Next
  Next

  Dim count_A(PRODUCTS - 1) As Integer
  For i = 0 To PRODUCTS - 1
    count_A(i) = 0
    For j = 0 To CITIZENS - 1
      If answers(i, j) = "A" Then
        count_A(i) += 1
      End If
    Next
    Console.WriteLine(prod_names(i) & ", " & count_A(i))
  Next

  For j = 0 To CITIZENS - 1
    count_B = 0
    For i = 0 To PRODUCTS - 1
      If answers(i, j) = "B" Then
        count_B += 1
      End If
    Next
    Console.WriteLine(count_B)
  Next

  max = count_A(0)
  For i = 1 To PRODUCTS - 1
    If count_A(i) > max Then
```

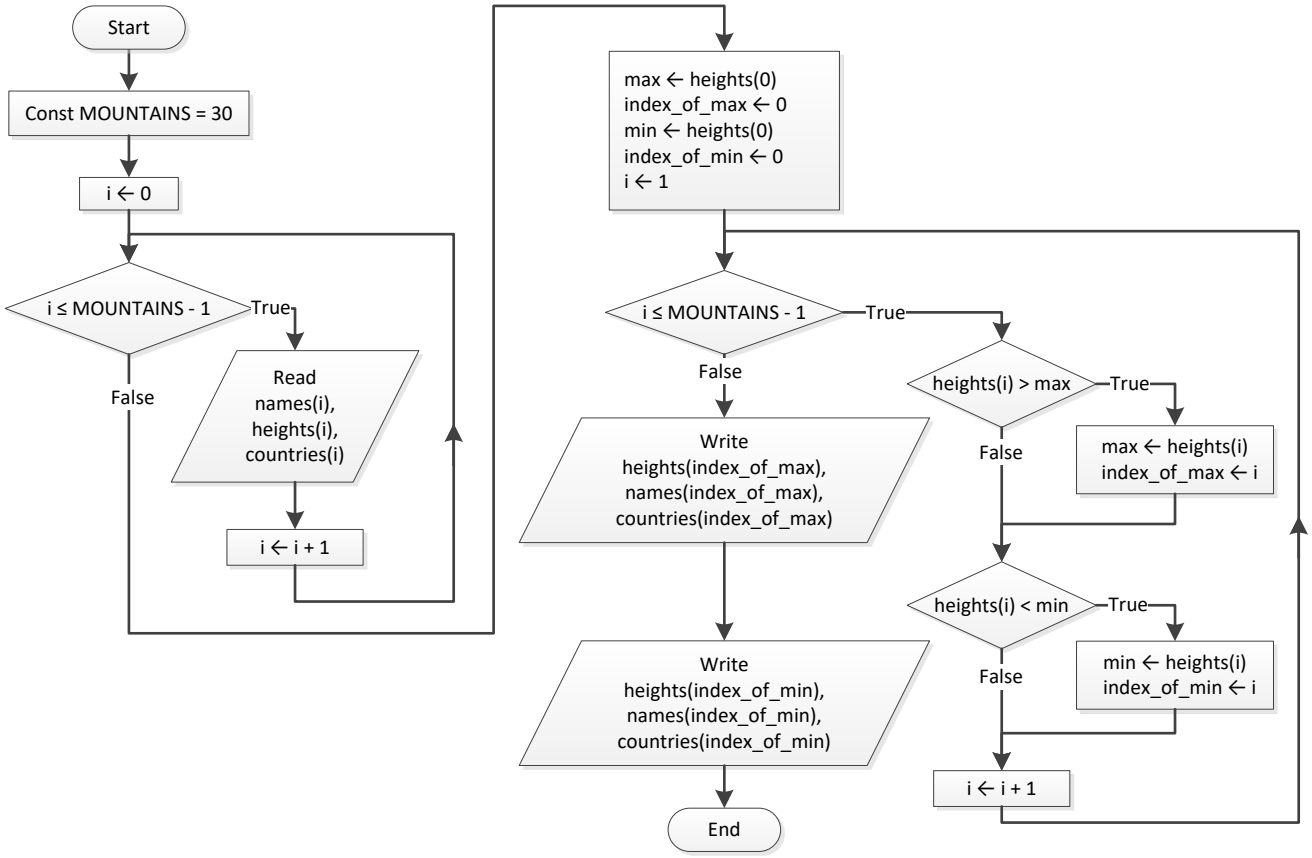
```
      max = count_A(i)
    End If
  Next
  For i = 0 To PRODUCTS - 1
    If count_A(i) = max Then
      Console.WriteLine(prod_names(i))
    End If
  Next

  Console.ReadKey()
End Sub
```

8. Solution

```
Const US_CITIES = 20
Const CANADIAN_CITIES = 20

Sub Main()
  Dim i, j, min_j As Integer
  Dim min As Double

  Dim us_names(US_CITIES - 1) As String
  For i = 0 To US_CITIES - 1
    Console.WriteLine("Enter name for US city No " & (i + 1) & ": ")
    us_names(i) = Console.ReadLine()
  Next

  Dim canadian_names(CANADIAN_CITIES - 1) As String
  For j = 0 To CANADIAN_CITIES - 1
    Console.WriteLine("Enter name for Canadian city No " & (j + 1) & ": ")
    canadian_names(j) = Console.ReadLine()
  Next

  Dim distances(US_CITIES - 1,  CANADIAN_CITIES - 1) As Double
  For i = 0 To US_CITIES - 1
    For j = 0 To CANADIAN_CITIES - 1
      Console.WriteLine("Enter distance between " & us_names(i) & " and " & canadian_names(j) & ": ")
      distances(i, j) = Console.ReadLine()
    Next
  Next

  For i = 0 To US_CITIES - 1
    min = distances(i, 0)
    min_j = 0
    For j = 1 To CANADIAN_CITIES - 1
      If distances(i, j) < min Then
        min = distances(i, j)
        min_j = j
      End If
    Next
    Console.WriteLine("Closest Canadian city to " & us_names(i) & " is " & canadian_names(min_j))
  Next

  Console.ReadKey()
```

```
End Sub
```

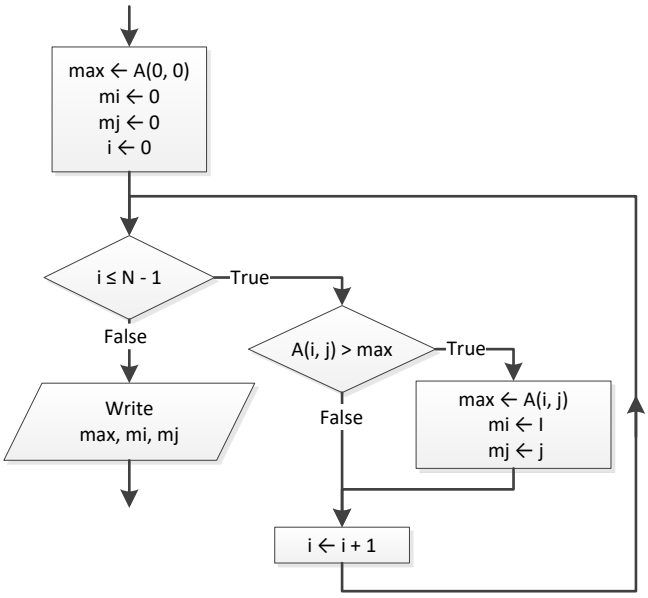
9. Solution




```
Const MOUNTAINS = 30

Sub Main()
  Dim i, index_of_max, index_of_min As Integer
  Dim max, min As Double

  Dim names(MOUNTAINS - 1) As String
  Dim heights(MOUNTAINS - 1) As Double
  Dim countries(MOUNTAINS - 1) As String
  For i = 0 To MOUNTAINS - 1
    names(i) = Console.ReadLine()
    heights(i) = Console.ReadLine()
    countries(i) = Console.ReadLine()
  Next

  max = heights(0)
  index_of_max = 0
  min = heights(0)
  index_of_min = 0
  For i = 1 To MOUNTAINS - 1
    If heights(i) > max Then
      max = heights(i)
```

```
      index_of_max = i
    End If
    If heights(i) < min Then
      min = heights(i)
      index_of_min = i
    End If
  Next

  Console.Write(heights(index_of_max) & ", " & names(index_of_max) & ", " & countries(index_of_max))
  Console.WriteLine()
  Console.Write(heights(index_of_min) & ", " & names(index_of_min) & ", " & countries(index_of_min))

  Console.ReadKey()
End Sub
```

10. Solution



11. Solution

```
Const TEAMS = 26
Const GAMES = 15

Sub Main()
  Dim i, j, m_i, max As Integer

  Dim names(TEAMS - 1) As String
  Dim results(TEAMS - 1,  GAMES - 1) As String
  For i = 0 To TEAMS - 1
    names(i) = Console.ReadLine()
    For j = 0 To GAMES - 1
      results(i, j) = Console.ReadLine()
    Next
  Next
```

```
  Dim points(TEAMS - 1) As Integer
  For i = 0 To TEAMS - 1
    points(i) = 0
    For j = 0 To GAMES - 1
      If results(i, j) = "W" Then
        points(i) += 3
      ElseIf results(i, j) = "T" Then
        points(i) += 1
      End If
    Next
  Next

  max = points(0)
  m_i = 0
  For i = 1 To TEAMS - 1
    If points(i) > max Then
      max = points(i)
      m_i = i
    End If
  Next

  Console.Write(names(m_i))

  Console.ReadKey()
End Sub
```

12. Solution

```
Const OBJECTS = 10
Const FALLS = 20

Sub Main()
  Dim i, j As Integer
  Dim maximum, minimum As Double

  Dim heights(OBJECTS - 1,  FALLS - 1) As Double
  Dim times(OBJECTS - 1,  FALLS - 1) As Double
  For i = 0 To OBJECTS - 1
    For j = 0 To FALLS - 1
      heights(i, j) = Console.ReadLine()
      times(i, j) = Console.ReadLine()
    Next
  Next

  Dim g(OBJECTS - 1,  FALLS - 1) As Double
  For i = 0 To OBJECTS - 1
    For j = 0 To FALLS - 1
      g(i, j) = 2 * heights(i, j) / times(i, j) ^ 2
    Next
  Next

  Dim min(OBJECTS - 1) As Double
  Dim max(OBJECTS - 1) As Double
```

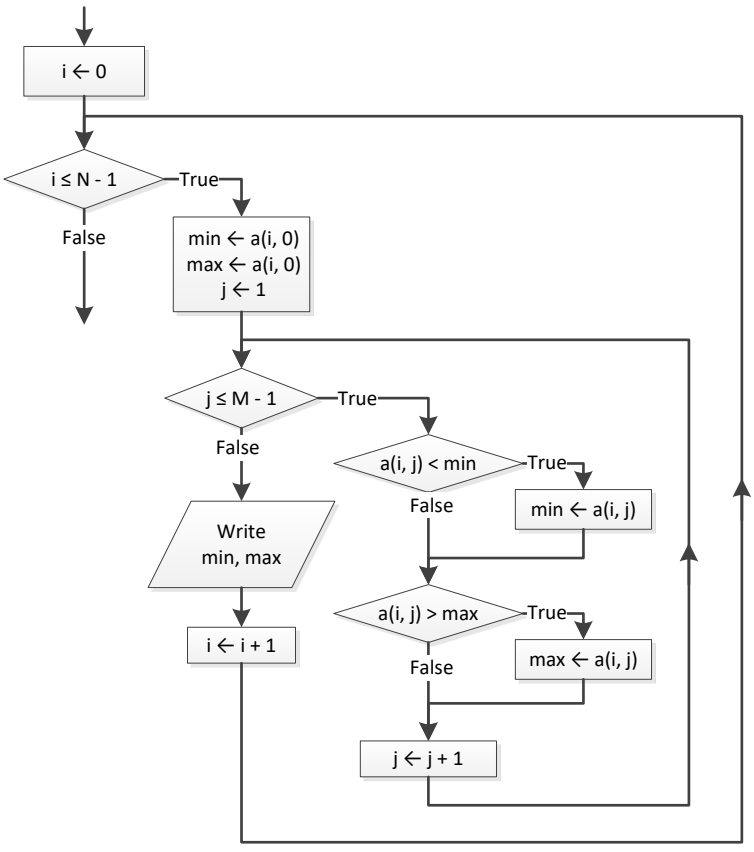
```
  For i = 0 To OBJECTS - 1
    min(i) = g(i, 0)
    max(i) = g(i, 0)
    For j = 1 To FALLS - 1
      If g(i, j) < min(i) Then
        min(i) = g(i, j)
      End If
      If g(i, j) > max(i) Then
        max(i) = g(i, j)
      End If
    Next
  Next

  For i = 0 To OBJECTS - 1
    Console.WriteLine(min(i) & ", " & max(i))
  Next

  maximum = max(0)
  minimum = min(0)
  For i = 1 To OBJECTS - 1
    If max(i) > maximum Then
      maximum = max(i)
    End If
    If min(i) < minimum Then
      minimum = min(i)
    End If
  Next

  Console.Write(minimum & ", " & maximum)

  Console.ReadKey()
End Sub
```

13. Solution

```
Const STATIONS = 10
Const DAYS = 365

Sub Main()
  Dim i, j, m_i As Integer
  Dim min As Double

  Dim names(STATIONS - 1) As String
  Dim co2(STATIONS - 1,  DAYS - 1) As Double
  For i = 0 To STATIONS - 1
    names(i) = Console.ReadLine()
    For j = 0 To DAYS - 1
      co2(i, j) = Console.ReadLine()
    Next
  Next

  Dim average(STATIONS - 1) As Double
  For i = 0 To STATIONS - 1
    average(i) = 0
```

```
    For j = 0 To DAYS - 1
      average(i) += co2(i, j)
    Next
    average(i) /= DAYS
  Next

  min = average(0)
  m_i = 0
  For i = 1 To STATIONS - 1
    If average(i) < min Then
      min = average(i)
      m_i = i
    End If
  Next
  Console.Write(names(m_i))

  Console.ReadKey()
End Sub
```

14. Solution



15. Solution

```
Const TEAMS = 20
Const GAMES = 10
```

```
Sub Main()
  Dim i, j, m, n, temp As Integer
  Dim swaps As Boolean
  Dim temp_str As String

