Visual Basic for Tweens and Teens

The Answers

By
Aristides S. Bouras
Loukia V. Ainarozidou

Visual Basic for Tweens and Teens - The Answers

http://www.bouraspage.com

RCode: 180101

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 for Tweens and Teens". 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.

The information is provided on an "as is" basis. The authors shall have neither liability nor responsibility to any person or entity with respect to any loss or damages arising from the information contained in this book or from the use of the files that may accompany it.

Table of Contents

How to Report Errata

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

http://www.bouraspage.com

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

Chapter 1

1.7 Review Questions: True/False

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

1.8 Review Questions: Multiple Choice

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

Chapter 3

3.11 Review Questions: True/False

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

3.12 Review Questions: Multiple Choice

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

Chapter 4

4.8 Review Questions: True/False

1. False
2. True
3. False
4. False
5. True
6. False
7. True
8. False
9. True
10. False
11. True
12. True
13. False
14. False
15. True
16. False

4.9 Review Questions: Multiple Choice

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

4.10 Review Exercises

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

Chapter 5

5.4 Review Questions: True/False

1. True
2. True
3. True
4. False
5. False

5.5 Review Questions: Multiple Choice

1. a
2. b
3. b

Chapter 6

6.6 Review Questions: True/False

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

6.7 Review Questions: Multiple Choice

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

6.8 Review Exercises

1. ii, iv, v, ix, x
2. i – String, ii – Boolean, iii – String, iv – String, v – Double or Single (Float), vi – Integer
3. i – b, ii – d, iii – c, iv – e
4. i – 27, ii – 28
5. i – 0, ii – 4

6. i – 2, ii – 40
7. My name is Alexander the Great
8. i – 3, ii – 1
9. California California California

Chapter 8

8.2 Review Exercises

1. *Solution*

```
Sub Main()
    Dim b, h, area As Double

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

    area = b * h / 2

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

2. *Solution*

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

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

    k = (f + 459.67) / 1.8

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

3. *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.WriteLine(angle3)
    Console.ReadKey()
End Sub
```

4. Solution

```
Sub Main()
    Dim average, g1, g2, g3, g4 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) / 4.0

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

5. Solution

```
Const PI = 3.14159
Sub Main()
    Dim r, perimeter As Double

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

    perimeter = 2 * PI * r

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

6. 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 * 703.0 / (h ^ 2)

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

7. *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.WriteLine(days_left)
    Console.ReadKey()
End Sub
```

Chapter 9

9.3 Review Questions: True/False

1. True
2. False
3. False
4. True
5. False
6. True
7. False
8. True
9. True
10. True
11. False

9.4 Review Exercises

1. 2
2. i – 2.5, ii – 2.2
3. i – 4, ii – 9
4. i – 12, ii – 8.5
5. i – 5, ii – 4

Chapter 10

10.4 Review Questions: True/False

1. True
2. False
3. False
4. True
5. True
6. True
7. False
8. False
9. False
10. True
11. True

10.5 Review Questions: Multiple Choice

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

10.6 Review Exercises

1. Solution

```
Sub Main()
    Dim f_name, m_name, l_name, title As String

    Console.Write("First name: ")
    f_name = Console.ReadLine()
    Console.Write("Middle name: ")
    m_name = Console.ReadLine()
    Console.Write("Last name: ")
    l_name = Console.ReadLine()
    Console.Write("Title: ")
    title = Console.ReadLine()

    Console.WriteLine(title & " " & f_name & " " & m_name & " " & l_name)
    Console.WriteLine(f_name & " " & m_name & " " & l_name)
    Console.WriteLine(l_name & ", " & f_name)
    Console.WriteLine(l_name & ", " & f_name & " " & m_name)
    Console.WriteLine(l_name & ", " & f_name & " " & m_name & ", " & title)
    Console.WriteLine(f_name & " " & l_name)
    Console.ReadKey()
End Sub
```

2. Solution