  Dim names(TEAMS - 1) As String
  Dim results(TEAMS - 1, GAMES - 1) As String
  For i = 0 To TEAMS - 1
    Console.Write("Enter team name: ")
    names(i) = Console.ReadLine()
    For j = 0 To GAMES - 1
      Console.WriteLine("Enter result For team " & names(i) & " for game No " & (j + 1) & ": ")
      results(i, j) = Console.ReadLine()
      Do While results(i, j) <> "W" And results(i, j) <> "L" And results(i, j) <> "T"
        Console.Write("Error! Enter only value W, L, or T: ")
        results(i, j) = Console.ReadLine()
      Loop
    Next
  Next

  Dim points(TEAMS - 1) As Integer
  For i = 0 To TEAMS - 1
    points(i) = 0
    For j = 0 To GAMES - 1
      If results(i, j) = "W" Then
        points(i) += 3
      ElseIf results(i, j) = "T" Then
        points(i) += 1
      End If
    Next
  Next

  For m = 1 To TEAMS - 1
    swaps = False
    For n = TEAMS - 1 To m Step -1
      If points(n) > points(n - 1) Then
        temp = points(n)
        points(n) = points(n - 1)
        points(n - 1) = temp

        temp_str = names(n)
        names(n) = names(n - 1)
        names(n - 1) = temp_str

        swaps = True
      End If
    Next
    If swaps = False Then Exit For
  Next

  Console.WriteLine("Gold: " & names(0))
  Console.WriteLine("Silver: " & names(1))
  Console.Write("Bronze: " & names(2))
```

```
  Console.ReadKey()
End Sub
```

16. Solution

```
Const PEOPLE = 50

Sub Main()
  Dim i, m, n As Integer
  Dim temp As Double
  Dim temp_str As String

  Dim names(PEOPLE - 1) As String
  Dim heights(PEOPLE - 1) As Double
  For i = 0 To PEOPLE - 1
    Console.Write("Enter name for person No. " & (i + 1) & ": ")
    names(i) = Console.ReadLine()
    Console.Write("Enter height for person No. " & (i + 1) & ": ")
    heights(i) = Console.ReadLine()
  Next

  For m = 1 To PEOPLE - 1
    For n = PEOPLE - 1 To m Step -1
      If heights(n) > heights(n - 1) Then
        temp = heights(n)
        heights(n) = heights(n - 1)
        heights(n - 1) = temp

        temp_str = names(n)
        names(n) = names(n - 1)
        names(n - 1) = temp_str
      ElseIf heights(n) = heights(n - 1) Then
        If names(n).CompareTo(names(n - 1)) < 0 Then
          temp_str = names(n)
          names(n) = names(n - 1)
          names(n - 1) = temp_str
        End If
      End If
    Next
  Next

  For i = 0 To PEOPLE - 1
    Console.WriteLine(heights(i) & vbTab & names(i))
  Next

  Console.ReadKey()
End Sub
```

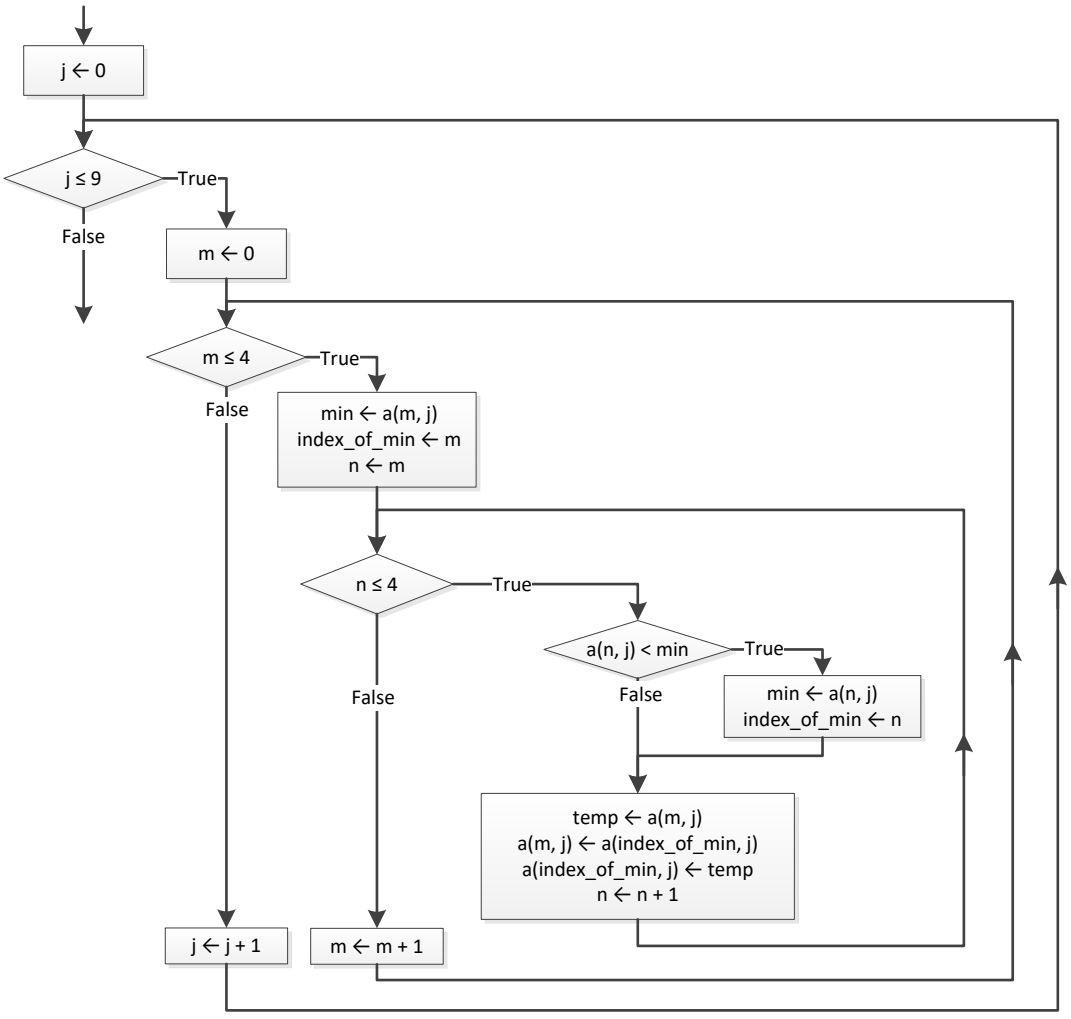
17. Solution

```
Const ARTISTS = 12
Const JUDGES = 10
```

```
Sub Main()
  Dim i, j, m, max, min, n, temp As Integer
  Dim temp_str As String

  Dim artist_names(ARTISTS - 1) As String
  Dim score(ARTISTS - 1,  JUDGES - 1) As Integer
  For i = 0 To ARTISTS - 1
    Console.WriteLine("Enter name for artist No " & (i + 1) & ": ")
    artist_names(i) = Console.ReadLine()
    For j = 0 To JUDGES - 1
      Console.Write("Enter score for artist: " & artist_names(i))
      Console.WriteLine(" gotten from judge No " & (j + 1) & ": ")
      score(i, j) = Console.ReadLine()
    Next
  Next

  Dim sum(ARTISTS - 1) As Integer
  For i = 0 To ARTISTS - 1
    sum(i) = 0
    For j = 1 To JUDGES - 1
      sum(i) += score(i, j)
    Next
  Next

  For i = 0 To ARTISTS - 1
    min = score(i, 0)
    max = score(i, 0)
    For j = 1 To JUDGES - 1
      If score(i, j) < min Then
        min = score(i, j)
      End If
      If score(i, j) > max Then
        max = score(i, j)
      End If
    Next
    sum(i) = sum(i) - min - max
    Console.WriteLine(sum(i))
  Next

  For m = 1 To ARTISTS - 1
    For n = ARTISTS - 1 To m Step -1
      If sum(n) > sum(n - 1) Then
        temp = sum(n)
        sum(n) = sum(n - 1)
        sum(n - 1) = temp

        temp_str = artist_names(n)
        artist_names(n) = artist_names(n - 1)
        artist_names(n - 1) = temp_str
      ElseIf sum(n) = sum(n - 1) Then
        If artist_names(n).CompareTo(artist_names(n - 1)) < 0 Then
          temp_str = artist_names(n)
          artist_names(n) = artist_names(n - 1)
```

```
          artist_names(n - 1) = temp_str
        End If
      End If
    Next
  Next

  For i = 0 To ARTISTS - 1
    Console.WriteLine(artist_names(i) & ", " & sum(i))
  Next

  Console.ReadKey()
End Sub
```

18. Solution



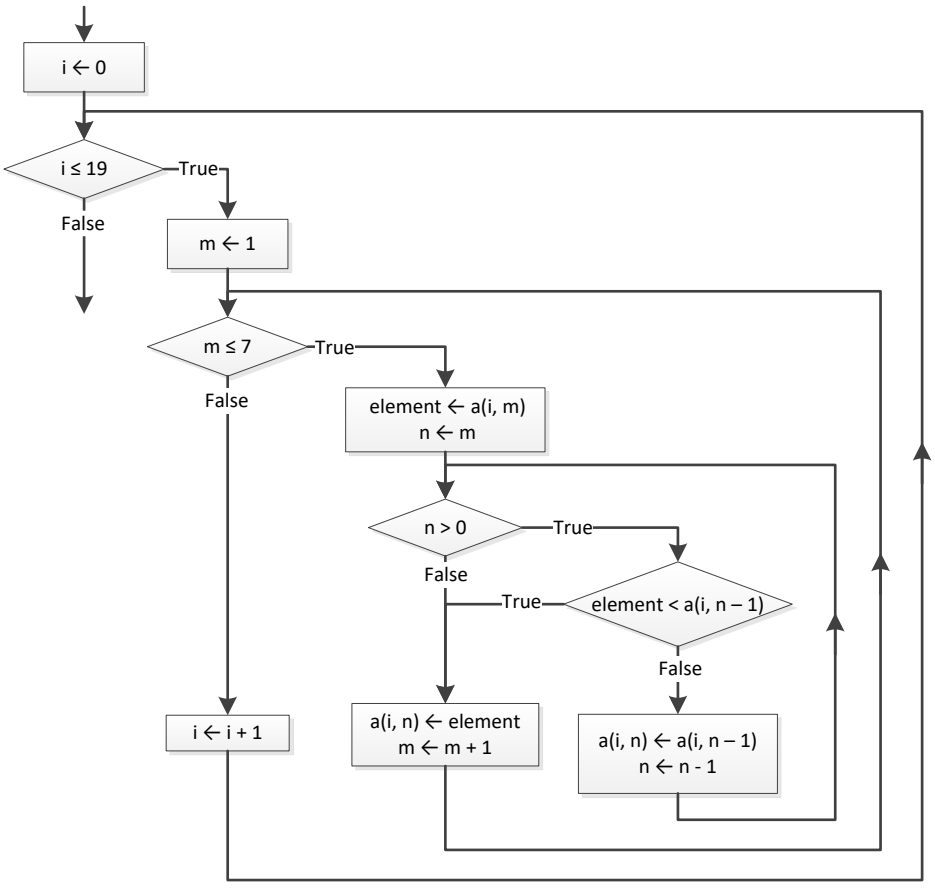
19. Solution

```
Const PEOPLE = 10
Const PUZZLES = 8
```

```
Sub Main()
  Dim i, index_of_min, j, m, n As Integer
  Dim min, temp As Double
  Dim temp_str As String

  Dim names(PEOPLE - 1) As String
  Dim times(PEOPLE - 1,  PUZZLES - 1) As Double
  For i = 0 To PEOPLE - 1
    names(i) = Console.ReadLine()
    For j = 0 To PUZZLES - 1
      times(i, j) = Console.ReadLine()
    Next
  Next

  For i = 0 To PEOPLE - 1
    For m = 0 To PUZZLES - 1
      min = times(i, m)
      index_of_min = m
      For n = m To PUZZLES - 1
        If times(i, n) < min Then
          min = times(i, n)
          index_of_min = n
        End If
      Next
      temp = times(i, m)
      times(i, m) = times(i, index_of_min)
      times(i, index_of_min) = temp
    Next
  Next

  For i = 0 To PEOPLE - 1
    Console.WriteLine(names(i))
    For j = 0 To 2
      Console.WriteLine(times(i, j))
    Next
  Next

  Dim average(PEOPLE - 1) As Double
  For i = 0 To PEOPLE - 1
    average(i) = 0
    For j = 0 To PUZZLES - 1
      average(i) += times(i, j)
    Next
    average(i) /= PUZZLES
  Next

  For m = 0 To PEOPLE - 1
    min = average(m)
    index_of_min = m
    For n = m To PEOPLE - 1
      If average(n) < min Then
        min = average(n)
        index_of_min = n
```

```
      End If
    Next
    temp = average(m)
    average(m) = average(index_of_min)
    average(index_of_min) = temp

    temp_str = names(m)
    names(m) = names(index_of_min)
    names(index_of_min) = temp_str
  Next

  Console.Write(names(0) & ", " & names(1) & ", " & names(2))

  Console.ReadKey()
End Sub
```

20. Solution



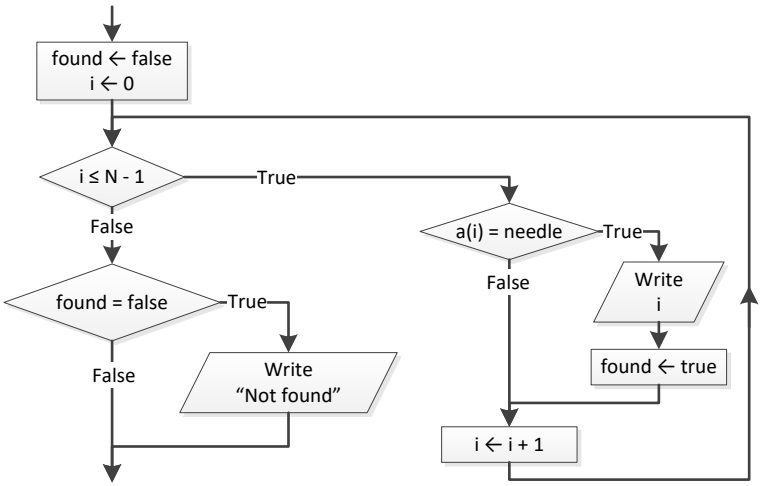
21. Solution

```
Const CITIES = 5
Const HOURS = 48

Sub Main()
```

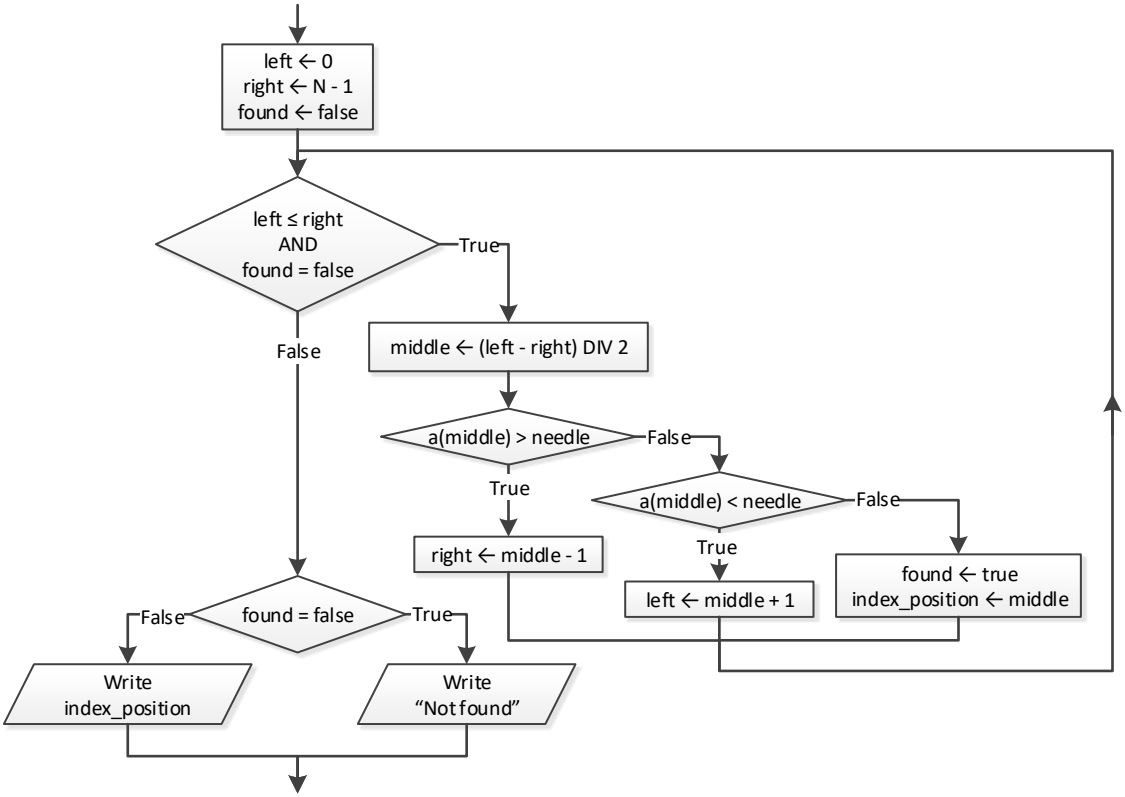
```
Dim i, j, m, m_i, m_j, n As Integer
Dim max, element_1 As Double
Dim element_2 As String

Dim names(CITIES - 1) As String
Dim CO2(CITIES - 1,  HOURS - 1) As Double
For i = 0 To CITIES - 1
  names(i) = Console.ReadLine()
  For j = 0 To HOURS - 1
    CO2(i, j) = Console.ReadLine()
  Next
Next

Dim average_per_hour(CITIES - 1) As Double
For i = 0 To CITIES - 1
  average_per_hour(i) = 0
  For j = 0 To HOURS - 1
    average_per_hour(i) += CO2(i, j)
  Next
  average_per_hour(i) /= HOURS
Next

For i = 0 To CITIES - 1
  Console.WriteLine(names(i) & ", " & average_per_hour(i))
Next

Dim average_per_city(HOURS - 1) As Double
For j = 0 To HOURS - 1
  average_per_city(j) = 0
  For i = 0 To CITIES - 1
    average_per_city(j) += CO2(i, j)
  Next
  average_per_city(j) /= CITIES
Next

For j = 0 To HOURS - 1
  Console.WriteLine(average_per_city(j))
Next

max = average_per_city(0)
m_j = 0
For j = 1 To HOURS - 1
  If average_per_city(j) > max Then
    max = average_per_city(j)
    m_j = j
  End If
Next
Console.WriteLine(m_j)

max = CO2(0, 0)
m_i = 0
m_j = 0
For i = 0 To CITIES - 1
  For j = 0 To HOURS - 1
```

```
      If CO2(i, j) > max Then
        max = CO2(i, j)
        m_i = i
        m_j = j
      End If
    Next
  Next
  Console.WriteLine(m_j & ", " & names(m_i))

  For m = 1 To CITIES - 1
    element_1 = average_per_hour(m)
    element_2 = names(m)

    n = m
    Do While n > 0
      If element_1 < average_per_hour(n - 1) Then Exit Do
      average_per_hour(n) = average_per_hour(n - 1)
      names(n) = names(n - 1)
      n -= 1
    Loop

    average_per_hour(n) = element_1
    names(n) = element_2
  Next

  Console.WriteLine(names(0) & ", " & names(1)  & ", " &  names(2))

  Console.ReadKey()
End Sub
```

22. Solution



23. Solution



24. Solution

```
Const TEAMS = 10
Const GAMES = 16

Sub Main()
  Dim i, j, sum As Integer
  Dim needle, input As String

  Dim names(TEAMS - 1) As String
  Dim goals_scored(TEAMS - 1,  GAMES - 1) As Integer
  Dim goals_let_in(TEAMS - 1,  GAMES - 1) As Integer
  For i = 0 To TEAMS - 1
    Console.Write("Enter team name: ")
    names(i) = Console.ReadLine()
    For j = 0 To GAMES - 1
      Console.Write("Enter goals scored: ")
      input = Console.ReadLine()
      Do While Int32.TryParse(input, goals_scored(i, j)) = False Or goals_scored(i, j) < 0
        Console.Write("Error! Enter goals scored: ")
        input = Console.ReadLine()
      Loop

      Console.Write("Enter goals let in: ")
```

```
      input = Console.ReadLine()
      Do While Int32.TryParse(input, goals_let_in(i, j)) = False Or goals_let_in(i, j) < 0
        Console.Write("Error! Enter goals let in: ")
        input = Console.ReadLine()
      Loop
    Next
  Next

  Console.Write("Enter a team to search: ")
  needle = Console.ReadLine()

  i = 0
  Do While i < TEAMS - 1 And names(i) <> needle
    i += 1
  Loop

  If names(i) <> needle Then
    Console.WriteLine("This team does not exist")
  Else
    sum = 0
    For j = 0 To GAMES - 1
      If goals_scored(i, j) > goals_let_in(i, j) Then
        sum += 3
      ElseIf goals_scored(i, j) = goals_let_in(i, j) Then
        sum += 1
      End If
    Next
    Console.WriteLine(sum)
  End If

  Console.ReadKey()
End Sub
```

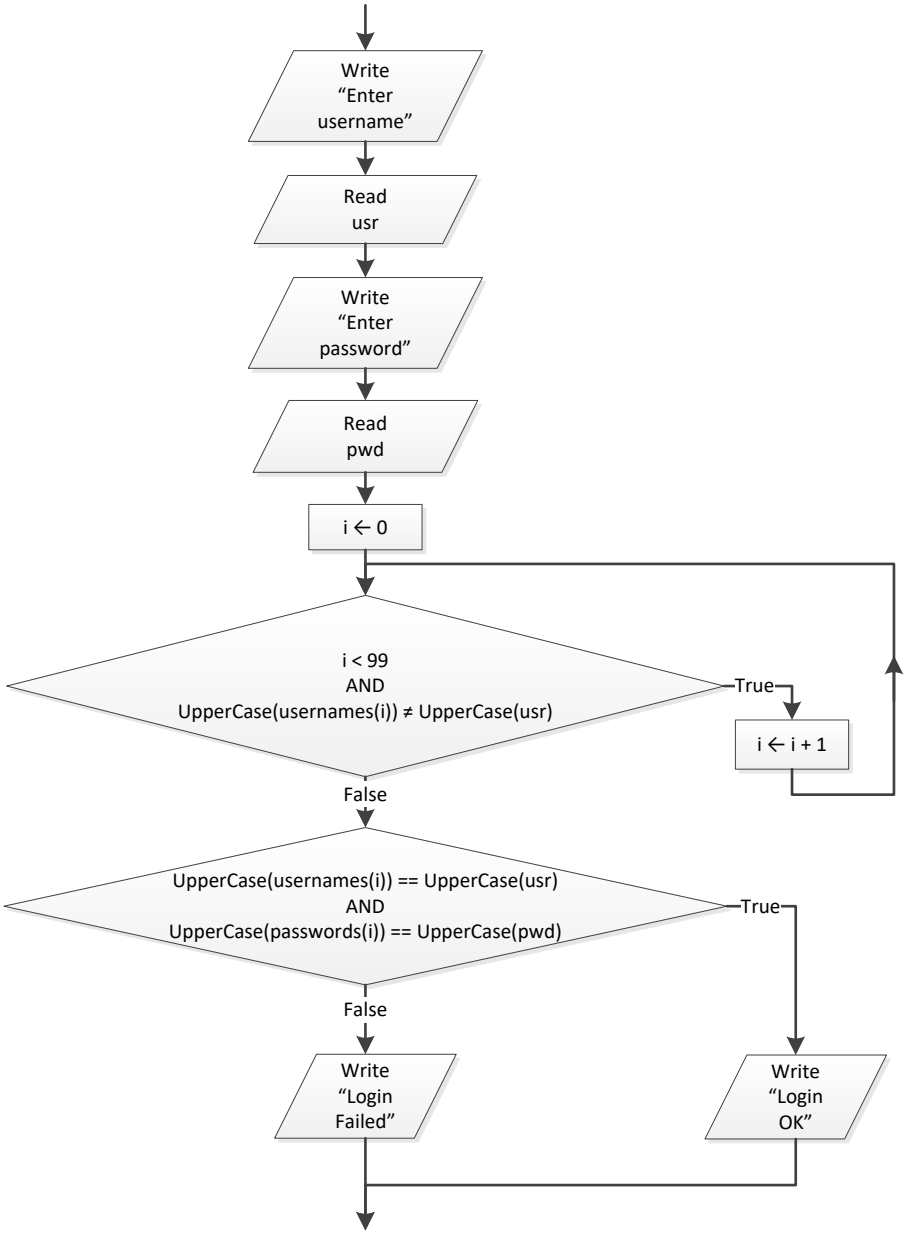
25. Solution

```
Const CLASS1 = 20
Const CLASS2 = 25

Sub Main()
  Dim i, left, m, middle, n, right As Integer
  Dim element, needle As String
  Dim found As Boolean

  Console.WriteLine("Class A")
  Dim names1(CLASS1 - 1) As String
  For i = 0 To CLASS1 - 1
    Console.Write("Enter name: ")
    names1(i) = Console.ReadLine()
  Next
  Console.WriteLine("Class B")
  Dim names2(CLASS2 - 1) As String
  For i = 0 To CLASS2 - 1
    Console.Write("Enter name: ")
    names2(i) = Console.ReadLine()
```

```
Next

'Insertion sort algorithm
For m = 1 To CLASS1 - 1
  element = names1(m)
  n = m
  Do While n > 0 And names1(n - 1).CompareTo(element) > 0
    names1(n) = names1(n - 1)
    n -= 1
  Loop
  names1(n) = element
Next
For m = 1 To CLASS2 - 1
  element = names2(m)
  n = m
  Do While n > 0 And names2(n - 1).CompareTo(element) > 0
    names2(n) = names2(n - 1)
    n -= 1
  Loop
  names2(n) = element
Next

Console.WriteLine(vbCrLf & "Class A")
For i = 0 To CLASS1 - 1
  Console.WriteLine(names1(i))
Next
Console.WriteLine(vbCrLf & "Class B")
For i = 0 To CLASS2 - 1
  Console.WriteLine(names2(i))
Next

Console.Write("Enter a name to search: ")
needle = Console.ReadLine()

left = 0
right = CLASS1 - 1
found = False
Do While left <= right And found = False
  middle = (left + right) \ 2

  If names1(middle).CompareTo(needle) > 0 Then
    right = middle - 1
  ElseIf names1(middle).CompareTo(needle) < 0 Then
    left = middle + 1
  Else
    found = True
  End If
Loop

If found = True Then
  Console.WriteLine("Student found in class No 1")
Else
  left = 0
  right = CLASS2 - 1
```

```
    Do While left <= right And found = False
      middle = (left + right) \ 2

      If names2(middle).CompareTo(needle) > 0 Then
        right = middle - 1
      ElseIf names2(middle).CompareTo(needle) < 0 Then
        left = middle + 1
      Else
        found = True
      End If
    Loop

    If found = True Then
      Console.WriteLine("Student found in class No 2")
    Else
      Console.WriteLine("Student not found in either class")
    End If
  End If

  Console.ReadKey()
End Sub
```

26. Solution




```
Console.Write("Enter username: ")
usr = Console.ReadLine()
Console.Write("Enter password: ")
pwd = Console.ReadLine()

i = 0
Do While i < 99 And usernames(i).ToUpper() <> usr.ToUpper()
  i += 1
Loop

If usernames(i).ToUpper() == usr.ToUpper() And passwords(i).ToUpper() = pwd.ToUpper() Then
```

```
  Console.WriteLine("Login OK!")
Else
  Console.WriteLine("Login Failed!")
End If
```

27. Solution

```
Console.Write("Enter a value to search: ")
value_str = Console.ReadLine()
found = False

'Check If entered value is a valid nine-digit SSN
If Int32.TryParse(value_str, value) = True And value >= 100000000 And value <= 999999999 Then
  i = 0
  Do While i < 999 And SSNs(i) <> value
    i += 1
  Loop