```
Sub Main()
    Dim alphabet As String
    Dim rnd = New Random(Guid.NewGuid().GetHashCode())

    alphabet = "abcdefghijklmnopqrstuvwxyz"

    Console.Write(alphabet(rnd.Next(0, 26)).ToString().ToUpper())
    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, x, secret_password As String
    Dim rnd = New Random(Guid.NewGuid().GetHashCode())

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

    'Convert to lower case and remove spaces
    x = name.ToLower().Replace(" ", "")

    secret_password = x(rnd.Next(0, x.Length)).ToString() &
                      x(rnd.Next(0, x.Length)).ToString() &
                      x(rnd.Next(0, x.Length)).ToString() &
                      rnd.Next(1000, 10000).ToString()

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

Chapter 11

11.7 Review Questions: True/False

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

11.8 Review Questions: Multiple Choice

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

11.9 Review Exercises

1. Solution

i. b, d, f

ii. i

iii. c, e

iv. a, g, h

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*

5. Solution

Expression	Value
`(x + y) ^ 3`	*8.0*
`(x + y) / (x ^ 2 - 14)`	*1.0*
`(x – 1) = y + 5`	*True*
`x > 2 And y = 1`	*False*
`x = 1 Or Not(flag = False)`	*True*

6. Solution

a. `age < 12 And age <> 8`

b. `age >= 6 And age <= 9 Or age = 11`

c. `age > 7 And age <> 10 And age <> 12`

d. `age = 6 Or age = 9 Or age = 11`

e. `age >= 6 And age <= 12 And age <> 8`

f. `age <> 7 And age <> 10`

Chapter 12

12.2 Review Questions: True/False

1. False
2. False
3. True
4. False

12.3 Review Questions: Multiple Choice

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

12.4 Review Exercises

1. Solution

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

    x = Console.ReadLine()

    y = -5
    If x * y / 2 > 20 Then
        y *= 2
        x = 4 * x ^ 2
    End If
    Console.Write(x & y)
    Console.ReadKey()
End Sub
```

2. Solution

i. 9 12 ii. 2 2

3. 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
```

4. 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("Positives")
    End If
    Console.ReadKey()
End Sub
```

5. Solution

```
Sub Main()
    Dim s As String

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

    If s = s.ToUpper() Then
        Console.WriteLine("Uppercase")
    End If
    Console.ReadKey()
End Sub
```

6. Solution

```
Sub Main()
    Dim s As String

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

    If s.Length > 20 Then
        Console.WriteLine("Many characters")
    End If
    Console.ReadKey()
End Sub
```

7. Solution

```
Sub Main()
    Dim n1, n2, n3 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()
```

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

8. Solution

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

9. Solution

```
Sub Main()
    Dim w1, w2, w3, w4, maximum As Double

    Console.Write("Enter the weight of the 1st person: ")
    w1 = Console.ReadLine()
    Console.Write("Enter the weight of the 2nd person: ")
    w2 = Console.ReadLine()
    Console.Write("Enter the weight of the 3rd person: ")
    w3 = Console.ReadLine()
    Console.Write("Enter the weight of the 4th person: ")
    w4 = Console.ReadLine()

    maximum = w1

    If w2 > maximum Then
        maximum = w2
    End If

    If w3 > maximum Then
        maximum = w3
```

```
    End If

    If w4 > maximum Then
        maximum = w4
    End If

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

10. Solution

```
Sub Main()
    Dim n1, n2, n3, n4, m_name As String
    Dim a1, a2, a3, a4, minimum As Integer

    Console.Write("Enter the age of the 1st person: ")
    a1 = Console.ReadLine()
    Console.Write("Enter the name of the 1st person: ")
    n1 = Console.ReadLine()

    Console.Write("Enter the age of the 2nd person: ")
    a2 = Console.ReadLine()
    Console.Write("Enter the name of the 2nd person: ")
    n2 = Console.ReadLine()

    Console.Write("Enter the age of the 3rd person: ")
    a3 = Console.ReadLine()
    Console.Write("Enter the name of the 3rd person: ")
    n3 = Console.ReadLine()

    Console.Write("Enter the age of the 4th person: ")
    a4 = Console.ReadLine()
    Console.Write("Enter the name of the 4th person: ")
    n4 = Console.ReadLine()

    minimum = a1
    m_name = n1

    If a2 < minimum Then
        minimum = a2
        m_name = n2
    End If

    If a3 < minimum Then
        minimum = a3
        m_name = n3
    End If
```

```
    If a4 < minimum Then
        minimum = a4
        m_name = n4
    End If

    Console.WriteLine("The youngest person is " & m_name)
    Console.ReadKey()
End Sub
```