  If SSNs(i) = value Then
    found = True
    Console.WriteLine(names(i))
  End If
Else
  For i = 0 To 999
    If names(i) = value_str Then
      Console.WriteLine(names(i))
      found = True
    End If
  Next
End If

If found = False Then
  Console.WriteLine("This value does not exist")
End If
```

28. Solution

```
Const STUDENTS = 12
Const LESSONS = 6

Sub Main()
  Dim i, j As Integer
  Dim found As Boolean

  Dim grades(STUDENTS - 1,  LESSONS - 1) As Integer
  For i = 0 To STUDENTS - 1
    For j = 0 To LESSONS - 1
      grades(i, j) = Console.ReadLine()
    Next
  Next

  Dim average(STUDENTS - 1) As Double
  For i = 0 To STUDENTS - 1
```

```
    average(i) = 0
    For j = 0 To LESSONS - 1
      average(i) += grades(i, j)
    Next
    average(i) /= LESSONS
  Next

  found = False
  For i = 0 To STUDENTS - 1
    If average(i) < 70 Then
      found = True
    End If
  Next

  If found = True Then
    Console.WriteLine("There is at least one student that has an average value below 70")
  End If

  Console.ReadKey()
End Sub
```

Chapter 38

38.4 Review Questions: True/False

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

Chapter 39

39.5 Review Questions: True/False

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

39.6 Review Exercises

1. Solution

```
Function find_max(a As Integer, b As Integer) As Integer
  Dim max As Integer

  If a > b Then
    max = a
  Else
    max = b
  End If
  Return max
End Function
```

2. Solution

Step	Statement	Main Code		Function sum_digits()		
		s	i	a	d1	d2
1	s = 0	**0**	?			
2	i = 25	0	**25**			
3	i <= 27	True				
4	s += sum_digits(i)			**25**	?	?
5	d1 = a Mod 10			25	**5**	?
6	d2 = a \ 10			25	5	**2**
7	Return d1 + d2	**7**	25			
8	i += 1	7	**26**			
9	i <= 27	True				

10	`s += sum_digits(i)`			**26**	?	?
11	`d1 = a Mod 10`			26	**6**	?
12	`d2 = a \ 10`			26	6	**2**
13	`Return d1 + d2`	**15**	26			
14	`i += 1`	15	**27**			
15	`i <= 27`	True				
16	`s += sum_digits(i)`			**27**	?	?
17	`d1 = a Mod 10`			27	**7**	?
18	`d2 = a \ 10`			27	7	**2**
19	`Return d1 + d2`	**24**	27			
20	`i += 1`	24	**28**			
21	`i <= 27`	False				
22	`Console.Write(s)`	24 is displayed				

3. Solution

Step	Statement	Main Code		Function sss ()		
		s	i	a	sum	k
1	`i = 1`	?	**1**			
2	`s = 0`	**0**	1			
3	`Do While i < 6`	True				
4	`If i Mod 2 = 1 Then`	True				
5	`s += 1`	**1**	1			
6	`i += 1`	1	**2**			
7	`Do While i < 6`	True				
8	`If i Mod 2 = 1 Then`	False				
9	`s += sss(i)`			**2**	?	?
10	`sum = 0`			2	**0**	?
11	`k = 1`			2	0	**1**
12	`k <= a`			True		
13	`sum += k`			2	**1**	1
14	`k += 1`			2	1	**2**
15	`k <= a`			True		
16	`sum += k`			2	**3**	2
17	`k += 1`			2	3	**3**
18	`k <= a`			False		

19	Return sum	**4**	2			
20	i += 1	4	**3**			
21	Do While i < 6	True				
22	If i Mod 2 = 1 Then	True				
23	s += 1	**5**	3			
24	i += 1	5	**4**			
25	Do While i < 6	True				
26	If i Mod 2 = 1 Then	False				
27	s += sss(i)			**4**	?	?
28	sum = 0			4	**0**	?
29	k = 1			4	0	**1**
30	k <= a			True		
31	sum += k			4	**1**	1
32	k += 1			4	1	**2**
33	k <= a			True		
34	sum += k			4	**3**	2
35	k += 1			4	3	**3**
36	k <= a			True		
37	sum += k			4	**6**	4
38	k += 1			4	6	**4**
39	k <= a			True		
40	sum += k			4	**10**	4
41	k += 1			4	10	**5**
42	k <= a			False		
43	Return sum	**15**	4			
44	i += 1	15	**5**			
45	Do While i < 6	True				
46	If i Mod 2 = 1 Then	True				
47	s += 1	**16**	5			
48	i += 1	16	**6**			
49	Do While i < 6	False				
50	Console.Write(s)	16 is displayed				

4. Solution

Step	Statement	Main Code				Function custom_div()	
		k	m	a	x	b	d
1	k = Console.ReadLine()	**12**	?	?	?		
2	m = 2	12	**2**	?	?		
3	a = 1	12	2	**1**	?		
4	Do While a < 6	True					
5	If k Mod m <> 0 Then	False					
6	x = a + m + custom_div(m, a)					2	1
7	Return (b + d) \ 2	12	2	1	**4**		
8	Console.Write(m & " " & a & " " & x)	2 1 4 is displayed					
9	a += 2	12	2	**3**	4		
10	m += 1	12	**3**	3	4		
11	Do While a < 6	True					
12	If k Mod m <> 0 Then	False					
13	x = a + m + custom_div(m, a)					3	3
14	Return (b + d) \ 2	12	3	3	**9**		
15	Console.Write(m & " " & a & " " & x)	3 3 9 is displayed					
16	a += 2	12	3	**5**	9		
17	m += 1	12	**4**	5	9		
18	Do While a < 6	True					
19	If k Mod m <> 0 Then	False					
20	x = a + m + custom_div(m, a)					4	5
21	Return (b + d) \ 2	12	4	5	**13**		
22	Console.Write(m & " " & a & " " & x)	4 5 13 is displayed					
23	a += 2	12	4	**7**	13		
24	m += 1	12	**5**	7	13		
25	Do While a < 6	False					

5. Solution

```
Function my_round(x As Double) As Double
  Dim digit_to_check As Integer
  Dim Return_value As Double

  digit_to_check = Fix(x * 1000) Mod 10
  If digit_to_check >= 5 Then
```

```
    Return_value = (Fix(x * 100) + 1) / 100
  Else
    Return_value = (Fix(x * 100)) / 100
  End If

  Return Return_value
End Function
```

6. Solution

```
Function find_min(a As Double, b As Double) As Double
  Dim min As Double

  min = a
  If b < min Then
    min = b
  End If
  Return min
End Function

Sub Main()
  Dim temp1, temp2, x1, x2, x3, x4 As Double

  Console.Write("Enter four numbers: ")
  x1 = Console.ReadLine()
  x2 = Console.ReadLine()
  x3 = Console.ReadLine()
  x4 = Console.ReadLine()

  'First approach
  temp1 = find_min(x1, x2)
  temp2 = find_min(x3, x4)
  Console.WriteLine(find_min(temp1, temp2))

  'Second approach
  Console.Write(find_min(find_min(x1, x2), find_min(x3, x4)))

  Console.ReadKey()
End Sub
```

7. Solution

```
Function Kelvin_to_Fahrenheit(kelvin As Double) As Double
  Return 1.8 * kelvin - 459.67
End Function

Function Kelvin_to_Celsius(kelvin As Double) As Double
  Return kelvin - 273.15
End Function

Sub Main()
  Dim k As Double
```

```
  Console.Write("Enter a temperature in degrees Kelvin: ")
  k = Console.ReadLine()
  Console.WriteLine("Fahrenheit: " & Kelvin_to_Fahrenheit(k))
  Console.Write("Celsius: " & Kelvin_to_Celsius(k))

  Console.ReadKey()
End Sub
```

8. Solution

```
Function bmi(w As Double, h As Double) As String
  Dim b As Double
  Dim Return_value As String

  b = w * 703 / h ^ 2
  If b < 16 Then
    Return_value = "You must add weight."
  ElseIf b < 18.5 Then
    Return_value = "You should add some weight."
  ElseIf b < 25 Then
    Return_value = "Maintain your weight."
  ElseIf b < 30 Then
    Return_value = "You should lose some weight."
  Else
    Return_value = "You must lose weight."
  End If

  Return Return_value
End Function

Sub Main()
  Dim height, weight As Double
  Dim age As Integer
  Dim input As String

  Console.Write("Enter your weight (in pounds): ")
  input = Console.ReadLine()
  Do While Double.TryParse(input, weight) = False Or weight < 0
    Console.Write("Error! Enter your weight (in pounds): ")
    input = Console.ReadLine()
  Loop

  Console.WriteLine("Enter your age: ")
  input = Console.ReadLine()
  Do While Int32.TryParse(input, age) = False Or age < 18
    Console.Write("Error! Enter your age: ")
    input = Console.ReadLine()
  Loop

  Console.WriteLine("Enter your height (in inches): ")
  input = Console.ReadLine()
  Do While Double.TryParse(input, height) = False Or height < 0
    Console.WriteLine("Error! Enter your height (in inches): ")
    input = Console.ReadLine()
```

```
  Loop

  Console.WriteLine(bmi(weight, height))

  Console.ReadKey()
End Sub
```

Chapter 40

40.5 Review Questions: True/False

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

40. 6 Review Exercises

1. Solution

Step	Statement	Main Code		Function display()
		i	x	a
1	i = 1	**1**	?	
2	i <= 5	True		
3	x = Console.ReadLine()	1	**3**	
4	display(x)			**3**
5	If a Mod 2 = 0 Then			False
6	Console.Write(a & " is odd")	The message “3 is odd” is displayed		
7	i += 1	**2**	3	
8	i <= 5	True		
9	x = Console.ReadLine()	2	**7**	
10	display(x)			**7**
11	If a Mod 2 = 0 Then			False
12	Console.Write(a & " is odd")	The message “7 is odd” is displayed		
13	i += 1	**3**	7	
14	i <= 5	True		
15	x = Console.ReadLine()	3	**9**	
16	display(x)			**9**
17	If a Mod 2 = 0 Then			False
18	Console.Write(a & " is odd")	The message “9 is odd” is displayed		
19	i += 1	**4**	9	
20	i <= 5	True		
21	x = Console.ReadLine()	4	**2**	

22	`display(x)`			**2**
23	`If a Mod 2 = 0 Then`			True
24	`Console.Write(a + " is even")`	The message “2 is even” is displayed		
25	`i += 1`	**5**	2	
26	`i <= 5`	True		
27	`x = Console.ReadLine()`	5	**4**	
28	`display(x)`			**4**
29	`If a Mod 2 = 0 Then`			True
30	`Console.Write(a & " is even")`	The message “4 is even” is displayed		
31	`i += 1`	**6**	4	
32	`i <= 5`	False		

2. *Solution*

Step	Statement	Main Code		Function `division()`	
		x	y	a	b
1	`x = 20`	**20**	?		
2	`y = 30`	20	**30**		
3	`Do While x Mod y < 30`	True			
4	`division(y, x)`			**30**	**20**
5	`b = b \ a`			30	**0**
6	`Console.Write(a * b)`	0 is displayed			
7	`x = 4 * y`	**120**	30		
8	`y += 1`	120	**31**		
9	`Do While x Mod y < 30`	True			
10	`division(y, x)`			**31**	**120**
11	`b = b \ a`			31	**3**
12	`Console.Write(a * b)`	93 is displayed			
13	`x = 4 * y`	**124**	31		
14	`y += 1`	124	**32**		
15	`Do While x Mod y < 30`	True			
16	`division(y, x)`			**32**	**124**
17	`b = b \ a`			32	**3**
18	`Console.Write(a * b)`	96 is displayed			
19	`x = 4 * y`	**128**	32		

20	`y += 1`	128	**33**		
21	`Do While x Mod y < 30`	True			
22	`division(y, x)`			**33**	**128**
23	`b = b \ a`			33	**3**
24	`Console.Write(a * b)`	99 is displayed			
25	`x = 4 * y`	**132**	33		
26	`y += 1`	132	**34**		
27	`Do While x Mod y < 30`	False			

3. Solution

Step	Statement	Main Code		Function `calculate()`		
		i	m	n	s	j
1	`i = 1`	**1**	?			
2	`i <= 3`	True				
3	`m = Console.ReadLine()`	1	**2**			
4	`calculate(m)`			**2**	?	?
5	`s = 0`			2	**0**	?
6	`j = 2`			2	0	**2**
7	`j <= 2 * n`			True		
8	`s = s + j ^ 2`			2	**4**	2
9	`j += 2`			2	4	**4**
10	`j <= 2 * n`			True		
11	`s = s + j ^ 2`			2	**20**	4
12	`j += 2`			2	20	**6**
13	`j <= 2 * n`			False		
14	`Console.Write(s)`	20 is displayed				
15	`i += 1`	**2**	2			
16	`i <= 3`	True				
17	`m = Console.ReadLine()`	2	**3**			
18	`calculate(m)`			**3**	?	?
19	`s = 0`			3	**0**	?
20	`j = 2`			3	0	**2**
21	`j <= 2 * n`			True		
22	`s = s + j ^ 2`			3	**4**	2
23	`j += 2`			3	4	**4**

24	`j <= 2 * n`				True	
25	`s = s + j ^ 2`			3	**20**	4
26	`j += 2`			3	20	**6**
27	`j <= 2 * n`				True	
28	`s = s + j ^ 2`			3	**56**	6
29	`j += 2`			3	56	**8**
30	`j <= 2 * n`				False	
31	`Console.Write(s)`	56 is displayed				
32	`i += 1`	**3**	3			
33	`i <= 3`	True				
34	`m = Console.ReadLine()`	3	**4**			
35	`calculate(m)`			**4**	?	?
36	`s = 0`			4	**0**	?
37	`j = 2`			4	0	**2**
38	`j <= 2 * n`				True	
39	`s = s + j ^ 2`			4	**4**	2
40	`j += 2`			4	4	**4**
41	`j <= 2 * n`				True	
42	`s = s + j ^ 2`			4	**20**	4
43	`j += 2`			4	20	**6**
44	`j <= 2 * n`				True	
45	`s = s + j ^ 2`			4	**56**	6
46	`j += 2`			4	56	**8**
47	`j <= 2 * n`				True	
48	`s = s + j ^ 2`			4	**120**	8
49	`j += 2`			4	120	**10**
50	`j <= 2 * n`				False	
51	`Console.Write(s)`	120 is displayed				
52	`i += 1`	**4**	4			
53	`i <= 3`	False				

4. Solution