11. Solution

```
Sub Main()
    Dim a1, a2, a3, minimum, maximum, middle As Integer

    Console.Write("Enter the age of the 1st person: ")
    a1 = Console.ReadLine()
    Console.Write("Enter the age of the 2nd person: ")
    a2 = Console.ReadLine()
    Console.Write("Enter the age of the 3rd person: ")
    a3 = Console.ReadLine()

    minimum = a1
    If a2 < minimum Then
        minimum = a2
    End If

    If a3 < minimum Then
        minimum = a3
    End If

    maximum = a1
    If a2 > maximum Then
        maximum = a2
    End If

    If a3 > maximum Then
        maximum = a3
    End If

    middle = a1 + a2 + a3 - minimum - maximum

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

Chapter 13

13.2 Review Questions: True/False

1. False
2. True
3. False
4. False

13.3 Review Questions: Multiple Choice

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

13.4 Review Exercises

1. *Solution*

i. 1

ii. 5

2. *Solution*

i. 7.0 18.0

ii. 0.5 3.5

3. *Solution*

```
Sub Main()
    Dim num As Double

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

    If num > 100 Then
        Console.WriteLine("Given number is greater than 100")
    Else
        Console.WriteLine("Given number is less than or equal to 100")
    End If
    Console.ReadKey()
End Sub
```

4. *Solution*

```
Sub Main()
    Dim num As Double

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

    If num >= 0 And num <= 100 Then
        Console.WriteLine("Given number is between 0 and 100")
    Else
        Console.WriteLine("Given number is not between 0 and 100")
    End If
    Console.ReadKey()
```

```
End Sub
```

5. Solution

```
Sub Main()
    Dim num As Integer

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

    If num >= 1000 And num <= 9999 Then
        Console.WriteLine("Given number is a four-digit integer")
    Else
        Console.WriteLine("Given number is not a four-digit integer")
    End If
    Console.ReadKey()
End Sub
```

6. Solution

```
Sub Main()
    Dim num1, num2 As Double

    Console.Write("Enter first number: ")
    num1 = Console.ReadLine()
    Console.Write("Enter second number: ")
    num2 = Console.ReadLine()

    If num1 < num2 Then
        Console.WriteLine(num1)
    Else
        Console.WriteLine(num2)
    End If
    Console.ReadKey()
End Sub
```

7. Solution

```
Sub Main()
    Dim a, b, c, average 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("Qualified")
    Else
        Console.WriteLine("Disqualified")
    End If
    Console.ReadKey()
End Sub
```

Chapter 14

14.2 Review Questions: True/False

1. True
2. False
3. False
4. False
5. False
6. True
7. True

14.3 Review Exercises

1. *Solution*

i. 1 ii. 2 iii. 4 iv. 4

2. *Solution*

i. 0 5 ii. 10 90 iii. 20 160

3. *Solution*

First Approach

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

    Console.Write("Enter an integer between -9999 and 9999: ")
    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
```

Second Approach

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

    Console.Write("Enter an integer between -9999 and 9999: ")
    a = Console.ReadLine()

    'If variable a is negative, make it positive
    If a < 0 Then
        a = (-1) * a
    End If

    If a >= 1000 And a <= 9999 Then
        n = 3
    ElseIf a >= 100 And a <= 999 Then
        n = 3
    ElseIf 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 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
```

5. *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
```

6. *Solution*

```
Sub Main()
    Dim name As String

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

    If name = "JANUARY" Then
        Console.WriteLine(1)
    ElseIf name = "FEBRUARY" Then
        Console.WriteLine(2)
    ElseIf name = "MARCH" Then
        Console.WriteLine(3)
    ElseIf name = "APRIL" Then
        Console.WriteLine(4)
    ElseIf name = "MAY" Then
        Console.WriteLine(5)
    ElseIf name = "JUNE" Then
        Console.WriteLine(6)
    ElseIf name = "JULY" Then
        Console.WriteLine(7)
    ElseIf name = "AUGUST" Then
        Console.WriteLine(8)
    ElseIf name = "SEPTEMBER" Then
        Console.WriteLine(9)
    ElseIf name = "OCTOBER" Then
        Console.WriteLine(10)
    ElseIf name = "NOVEMBER" Then
```

```
        Console.WriteLine(11)
    ElseIf name = "DECEMBER" Then
        Console.WriteLine(12)
    Else
        Console.WriteLine("Error")
    End If
    Console.ReadKey()
End Sub
```

7. Solution

```
Sub Main()
    Dim roman As String

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

    If roman = "I" Then
        Console.WriteLine(1)
    ElseIf roman = "II" Then
        Console.WriteLine(2)
    ElseIf roman = "III" Then
        Console.WriteLine(3)
    ElseIf roman = "IV" Then
        Console.WriteLine(4)
    ElseIf roman = "V" Then
        Console.WriteLine(5)
    ElseIf roman = "VI" Then
        Console.WriteLine(6)
    ElseIf roman = "VII" Then
        Console.WriteLine(7)
    ElseIf roman = "VIII" Then
        Console.WriteLine(8)
    ElseIf roman = "IX" Then
        Console.WriteLine(9)
    ElseIf roman = "X" Then
        Console.WriteLine(10)
    Else
        Console.WriteLine("Error")
    End If
    Console.ReadKey()
End Sub
```

8. Solution

```
Sub Main()
    Dim total  As Integer

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

```
    total = Console.ReadLine()

    If total = 1 Then
        Console.WriteLine("You are awarded 3 points")
    ElseIf total = 2 Then
        Console.WriteLine("You are awarded 10 points")
    ElseIf total = 3 Then
        Console.WriteLine("You are awarded 20 points")
    Else
        Console.WriteLine("You are awarded 45 points")
    End If
    Console.ReadKey()
End Sub
```

9. Solution

```
Sub Main()
    Dim num As String

    Console.Write("Enter a number (0 - 3)")
    num = Console.ReadLine()

    If num = "zero" Then
        Console.WriteLine(0)
    ElseIf num = "one" Then
        Console.WriteLine(1)
    ElseIf num = "two" Then
        Console.WriteLine(2)
    ElseIf num = "three" Then
        Console.WriteLine(3)
    Else
        Console.WriteLine("I don't know this number!")
    End If
    Console.ReadKey()
End Sub
```

10. Solution

```
Sub Main()
    Dim num As String

    Console.Write("Enter a number (0 - 3)")
    num = Console.ReadLine()

    If num = "zero" Then
        Console.WriteLine(0)
    ElseIf num = "one" Then
        Console.WriteLine(1)
    ElseIf num = "two" Then
```

```
        Console.WriteLine(2)
    ElseIf num = "three" Then
        Console.WriteLine(3)
    Else
        Console.WriteLine("I don't know this number!")
    End If
    Console.ReadKey()
End Sub
```

11. Solution