```
Sub maximum(a As Double, b As Double, c As Double, d As Double, e As Double)
  Dim max As Double

  max = a
```

```
  If b > max Then
    max = b
  End If
  If c > max Then
    max = c
  End If
  If d > max Then
    max = d
  End If
  If e > max Then
    max = e
  End If
  Console.WriteLine(max)
End Sub
```

5. Solution

```
Sub num_of_days(year As Integer, month As Integer)
  Dim days As Integer

  Select month
    Case 4, 6, 9, 11
      days = 30
    Case 2
      If year Mod 4 = 0 And year Mod 100 <> 0 Or year Mod 400 = 0 Then
        days = 29
      Else
        days = 28
      End If
    Case Else
      days = 31
  End Select
  Console.WriteLine(days)
End Sub

Sub Main()
  Dim m, y As Integer

  Console.Write("Enter a year: ")
  y = Console.ReadLine()
  For m = 1 To 12
    num_of_days(y, m)
  Next

  Console.ReadKey()
End Sub
```

6. Solution

```
Sub display_menu()
  Console.WriteLine()
  Console.WriteLine("1. Convert meters to miles")
  Console.WriteLine("2. Convert miles to meters")
```

```
  Console.WriteLine("3. Exit")
  Console.Write("Enter a choice: ")
End Sub

Sub meters_to_miles(meters As Double)
  Console.WriteLine(meters & " meters equals " & (meters / 1609.344) & " miles")
End Sub

Sub miles_to_meters(miles As Double)
  Console.WriteLine(miles & " miles equals " & (miles * 1609.344) & " meters")
End Sub

Sub Main()
  Dim choice As Integer
  Dim distance As Double

  Do
    display_menu()

    choice = Console.ReadLine()

    If choice = 3 Then
      Console.WriteLine("Bye!")
    Else
      Console.WriteLine("Enter distance: ")
      distance = Console.ReadLine()
      If choice = 1 Then
        meters_to_miles(distance)
      Else
        miles_to_meters(distance)
      End If
    End If
  Loop While choice <> 3
End Sub
```

7. Solution

```
Sub amount_to_pay(seconds As Integer)
  Dim extra, tax, total, total_without_tax As Double

  If seconds <= 600 Then
    extra = 0
  ElseIf seconds <= 1200 Then
    extra = (seconds - 600) * 0.01
  Else
    extra = 600 * 0.01 + (seconds - 1200) * 0.02
  End If

  total_without_tax = 10 + extra
  tax = total_without_tax * 11 / 100
  total = total_without_tax + tax

  Console.WriteLine("Total amount to pay: " & total)
End Sub
```

```
Sub Main()
  Dim seconds As Integer

  Console.Write("Enter number of seconds: ")
  seconds = Console.ReadLine()
  amount_to_pay(seconds)

  Console.ReadKey()
End Sub
```

Chapter 41

41.10 Review Questions: True/False

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

41.11 Review Exercises

1. Solution

The value 5 is displayed

2. Solution

The value 14 is displayed

3. Solution

The value 14 is displayed

4. Solution

Step	Statement	Main Code				Function swap()		
		a	m	k	x	x	y	temp
1	`k = Console.ReadLine()`	?	?	**12**	?			
2	`m = 1`	?	**1**	12	?			
3	`a = 1`	**1**	1	12	?			
4	`Do While a < 8`	True						
5	`If k Mod m <> 0 Then`	False						
6	`x = a + m + Fix(a - m)`	1	1	12	**2**			
7	`Console.Write(m & " " & a & " " & x)`	1 1 2 is displayed						
8	`a += 2`	**3**	1	12	2			

9	`m += 1`	3	**2**	12	2			
10	`swap(a, m)`					**3**	**2**	?
11	`temp = x`					3	2	**3**
12	`x = y`					**2**	2	3
13	`y = temp`					2	**3**	3
14	`Do While a < 8`	**2**	**3**	12	2			
		True						
15	`If k Mod m <> 0 Then`	False						
16	`x = a + m + Fix(a - m)`	2	3	12	**4**			
17	`Console.Write(m & " " & a & " " & x)`	3 2 4 is displayed						
18	`a += 2`	**4**	3	12	4			
19	`m += 1`	4	**4**	12	4			
20	`swap(a, m)`					**4**	**4**	?
21	`temp = x`					4	4	**4**
22	`x = y`					**4**	4	4
23	`y = temp`					4	**4**	4
24	`Do While a < 8`	**4**	**4**	12	4			
		True						
25	`If k Mod m <> 0 Then`	False						
26	`x = a + m + Fix(a - m)`	4	4	12	**8**			
27	`Console.Write(m & " " & a & " " & x)`	4 4 8 is displayed						
28	`a += 2`	**6**	4	12	8			
29	`m += 1`	6	**5**	12	8			
30	`swap(a, m)`					**6**	**5**	?
31	`temp = x`					6	5	**6**
32	`x = y`					**5**	5	6
33	`y = temp`					5	**6**	5
34	`Do While a < 8`	**5**	**6**	12	8			
		True						
35	`If k Mod m <> 0 Then`	False						
36	`x = a + m + Fix(a - m)`	5	6	12	**10**			
37	`Console.Write(m & " " & a & " " & x)`	6 5 10 is displayed						
38	`a += 2`	**7**	6	12	10			
39	`m += 1`	7	**7**	12	10			
40	`swap(a, m)`					**7**	**7**	?

41	temp = x					7	7	**7**
42	x = y					**7**	7	7
43	y = temp					7	**7**	7
44	Do While a < 8	**7**	**7**	12	10			
		True						
45	If k Mod m <> 0 Then	True						
46	x = a Mod m	7	7	12	**0**			
47	swap(m, a)					**7**	**7**	?
48	temp = x					7	7	**7**
49	x = y					**7**	7	7
50	y = temp					7	**7**	7
51	Console.Write(m & " " & a & " " & x)	**7**	**7**	12	0			
		7 7 0 is displayed						
52	a += 2	**9**	7	12	0			
53	m += 1	9	**8**	12	0			
54	swap(a, m)					**9**	**8**	?
55	temp = x					9	8	**9**
56	x = y					**8**	8	9
57	y = temp					8	**9**	9
58	Do While a < 8	**8**	**9**	12	0			
		False						

5. Solution

"hellohellohello" is displayed

6. Solution

The value 15 is displayed

7. Solution

11 4 is displayed

8. Solution

```
Const STUDENTS = 10
Const LESSONS = 5

Sub part1(names() As String, grades(,) As Integer)
  Dim i, j As Integer
```

```
  For i = 0 To STUDENTS - 1
    Console.Write("Enter name for student No. " & (i + 1) & ": ")
    names(i) = Console.ReadLine()
    For j = 0 To LESSONS - 1
      Console.Write("Enter grade for lesson No. " & (j + 1) & ": ")
      grades(i, j) = Console.ReadLine()
    Next
  Next
End Sub

Function part2(grades(,) As Integer) As Double()
  Dim average(STUDENTS - 1) As Double
  Dim i, j As Integer

  For i = 0 To STUDENTS - 1
    average(i) = 0
    For j = 0 To LESSONS - 1
      average(i) += grades(i, j)
    Next
    average(i) /= LESSONS
  Next
  Return average
End Function

Sub part3(average() As Double, names() As String)
  Dim m, n As Integer
  Dim temp As Double
  Dim temp_str As String

  For m = 1 To STUDENTS - 1
    For n = STUDENTS - 1 To m Step -1
      If average(n) > average(n - 1) Then
        temp = average(n)
        average(n) = average(n - 1)
        average(n - 1) = temp

        temp_str = names(n)
        names(n) = names(n - 1)
        names(n - 1) = temp_str
      ElseIf average(n) = average(n - 1) Then
        If names(n).CompareTo(names(n - 1)) < 0 Then
          temp_str = names(n)
          names(n) = names(n - 1)
          names(n - 1) = temp_str
        End If
      End If
    Next
  Next
End Sub

Sub Main()
  Dim i As Integer

  Dim names(STUDENTS - 1) As String
```

```
  Dim grades(STUDENTS - 1, LESSONS - 1) As Integer

  part1(names, grades)

  Dim average(STUDENTS - 1) As Double
  average = part2(grades)

  part3(average, names)

  For i = 0 To STUDENTS - 1
    Console.WriteLine(names(i) & vbTab & average(i))
  Next

  Console.ReadKey()
End Sub
```

9. Solution

```
Sub Main()
  Dim a, b, c, max As Integer

  a = Console.ReadLine()
  b = Console.ReadLine()
  c = Console.ReadLine()
  d = Console.ReadLine()

  max = a
  If b > max Then
    max = b
  End If
  If c > max Then
    max = c
  End If
  If d > max Then
    max = d
  End If

  Console.Write(max)

  Console.ReadKey()
End Sub
```

10. Solution

```
Function part1() As String
  Dim message As String
  Console.Write("Enter a message: ")
  message = Console.ReadLine().ToLower()
  Return message
End Function

Function part2(message As String) As Integer
  Dim last_pos As Integer = message.Length - 1
```

```
  Return last_pos
End Function

Function part3(message As String, last_pos As Integer) As String
  Dim letter, message_clean As String
  Dim i As Integer

  message_clean = ""
  For i = 0 To last_pos
    letter = message(i)
    If letter <> " " And letter <> "," And letter <> "." And letter <> "?" Then
      message_clean += letter
    End If
  Next
  Return message_clean
End Function

Function part4(message_clean As String) As Boolean
  Dim middle_pos, i, j As Integer
  Dim palindrome As Boolean
  Dim left_letter, right_letter As String

  middle_pos = (message_clean.Length - 1) \ 2
  j = message_clean.Length - 1  'or you can write  j = part2(message_clean)
  palindrome = True
  For i = 0 To middle_pos
    left_letter = message_clean(i)
    right_letter = message_clean(j)
    If left_letter <> right_letter Then
      palindrome = False
      Exit For
    End If
    j -= 1
  Next
  Return palindrome
End Function

Function part5(message As String) As Boolean
  Dim last_pos As Integer
  Dim message_clean As String
  Dim palindrome As Boolean

  last_pos = part2(message)
  message_clean = part3(message, last_pos)
  palindrome = part4(message_clean)
  Return palindrome
End Function

Sub Main()
  Dim message As String
  Dim palindrome As Boolean

  message = part1()
  palindrome = part5(message)
```

```
  If palindrome = True Then
    Console.WriteLine("The message is palindrome")
  End If

  Console.ReadKey()
End Sub
```

11. Solution

```
Sub f1(a As Double, b As Double, c As Double, ByRef sum As Double, ByRef average As Double)
  sum = a + b + c
  average = sum / 3
End Sub
```

12. Solution

```
Function my_round(x As Double, Optional decimal_places As Integer = 2) As Double
  Dim Return_value As Double

  Dim digit_to_check As Integer = x * 10 ^ (decimal_places + 1) Mod 10
  If digit_to_check >= 5 Then
    Return_value = Fix(x * 10 ^ decimal_places + 1) / 10 ^ decimal_places
  Else
    Return_value = Fix(x * 10 ^ decimal_places) / 10 ^ decimal_places
  End If
  Return Return_value
End Function
```

13. Solution

```
Function get_input() As String
  Dim answer As String

  Do
    Console.Write("Enter Yes or No: ")
    answer = Console.ReadLine().ToUpper()
  Loop While answer <> "YES" And answer <> "NO"
  Return answer
End Function

Function find_area(b As Double, h As Double) As Double
  Return b * h
End Function

Sub Main()
  Dim bas, height As Double

  Do
    Console.Write("Enter the base of the parallelogram: ")
    bas = Console.ReadLine()
    Console.Write("Enter the height of the parallelogram: ")
    height = Console.ReadLine()
```

```
    Console.WriteLine("Area = " & find_area(bas, height))

    Console.WriteLine("Would you like to repeat? ")
  Loop While get_input() = "YES"
End Sub
```

14. Solution

```
Const STUDENTS = 100

Sub get_arrays(names() As String, grades() As Integer)
  Dim i As Integer

  For i = 0 To STUDENTS - 1
    Console.Write("Enter name: ")
    names(i) = Console.ReadLine()
    Console.Write("Enter grade: ")
    grades(i) = Console.ReadLine()
  Next
End Sub

Function get_average(grades() As Integer) As Double
  Dim i, sum As Integer
  sum = 0
  For i = 0 To STUDENTS - 1
    sum += grades(i)
  Next
  Return sum / STUDENTS
End Function

Sub sort_arrays(grades() As Integer, names() As String)
  Dim m, n, element_grds As Integer
  Dim element_nms As String

  For m = 1 To STUDENTS - 1
    element_grds = grades(m)
    element_nms = names(m)

    n = m
    Do While n > 0
      If element_grds < grades(n - 1) Then Exit Do
      grades(n) = grades(n - 1)
      names(n) = names(n - 1)
      n -= 1
    Loop

    grades(n) = element_grds
    names(n) = element_nms
  Next
End Sub

Sub Main()

  Dim i As Integer
```

```
  Dim average As Double

  Dim names(STUDENTS - 1) As String
  Dim grades(STUDENTS - 1) As Integer

  get_arrays(names, grades)
  average = get_average(grades)
  sort_arrays(grades, names)
  For i = 0 To STUDENTS - 1
    If grades(i) < average Then
      Console.WriteLine(names(i))
    End If
  Next

  Console.ReadKey()
End Sub
```

15. Solution

```
Const JUDGES = 10

Function get_array() As Integer()
  Dim score(JUDGES - 1) As Integer
  Dim i As Integer

  For i = 0 To JUDGES - 1
    Console.Write("Judge No " & (i + 1) & ". Enter score: ")
    score(i) = Console.ReadLine()
  Next
  Return score
End Function

Sub find_min_max(score() As Integer, ByRef min As Integer, ByRef max As Integer)
  Dim i As Integer

  min = score(0)
  max = score(0)
  For i = 1 To JUDGES - 1
    If score(i) > max Then
      max = score(i)
    End If
    If score(i) < min Then
      min = score(i)
    End If
  Next
End Sub

Sub Main()
  Dim name As String
  Dim sum, i, points, min, max As Integer
  Dim score(JUDGES - 1) As Integer

  Console.Write("Enter artist's name: ")
  name = Console.ReadLine()
```

```
  score = get_array()
  find_min_max(score, min, max)

  sum = 0
  For i = 0 To JUDGES - 1
    sum += score(i)
  Next

  points = sum - min - max
  Console.Write("Artist " & name & " got " & points & " points")

  Console.ReadKey()
End Sub
```

16. Solution

```
Function woc(index As Integer) As Double
  Dim Return_value As Double

  If index = 1 Then
    Return_value = 1
  Else
    Return_value = 2 * woc(index - 1)
  End If
  Return Return_value
End Function

Sub Main()
  Dim sum As Double
  Dim i As Integer

  sum = 0
  For i = 1 To 64
    sum += woc(i)
  Next
  Console.Write(sum)

  Console.ReadKey()
End Sub
```

17. Solution

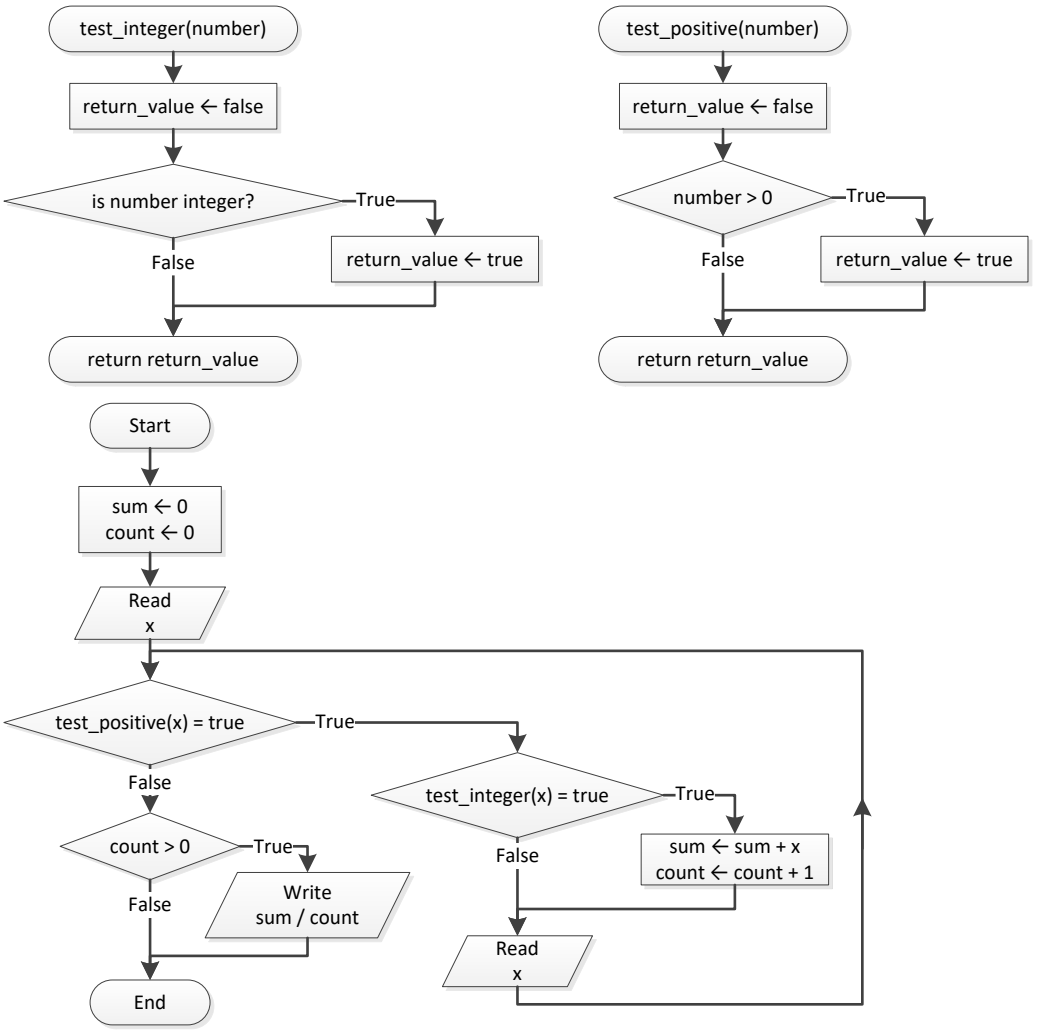
```
Function fact(value As Integer) As Double
  Dim Return_value As Double

  If value = 1 Then
    Return_value = 1
  Else
    Return_value = value * fact(value - 1)
  End If

  Return Return_value
End Function
```

```
Function my_cos(x As Double, Optional i As Integer = 40) As Double
  Dim Return_value As Double

  If i = 0 Then
    Return_value = 1
  Else
    Return_value = my_cos(x, i - 4) + x ^ i / fact(i) - x ^ (i - 2) / fact(i - 2)
  End If

  Return Return_value
End Function

Sub Main()
  Console.Write(my_cos(Math.PI / 4))

  Console.ReadKey()
End Sub
```

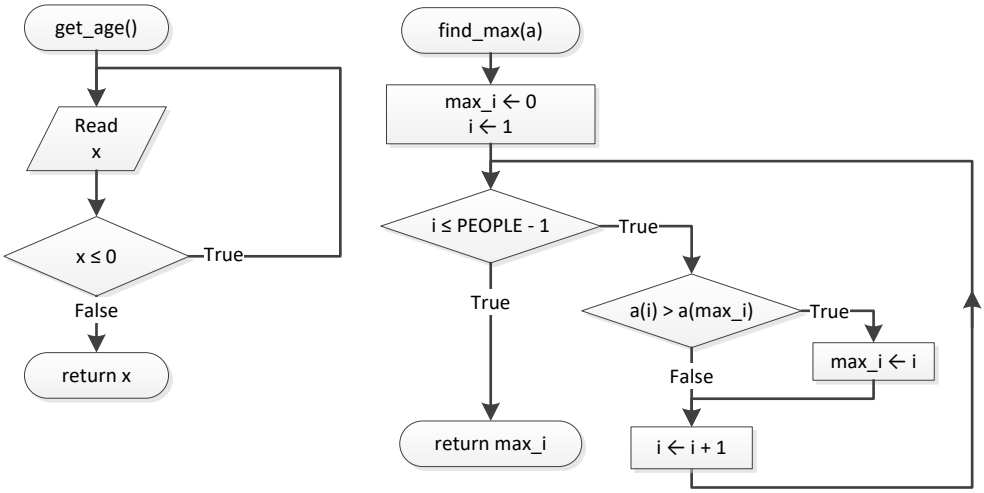
Chapter 42

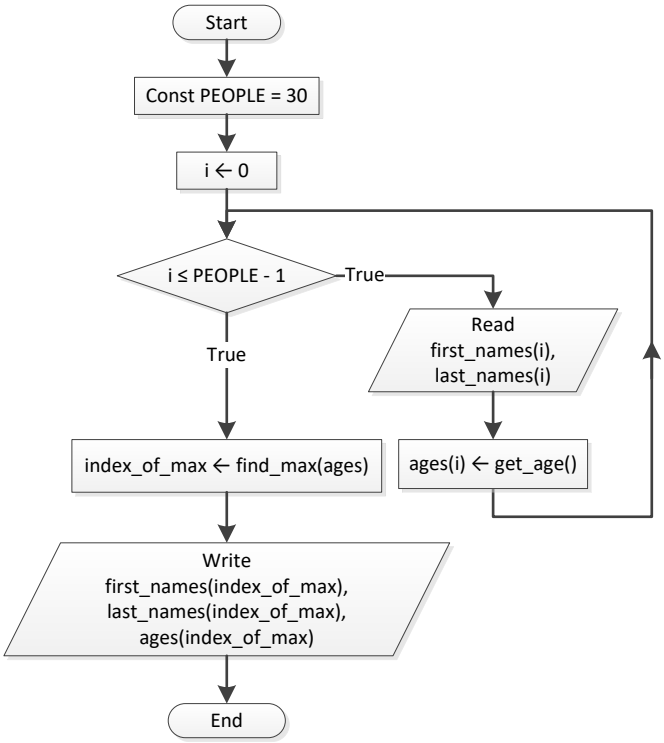
42.4 Review Exercises

1. Solution

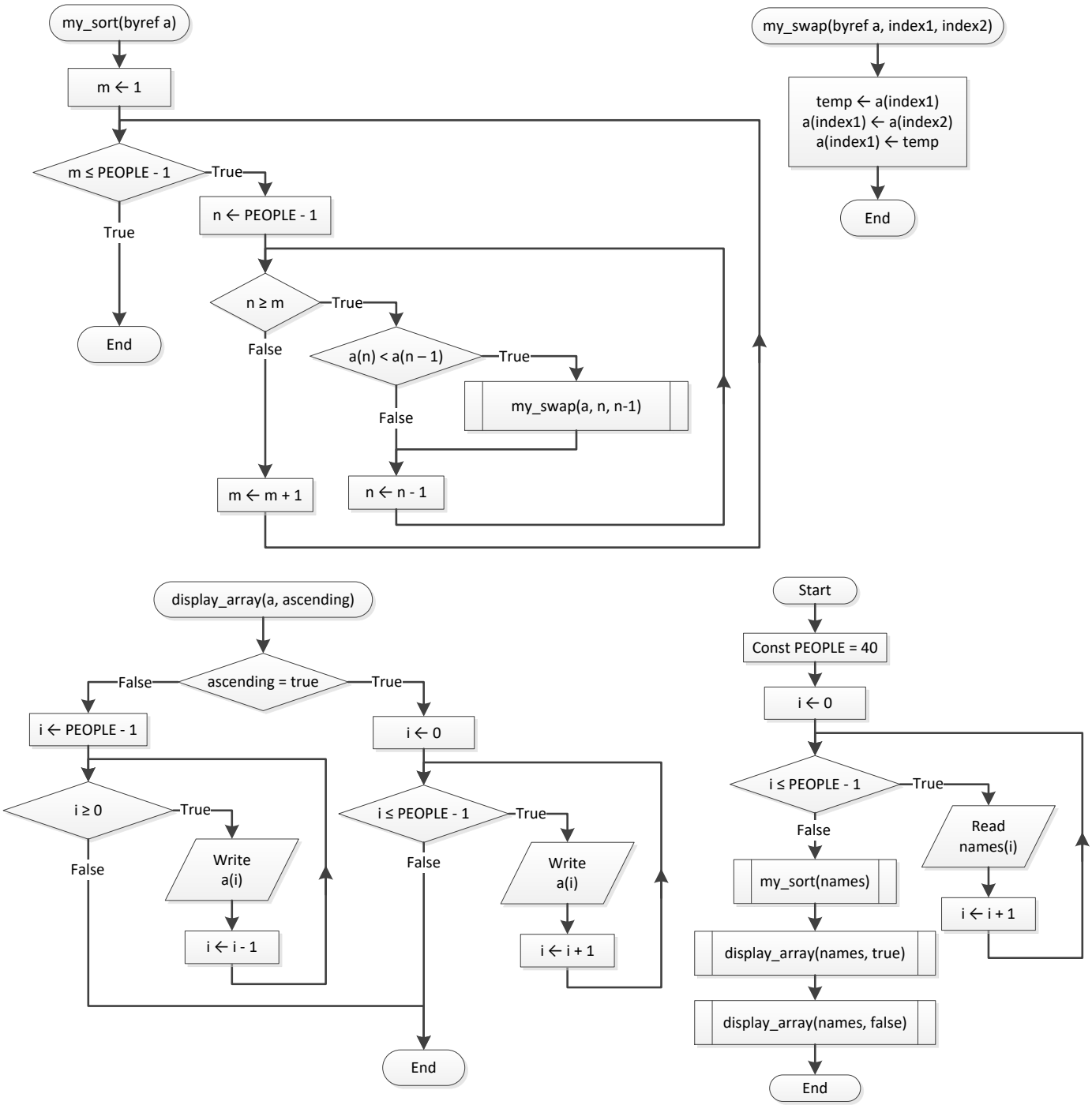


2. Solution

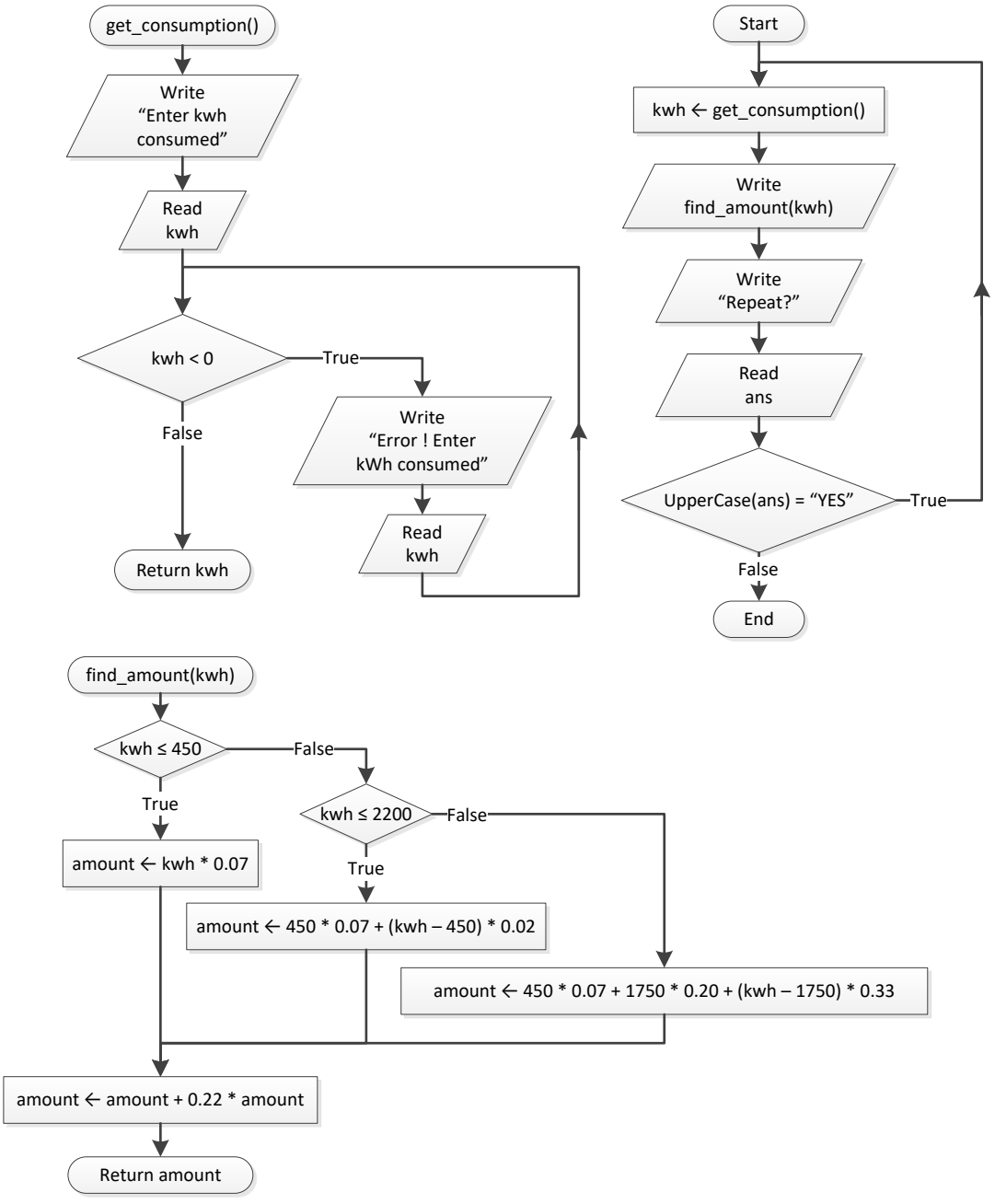

get_age()
Read
x
x ≤ 0
True
False
return x
find_max(a)
max_i ← 0
i ← 1
i ≤ PEOPLE - 1
True
True
a(i) > a(max_i)
True
max_i ← i
False
i ← i + 1
return max_i


Start
Const PEOPLE = 30
i ← 0
i ≤ PEOPLE - 1
True
True
Read
first_names(i),
last_names(i)
index_of_max ← find_max(ages)
ages(i) ← get_age()
Write
first_names(index_of_max),
last_names(index_of_max),
ages(index_of_max)
End

3. Solution


my_sort(byref a)
m ← 1
m ≤ PEOPLE - 1
True
n ← PEOPLE - 1
True
End
n ≥ m
True
False
a(n) < a(n – 1)
True
my_swap(a, n, n-1)
False
m ← m + 1
n ← n - 1
my_swap(byref a, index1, index2)
temp ← a(index1)
a(index1) ← a(index2)
a(index1) ← temp
End
display_array(a, ascending)
ascending = true
False
True
i ← PEOPLE - 1
i ≥ 0
True
Write
a(i)
i ← i - 1
False
i ← 0
i ≤ PEOPLE - 1
True
Write
a(i)
i ← i + 1
False
End
Start
Const PEOPLE = 40
i ← 0
i ≤ PEOPLE - 1
True
Read
names(i)
i ← i + 1
False
my_sort(names)
display_array(names, true)
display_array(names, false)
End

4. Solution



5. Solution