```
Sub Main()
    Dim wind As Double

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

    If wind < 0 Then
        Console.WriteLine("Entered value is negative")
    ElseIf wind < 1 Then
        Console.Write("Beaufort: 0" & vbCrLf & "Calm")
    ElseIf wind < 4 Then
        Console.Write("Beaufort: 1" & vbCrLf & "Light air")
    ElseIf wind < 8 Then
        Console.Write("Beaufort: 2" & vbCrLf & "Light breeze")
    ElseIf wind < 13 Then
        Console.Write("Beaufort: 3" & vbCrLf & "Gentle breeze")
    ElseIf wind < 18 Then
        Console.Write("Beaufort: 4" & vbCrLf & "Moderate breeze")
    ElseIf wind < 25 Then
        Console.Write("Beaufort: 5" & vbCrLf & "Fresh breeze")
    ElseIf wind < 31 Then
        Console.Write("Beaufort: 6" & vbCrLf & "Strong breeze")
    ElseIf wind < 39 Then
        Console.Write("Beaufort: 7" & vbCrLf & "Moderate gale")
    ElseIf wind < 47 Then
        Console.Write("Beaufort: 8" & vbCrLf & "Gale")
    ElseIf wind < 55 Then
        Console.Write("Beaufort: 9" & vbCrLf & "Strong gale")
    ElseIf wind < 64 Then
        Console.Write("Beaufort: 10" & vbCrLf & "Storm")
    ElseIf wind < 74 Then
        Console.Write("Beaufort: 11" & vbCrLf & "Violent storm")
    Else
        Console.Write("Beaufort: 12" & vbCrLf & "Hurricane force")
    End If
    Console.ReadKey()
End Sub
```

12. Solution

```
Sub Main()
    Dim choice As Integer
    Dim kelvin, fahrenheit, celsius As Double

    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()

    If choice = 1 Then
        Console.Write("Enter a temperature in degrees Kelvin: ")
        kelvin = Console.ReadLine()
        fahrenheit = 1.8 * kelvin - 459.67
        Console.Write(kelvin & " degrees Kelvin = ")
        Console.Write(fahrenheit & " degrees Fahrenheit")
    ElseIf choice = 2 Then
        Console.Write("Enter a temperature in degrees Fahrenheit: ")
        fahrenheit = Console.ReadLine()
        kelvin = (fahrenheit + 459.67) / 1.8
        Console.Write(fahrenheit & " degrees Fahrenheit = ")
        Console.Write(kelvin & " degrees Kelvin")
    ElseIf choice = 3 Then
        Console.Write("Enter a temperature in degrees Fahrenheit: ")
        fahrenheit = Console.ReadLine()
        celsius = 5 / 9 * (fahrenheit - 32)
        Console.Write(fahrenheit & " degrees Fahrenheit = ")
        Console.Write(celsius & " degrees Celsius")
    ElseIf choice = 4 Then
        Console.Write("Enter a temperature in degrees Celsius: ")
        celsius = Console.ReadLine()
        fahrenheit = 9 / 5 * celsius + 32
        Console.Write(celsius & " degrees Celsius = ")
        Console.Write(fahrenheit & " degrees Fahrenheit")
    Else
        Console.WriteLine("Invalid choice!")
    End If
    Console.ReadKey()
End Sub
```

Chapter 15

15.2 Review Questions: True/False

1. True
2. True
3. False

15.3 Review Exercises

1. *Solution*

i. 25 6 ii. 10 9 iii. 50 2

2. *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.WriteLine("The day is " & message1 & " and " & message2)
    Console.ReadKey()
End Sub
```

3. Solution

```
Sub Main()
    Dim a, w, h 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
```

Chapter 16

16.3 Review Questions: True/False

1. True
2. True
3. False
4. True

Chapter 17

17.3 Review Questions: True/False

1. True
2. False
3. False
4. False
5. False
6. False
7. False
8. False
9. True
10. True
11. True

17.4 Review Questions: Multiple Choice

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

17.5 Review Exercises

1. *Solution*

```
Dim i As Double

i = 30.0
Do While i > 5
    Console.WriteLine(i)
    i /= 2
Loop
Console.WriteLine("The end")
```

2. *Solution*

```
Dim i As Integer = 3

Do
    i -= 1
Loop While i > 0
```

```
Console.Write("The end")
```