```
Const STUDENTS = 20
Const LESSONS = 10

Sub get_arrays(names() As String, grades(,) As Integer)
  Dim i, j As Integer

  For i = 0 To STUDENTS - 1
```

```
    names(i) = Console.ReadLine()
    For j = 0 To LESSONS - 1
      grades(i, j) = Console.ReadLine()
    Next
  Next
End Sub

Function find_average(grades(,) As Integer) As Double()
  Dim i, j As Integer
  Dim average(STUDENTS - 1) As Double

  For i = 0 To STUDENTS - 1
    average(i) = 0
    For j = 0 To LESSONS - 1
      average(i) += grades(i, j)
    Next
    average(i) /= LESSONS
  Next
  Return average
End Function

Sub display(names() As String, average() As Double)
  Dim i As Integer

  For i = 0 To STUDENTS - 1
    If average(i) > 89 Then
      Console.WriteLine(names(i) & ", " & average(i))
    End If
  Next
End Sub

Sub Main()
  Dim names(STUDENTS - 1) As String
  Dim grades(STUDENTS - 1, LESSONS - 1) As Integer
  Dim av(STUDENTS - 1) As Double

  get_arrays(names, grades)
  av = find_average(grades)
  display(names, av)

  Console.ReadKey()
End Sub
```

6. Solution

```
Function fib(n As Integer) As Double
  Dim Return_val As Double

  If n = 0 Or n = 1 Then
    Return_val = n
  Else
    Return_val = fib(n - 1) + fib(n - 2)
  End If
```

```
  Return Return_val
End Function

Sub Main()
  Dim n As Integer
  Dim ans As String

  Do
    n = Console.ReadLine()
    Do While n < 0
      Console.WriteLine("Error")
      n = Console.ReadLine()
    Loop

    Console.WriteLine(fib(n))
    Console.WriteLine("Again? ")
    ans = Console.ReadLine().ToUpper()
  Loop While ans = "Y"
End Sub
```

Chapter 43

43.3 Review Exercises

1. Solution

```
Const ACCURACY = 0.000000001

Function factorial(n As Integer) As Double
  Dim i As Integer

  Dim Return_value As Double = 1
  For i = 1 To n
    Return_value *= i
  Next
  Return Return_value
End Function

Function my_sin(x As Double) As Double
  Dim i, sign As Integer
  Dim sinus, sinus_previous As Double
  sign = 1
  sinus = 0
  i = 1
  Do
    sinus_previous = sinus
    sinus += sign * x ^ i / factorial(i)

    sign = -sign
    i += 2
  Loop While Math.Abs(sinus - sinus_previous) > ACCURACY
  Return sinus
End Function

Function degrees_to_rad(degrees As Double) As Double
  Return 2 * Math.PI * degrees / 360
End Function

Sub Main()
  Dim i As Integer

  For i = 0 To 360
    Console.WriteLine("sin(" & i & ") ~= " & my_sin(degrees_to_rad(i)))
  Next

  Console.ReadKey()
End Sub
```

2. Solution

```
Function is_leap(year As Integer) As Boolean
  Dim Return_value As Boolean = False
```

```
  If year Mod 4 = 0 And year Mod 100 <> 0 Or year Mod 400 = 0 Then
    Return_value = True
  End If
  Return Return_value
End Function

Function num_of_days(year As Integer, month As Integer) As Integer
  Dim days As Integer

  Select month
    Case 4, 6, 9, 11
      days = 30
    Case 2
      If is_leap(year) = True Then
        days = 29
      Else
        days = 28
      End If
    Case Else
      days = 31
  End Select

  Return days
End Function

Function check_date(day As Integer, month As Integer, year As Integer) As Boolean
  Dim Return_value As Boolean = True
  If month < 1 Or month > 12 Then
    Return_value = False
  ElseIf day < 1 Or day > num_of_days(year, month) Then
    Return_value = False
  End If
  Return Return_value
End Function

Sub Main()
  Dim day, month, year, sum, i As Integer

  Console.Write("Enter day: ")
  day = Console.ReadLine()
  Console.Write("Enter month: ")
  month = Console.ReadLine()
  Console.Write("Enter year: ")
  year = Console.ReadLine()
  Do While check_date(day, month, year) = False
    Console.WriteLine("Error!")
    Console.Write("Enter day: ")
    day = Console.ReadLine()
    Console.Write("Enter month: ")
    month = Console.ReadLine()
    Console.Write("Enter year: ")
    year = Console.ReadLine()
  Loop
```

```
  sum = 0
  For i = 1 To month - 1
    sum += num_of_days(year, i)
  Next
  sum += day

  Console.Write(sum)

  Console.ReadKey()
End Sub
```

3. Solution

```
Dim rnd As New Random()

Function dice() As Integer
  Return rnd.Next(1, 7)
End Function

Sub Main()
  Dim dice1, dice2, i, player, sum, sum_player1, sum_player2 As Integer
  Dim key As String
  Dim name1, name2 As String

  Console.Write("Player1 - Enter name: ")
  name1 = Console.ReadLine()
  Console.Write("Player2 - Enter name: ")
  name2 = Console.ReadLine()

  For player = 1 To 2
    sum = 0
    For i = 1 To 10
      If player = 1 Then
        Console.WriteLine(name1 & ", hit enter to roll the dice!")
      Else
        Console.WriteLine(name2 & ", hit enter to roll the dice!")
      End If
      key = Console.ReadLine()

      dice1 = dice()
      dice2 = dice()
      Console.WriteLine(dice1 & "   " & dice2)
      sum += dice1 + dice2
    Next
    If player = 1 Then
      sum_player1 = sum
    Else
      sum_player2 = sum
    End If
  Next

  If sum_player1 = sum_player2 Then
    Console.WriteLine("Tie!")
  ElseIf sum_player1 > sum_player2 Then
```

```
    Console.WriteLine(name1 & " wins")
  Else
    Console.WriteLine(name2 & " wins")
  End If

  Console.ReadKey()
End Sub
```

4. Solution

```
Const GAS = 1
Const DIESEL = 2
Const HYBRID = 3
Const TAX_RATE = 0.1
Const CARS = 40

Function get_choice() As Integer
  Dim choice As Integer
  Console.WriteLine("1. Gas")
  Console.WriteLine("2. Diesel")
  Console.WriteLine("3. Hybrid")
  Console.Write("Enter type of the car: ")
  choice = Console.ReadLine()
  Return choice
End Function

Function get_days() As Integer
  Dim days As Integer
  Console.Write("Enter total number of rental days: ")
  days = Console.ReadLine()
  Return days
End Function

Function get_charge(type As Integer, rental_days As Integer) As Double
  Dim charge As Double

  If type = GAS Then
    If rental_days <= 5 Then
      charge = rental_days * 24
    ElseIf rental_days <= 8 Then
      charge = 5 * 24 + (rental_days - 5) * 22
    Else
      charge = 5 * 24 + 3 * 22 + (rental_days - 8) * 18
    End If
  ElseIf type = DIESEL Then
    If rental_days <= 5 Then
      charge = rental_days * 28
    ElseIf rental_days <= 8 Then
      charge = 5 * 28 + (rental_days - 5) * 25
    Else
      charge = 5 * 28 + 3 * 25 + (rental_days - 8) * 21
    End If
  Else
    If rental_days <= 5 Then
```

```
      charge = rental_days * 30
    ElseIf rental_days <= 8 Then
      charge = 5 * 30 + (rental_days - 5) * 28
    Else
      charge = 5 * 30 + 3 * 28 + (rental_days - 8) * 23
    End If
  End If
  charge = charge * (1 + TAX_RATE) 'This is equivalent to charge += charge * TAX_RATE
  Return charge
End Function

Sub Main()

  Dim count, i As Integer
  Dim charge, sum As Double

  Dim rented_car_types(CARS - 1) As Integer
  Dim rented_days(CARS - 1) As Integer

  For i = 0 To CARS - 1
    rented_car_types(i) = get_choice()
    rented_days(i) = get_days()
  Next

  sum = 0
  For i = 0 To CARS - 1
     charge = get_charge(rented_car_types(i), rented_days(i))
     Console.WriteLine("Car No " & (i + 1) & ": " & charge)
     sum += charge
  Next

  count = 0
  For i = 0 To CARS - 1
   If rented_car_types(i) = HYBRID Then
     count += 1
   End If
  Next

  Console.WriteLine("Hybrids rented: " & count)
  Console.Write("Net profit: " & sum / (1 + TAX_RATE))

  Console.ReadKey()
End Sub
```

5. Solution

```
Const CHANNELS = 10
Const DAYS = 7

Sub get_data(names() As String, viewers(,) As Integer)
  Dim i, j As Integer

  Dim day_names() As String = {"Monday", "Tuesday", "Wednesday",
                               "Thursday", "Friday", "Saturday", "Sunday"}
```

```
  For i = 0 To CHANNELS - 1
    Console.WriteLine("Enter name For channel No. " & (i + 1) & ": ")
    names(i) = Console.ReadLine()
    For j = 0 To DAYS - 1
      Console.Write("Enter the number of viewers of the main news program on " & day_names(j))
      Console.Write(" For channel " & names(i) & ": ")
      viewers(i, j) = Console.ReadLine()
    Next
  Next
End Sub

Function get_average(a() As Integer) As Double
  Dim sum, i As Integer

  sum = 0
  For i = 0 To 4
    sum += a(i)
  Next
  Return sum / 5
End Function

Sub Main()
  Dim i, j As Integer
  Dim weekend As Double
  Dim increasing As Boolean

  Dim names(CHANNELS - 1) As String
  Dim viewers(CHANNELS - 1, DAYS - 1) As Integer
  get_data(names, viewers)

  Dim temporary_array(4) As Integer
  For i = 0 To CHANNELS - 1
    For j = 0 To 4
      temporary_array(j) = viewers(i, j)
    Next
    weekend = (viewers(i, DAYS - 2) + viewers(i, DAYS - 1)) / 2
    If weekend >= 1.2 * get_average(temporary_array) Then
      Console.WriteLine(names(i))
    End If
  Next

  For i = 0 To CHANNELS - 1
    increasing = True
    For j = 1 To DAYS - 1
      If viewers(i, j) <= viewers(i, j - 1) Then
        increasing = False
      End If
    Next
    If increasing = True Then
      Console.WriteLine(names(i))
    End If
  Next
```

```
  Console.ReadKey()
End Sub
```

6. Solution

```
Const CITIZENS = 30

Sub input_data(SSNs() As Integer, answers() As String)
  Dim i As Integer

  For i = 0 To CITIZENS - 1
    Console.Write("Enter SSN: ")
    SSNs(i) = Console.ReadLine()
    Console.Write("Enter answer: ")
    answers(i) = Console.ReadLine()
  Next
End Sub

Sub sort_arrays(SSNs() As Integer, answers() As String)
  Dim m, n, index_of_min As Integer
  Dim min, temp As Integer
  Dim temp_str As String