3. Solution

Four

4. Solution

Zero

5. Solution

It displays

2 14 6

and performs three iterations

6. Solution

i. -1
ii. 9
iii. 0.5
iv. -7
v. A value between 17 and 32
vi. 1.4

7. Solution

i. -1
ii. 18
iii. 0.5
iv. -20
v. 128
vi. 11.5

8. Solution

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

9. Solution

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

    total = 0

    i = 1
    Do While i <= 20
        Console.Write("Enter a number: ")
        x = Console.ReadLine()
        If x > 0 Then
            total += x
        End If
        i += 1
    Loop
    Console.WriteLine(total)
    Console.ReadKey()
End Sub
```

10. Solution

```
Sub Main()
```

```
    Dim n, i As Integer
    Dim p, x As Double

    Console.Write("Enter N: ")
    n = Console.ReadLine()

    p = 1
    i = 1
    Do While i <= n
        Console.Write("Enter a number: ")
        x = Console.ReadLine()
        If x > 0 Then
            p *= x
        End If
        i += 1
    Loop
    Console.WriteLine(p)
    Console.ReadKey()
End Sub
```

11. Solution

```
Sub Main()
    Dim i, x, total As Integer

    total = 0

    i = 1
    Do While i <= 10
        Console.Write("Enter an integer: ")
        x = Console.ReadLine()
        If x >= 100 And x <= 200 Then
            total += x
        End If
        i += 1
    Loop
    Console.WriteLine(total)
    Console.ReadKey()
End Sub
```

12. Solution

```
Sub Main()
    Dim i, x, total As Integer

    total = 0
    i = 1
    Do While i <= 20
        Console.Write("Enter an integer between: ")
```

```
        x = Console.ReadLine()
        If x >= 100 And x <= 999 Then
            total += x
        End If
        i += 1
    Loop
    Console.WriteLine(total)
    Console.ReadKey()
End Sub
```

13. Solution

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

    p = 1
    Console.Write("Enter a number: ")
    x = Console.ReadLine()
    Do While x <> 0
        p *= x
        Console.Write("Enter a number: ")
        x = Console.ReadLine()
    Loop
    Console.WriteLine(p)
    Console.ReadKey()
End Sub
```

14. 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 18

18.3 Review Questions: True/False

1. True
2. True
3. False
4. False
5. True
6. True
7. False
8. False
9. False
10. False

18.4 Review Questions: Multiple Choice

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

18.5 Review Exercises

1. *Solution*

It displays

12 3

and performs five iterations

2. *Solution*

It displays

10 4

19 20

28 32

3. *Solution*

i. 9

ii. 2

iii. -7 or -8

iv. -1

4. *Solution*

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

    p = 1
    total = 0
    For i = 1 To 20
        Console.Write("Enter a number: ")
        x = Console.ReadLine()
        p *= x
        total += x
    Next

    Console.WriteLine(p & " " & total / 20)
```

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

5. Solution

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

    Console.Write("Enter N: ")
    n = Console.ReadLine()

    count = 0
    For i = 1 To n
        Console.Write("Enter an integer: ")
        x = Console.ReadLine()
        If x > 0 Then
            count += 1
        End If
    Next

    If count > 0 Then
        Console.WriteLine(count)
    Else
        Console.WriteLine("You entered no positive integers")
    End If
    Console.ReadKey()
End Sub
```

6. Solution

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

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

    For i = start To finish
        Console.WriteLine(i)
    Next
    Console.ReadKey()
End Sub
```

7. Solution

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

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

    p = 1
    For i = 1 To e
        p *= b
    Next

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

8. Solution

First Approach

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

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

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

    Console.WriteLine("The message entered contains " & words & " words")
    Console.ReadKey()
End Sub
```

Second Approach

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

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

    count = 0
    For Each ch In msg
        If ch.ToString() = " " Then
```

```
            count += 1
        End If
    Next
    words = count + 1

    Console.WriteLine("The message entered contains " & words & " words")
    Console.ReadKey()
End Sub
```

Chapter 19

19.2 Review Questions: True/False

1. True
2. False
3. True
4. False
5. True
6. True

19.3 Review Questions: Multiple Choice

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

19.4 Review Exercises

1. *Solution*

i. 10

ii. A value between 45 and 49

iii. -7 or -8

iv. 138 or 139

2. *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
```