  For m = 0 To CITIZENS - 1
    min = SSNs(m)
    index_of_min = m
    For n = m To CITIZENS - 1
      If SSNs(n) < min Then
        min = SSNs(n)
        index_of_min = n
      End If
    Next
    temp = SSNs(m)
    SSNs(m) = SSNs(index_of_min)
    SSNs(index_of_min) = temp
    temp_str = answers(m)
    answers(m) = answers(index_of_min)
    answers(index_of_min) = temp_str
  Next
End Sub

Function search_array(SSNs() As Integer, SSN As Integer) As Integer
  Dim left, right, middle, index_position, Return_value As Integer
  Dim found As Boolean

  left = 0
  right = CITIZENS - 1
  found = False
  Do While left <= right And found = False
    middle = (left + right) \ 2

    If SSNs(middle) > SSN Then
      right = middle - 1
    ElseIf SSNs(middle) < SSN Then
```

```
      left = middle + 1
    Else
      found = True
      index_position = middle
    End If
  Loop

  If found = False Then
    Console.WriteLine("SSN not found!")
    Return_value = -1
  Else
    Return_value = index_position
  End If
  Return Return_value
End Function

Function count_answers(answers() As String, answer As String) As Integer
  Dim count, i As Integer

  count = 0
  For i = 0 To CITIZENS - 1
    If answers(i) = answer Then
      count += 1
    End If
  Next
  Return count
End Function

Sub Main()
  Dim SSNs(CITIZENS - 1) As Integer
  Dim SSN As Integer
  Dim answers(CITIZENS - 1) As String
  Dim index, count As Integer
  Dim answer As String

  Do
    input_data(SSNs, answers)
    sort_arrays(SSNs, answers)

    Console.Write("Enter an SSN to search: ")
    SSN = Console.ReadLine()

    index = search_array(SSNs, SSN)
    If index <> -1 Then
      answer = answers(index)
      Console.WriteLine(answer)

      count = count_answers(answers, answer)
      Console.WriteLine(count * 100 / CITIZENS)
    End If
    Console.WriteLine("Repeat? ")
    answer = Console.ReadLine()
  Loop While answer = "Yes"
End Sub
```

7. Solution

```
Const TEAMS = 8
Const GAMES = 12

Sub input_data(names() As String, results(,) As String)
  Dim i, j As Integer

  For i = 0 To TEAMS - 1
    Console.Write("Enter team name: ")
    names(i) = Console.ReadLine()
    For j = 0 To GAMES - 1
      Console.Write("Enter result (W, L, T): ")
      results(i, j) = Console.ReadLine()
    Next
  Next
End Sub

Sub display_result(names() As String, results(,) As String)
  Dim result As String
  Dim i, j As Integer
  Dim found As Boolean

  Console.Write("Enter a result to search (W, L, T): ")
  result = Console.ReadLine()
  For i = 0 To TEAMS - 1
    Console.WriteLine("Team: " & names(i))
    found = False
    For j = 0 To GAMES - 1
      If results(i, j) = result Then
        Console.WriteLine("Week: " & (j + 1))
        found = True
      End If
    Next
    If found = False Then
      Console.WriteLine("Nothing found")
    End If
  Next
End Sub

Function find_team(names() As String) As Integer
  Dim name As String
  Dim i, Return_value As Integer

  Console.Write("Enter a name to search: ")
  name = Console.ReadLine()

  i = 0
  Do While i < TEAMS - 1 And names(i) <> name
    i += 1
  Loop

  If names(i) <> name Then
```

```
    Return_value = -1
  Else
    Return_value = i
  End If
  Return Return_value
End Function

Sub Main()
  Dim names(TEAMS - 1) As String
  Dim results(TEAMS - 1, GAMES - 1) As String
  Dim j, index, sum As Integer

  input_data(names, results)
  display_result(names, results)

  index = find_team(names)
  Do While index <> -1
    sum = 0
    For j = 0 To GAMES - 1
      If results(index, j) = "W" Then
        sum += 3
      ElseIf results(index, j) = "T" Then
        sum += 1
      End If
    Next
    Console.WriteLine("Points: " & sum)
    index = find_team(names)
  Loop

  Console.ReadKey()
End Sub
```

8. Solution

```
'space is a valid character!
Dim alphabet As String = " abcdefghijklmnopqrstuvwxyz"

Function my_encrypt(message As String, encryption_key As Integer) As String
  Dim Return_value As String
  Dim i, index, new_index As Integer
  Dim letter, new_letter As String

  Return_value = ""
  For i = 0 To message.Length - 1
    letter = message(i)
    index = alphabet.IndexOf(letter)
    new_index = (index + encryption_key) Mod 27 '26 letters + 1 space
    new_letter = alphabet(new_index)
    Return_value += new_letter
  Next
  Return Return_value
End Function

Function my_decrypt(message As String, decryption_key As Integer) As String
```

```
  Dim Return_value As String
  Dim i, index, new_index As Integer
  Dim letter, new_letter As String

  Return_value = ""
  For i = 0 To message.Length - 1
    letter = message(i)
    index = alphabet.IndexOf(letter)
    new_index = (index + 27 - decryption_key) Mod 27 '26 letters + 1 space
    new_letter = alphabet(new_index)
    Return_value += new_letter
  Next
  Return Return_value
End Function

Sub display_menu()
  Console.WriteLine()
  Console.WriteLine("1. Encrypt a message")
  Console.WriteLine("2. Decrypt a message")
  Console.WriteLine("3. Exit")
End Sub

Sub Main()
  Dim choice, encryption_key, decryption_key As Integer
  Dim message As String

  Do
    display_menu()
    Console.Write("Enter a choice: ")
    choice = Console.ReadLine()

    If choice = 1 Then
      Console.Write("Enter a message to encrypt: ")
      message = Console.ReadLine()
      Console.Write("Enter an encryption key: ")
      encryption_key = Console.ReadLine()
      Console.WriteLine("Your encrypted message is: " & my_encrypt(message, encryption_key))
    ElseIf choice = 2 Then
      Console.Write("Enter a message to decrypt: ")
      message = Console.ReadLine()
      Console.Write("Enter an decryption key: ")
      decryption_key = Console.ReadLine()
      Console.WriteLine("Your decrypted message is: " & my_decrypt(message, decryption_key))
    End If
  Loop While choice <> 3
End Sub
```

Some Final Words from the Authors

We hope you really enjoyed reading this book. We 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 us your gratitude by writing a good review and giving us as many stars as possible. By doing this, you will encourage us to continue writing and of course you'll help other readers to reach us.

And remember: Learning is a process within an endless loop structure. It begins at birth and continues throughout your lifetime!

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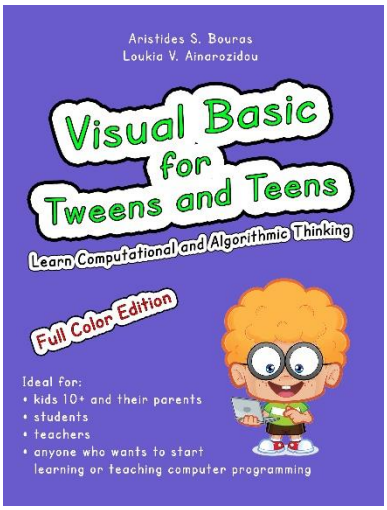

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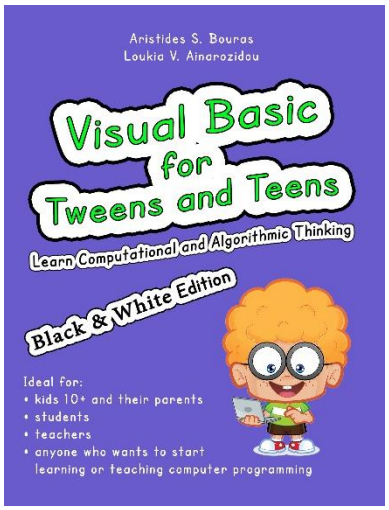

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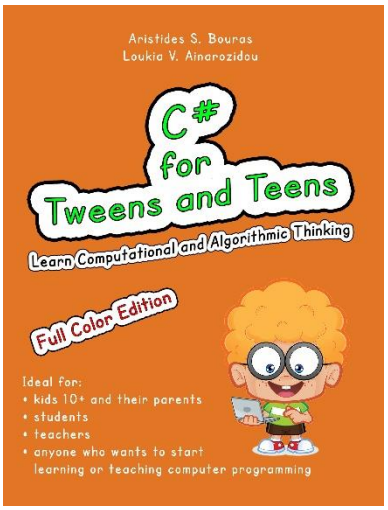

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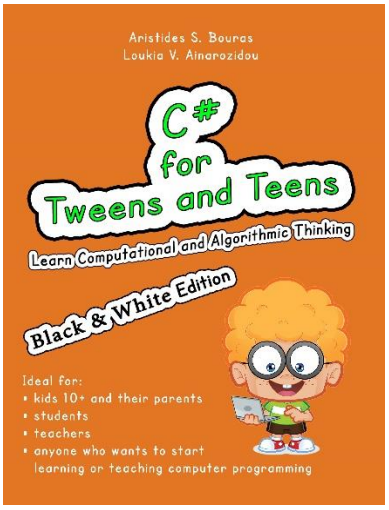

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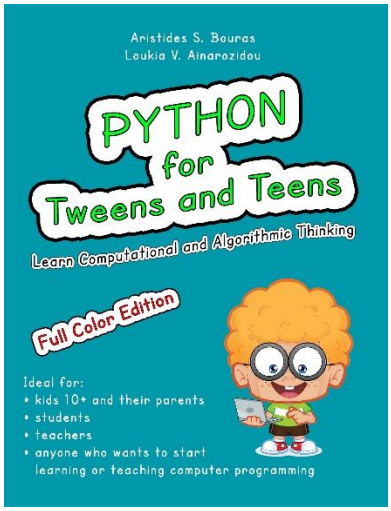

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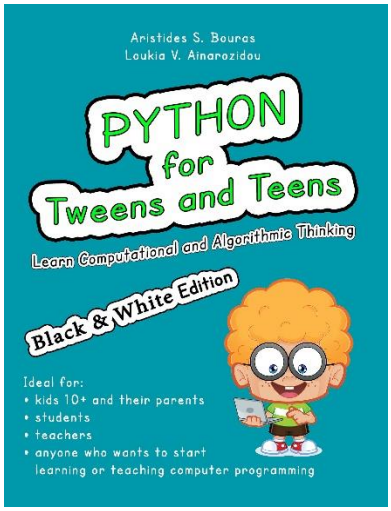

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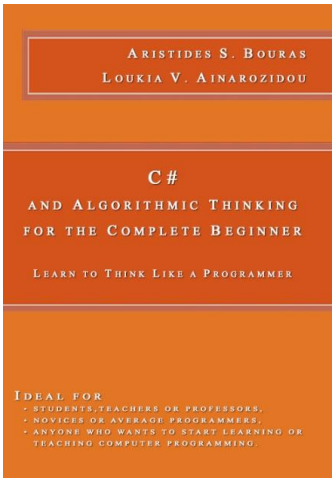

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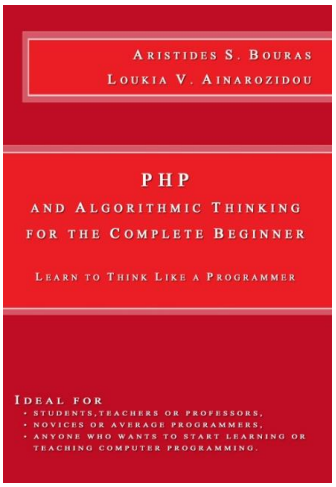

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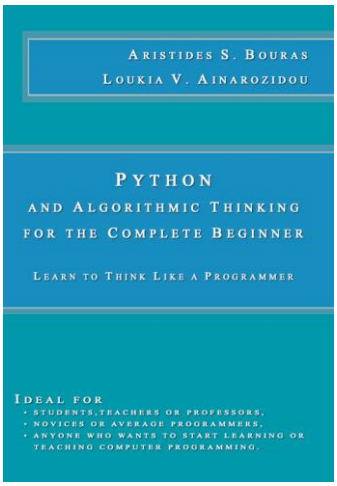

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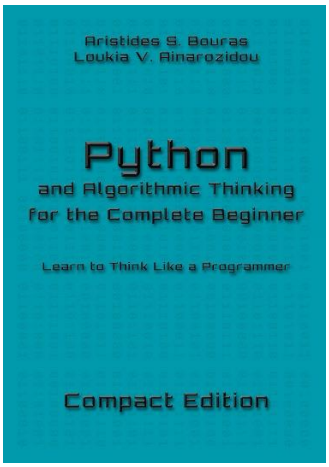

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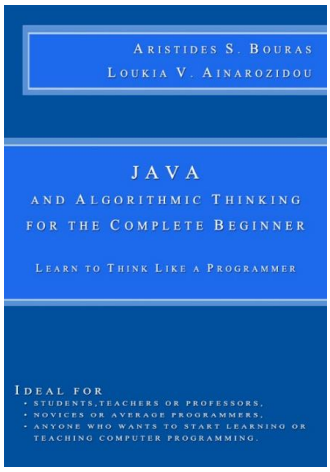

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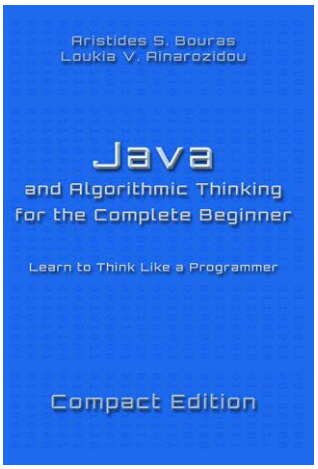

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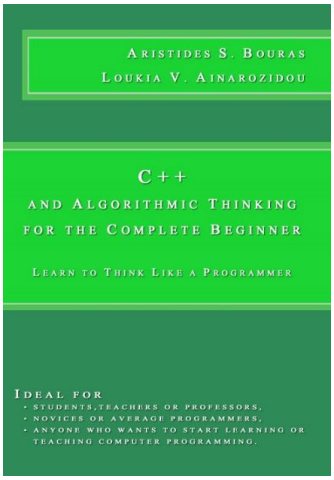

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