3. *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
```

4. Solution

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

    For i = 1 To 6
        For j = 0 To i - 1
            Console.Write(j)
        Next
        Console.WriteLine()
    Next
    Console.ReadKey()
End Sub
```

5. Solution

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

    For i = 1 To 3
        For j = 1 To 8
            Console.Write("* ")
        Next
        Console.WriteLine()
    Next
    Console.ReadKey()
End Sub
```

6. Solution

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

7. Solution

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

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

8. 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 20

20.7 Review Questions: True/False

1. False
2. False
3. False
4. False
5. True
6. True
7. False
8. False

20.8 Review Questions: Multiple Choice

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

5. a 6. d

20.9 Review Exercises

1. *Solution*

```
count_not_johns = count_names = 0
name = ""
Console.Write("Enter a name: ")
name = Console.ReadLine()
Do While name <> "STOP"
    Console.Write("Enter a name: ")
    name = Console.ReadLine()

    count_names += 1
    If name <> "John" Then
        count_not_johns += 1
    End If
    Console.Write("Enter a name: ")
    name = Console.ReadLine()
Loop
Console.WriteLine("Names other than John : " & count_ not_johns)
Console.WriteLine(count_names & " names entered")
```

2. *Solution*

```
Sub Main()
    Dim text As String
    Dim found As Boolean

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

    found = False
    For Each ch In text
        If ch.ToString() = " " Then
            found = True
            Exit For
        End If
    Next

    If found = False Then
        Console.WriteLine("One Single Word")
    Else
        Console.WriteLine("Complete Sentence")
    End If
    Console.ReadKey()
End Sub
```

3. Solution

```
Sub Main()
    Dim sentence As String

    Dim found As Boolean
    Console.Write("Enter a sentence: ")
    sentence = Console.ReadLine()

    found = False
    For Each ch In "0123456789"
        If sentence.IndexOf(ch) > -1 Then
            found = True
            Exit For
        End If
    Next

    If found = True Then
        Console.WriteLine("The sentence contains a number")
    End If
    Console.ReadKey()
End Sub
```

4. Solution

```
Console.WriteLine("Printing all integers from 1 to 100")
i = 1
Do While i < 101
    Console.WriteLine(i)
    i += 1
Loop
```

5. Solution

```
Console.WriteLine("Printing odd integers from 1 to 99")
i = 1
Do While Not (i > 100)
    Console.WriteLine(i)
    i += 2
Loop
```

6. 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
```

7. 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 21

21.2 Review Exercises

1. Solution

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

    total = 0
    For i = 1 To 99 Step 2
        total += i
    Next

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

2. Solution

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

    Console.Write("Enter N: ")
    n = Console.ReadLine()

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

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

3. Solution

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

    Console.Write("Enter total number of students: ")
    n = Console.ReadLine()

    total = 0
    count = 0
    For i = 1 To n
        Console.Write("Enter grade: ")
        grade = Console.ReadLine()
        If grade >= 90 And grade <= 100 Then
            total += grade
            count += 1
        End If
    Next

    If count > 0 Then
        Console.WriteLine(total / count)
    Else
        Console.WriteLine("There are no students that got an A")
    End If
    Console.ReadKey()
End Sub
```

4. Solution

```
Sub Main()
    Dim count_pos, count_neg, total_pos, total_neg, i, x As Integer

    count_pos = count_neg = 0
```

```
    total_pos = total_neg = 0

    For i = 1 To 50
        Console.Write("Enter an integer: ")
        x = Console.ReadLine()
        If x > 0 Then
            count_pos += 1
            total_pos += x
        ElseIf x < 0 Then
            count_neg += 1
            total_neg += x
        End If
    Next

    If count_pos > 0 Then
        Console.WriteLine(total_pos / count_pos)
    End If

    If count_neg > 0 Then
        Console.WriteLine(total_neg / count_neg)
    End If
    Console.ReadKey()
End Sub
```

5. Solution

```
Sub Main()
    Dim count As Integer
    Dim total, x As Double

    total = 0
    count = 0
    Do
        Console.Write("Enter a number: ")
        x = Console.ReadLine()
        If x = 0 Then
            count += 1
        End If
        total += x
    Loop While total <= 3000

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

6. Solution

```
Sub Main()
    Dim answer As String
```

```
    Dim r, area As Double

    Do
        Console.Write("Enter the length of a radius: ")
        r = Console.ReadLine()

        area = 3.141 * 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
```

7. Solution

```
Sub Main()
    Dim x As Long

    x = 1
    Do While x <= 1073741824
        Console.WriteLine(x)
        x *= 2
    Loop
    Console.ReadKey()
End Sub
```

8. Solution

```
Sub Main()
    Dim i As Integer

    For i = 1 To 100
        Console.WriteLine(-i & vbCrLf & i)
    Next
    Console.ReadKey()
End Sub
```

9. Solution

First approach

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

    value = 0
    For i = 0 To 7
        offset = 10 ^ i
        value += offset
        Console.WriteLine(value)
```

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

Second approach

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

    value = "1"
    For i = 0 To 7
        Console.WriteLine(value)
        value += "1"
    Next
    Console.ReadKey()
End Sub
```

10. Solution

```
Sub Main()
    Dim t, maximum, total As Double
    Dim i As Integer

    Console.Write("Enter temperature for day 1: ")
    t = Console.ReadLine()
    maximum = t
    total = t
    For i = 2 To 31
        Console.Write("Enter temperature for day " & i & ": ")
        t = Console.ReadLine()

        total += t
        If t > maximum Then
            maximum = t
        End If
    Next
    Console.WriteLine(total / 31 & " " & maximum)
    Console.ReadKey()
End Sub
```

11. Solution

```
Sub Main()
    Dim level, maximum, minimum As Double
    Dim hour, min_hour, max_hour, i As Integer

    Console.Write("Enter level: ")
    level = Console.ReadLine()
    Console.Write("Enter hour: ")
    hour = Console.ReadLine()
```

```
    maximum = minimum = level
    max_hour = min_hour = hour

    For i = 2 To 24
        Console.Write("Enter level: ")
        level = Console.ReadLine()
        Console.Write("Enter hour: ")
        hour = Console.ReadLine()

        If level > maximum Then
            maximum = level
            max_hour = hour
        End If

        If level < minimum Then
            minimum = level
            min_hour = hour
        End If
    Next
    Console.WriteLine(maximum & " " & max_hour)
    Console.WriteLine(minimum & " " & min_hour)
    Console.ReadKey()
End Sub
```

12. Solution

```
Sub Main()
    Dim attempts As Integer = 0
    Dim first_player_attempts As Integer = 0, second_player_attempts As Integer = 0
    Dim guess, i, secret_number As Integer

    Dim rnd = New Random(Guid.NewGuid().GetHashCode())

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

        attempts = 1
        Console.Write("Player " & i & ", enter a guess: ")
        guess = Console.ReadLine()
        Do While guess <> secret_number
            If guess > secret_number Then
                Console.Write("Your guess is bigger than my secret number.")
            Else
                Console.Write("Your guess is smaller than my secret number.")
            End If
            attempts += 1
            Console.Write(" Try again! Enter a guess: ")
```

```
            guess = Console.ReadLine()
        Loop
        Console.WriteLine("You found it!")
        Console.WriteLine("Attempts: " & attempts)

        If i = 0 Then
            first_player_attempts = attempts
        Else
            second_player_attempts = attempts
        End If
    Next

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

13. Solution

```
Sub Main()
    Dim gender As String
    Dim n, i, grade, total, total_a, count_a, total_b, count_b As Integer
    Dim total_a_boys, count_a_boys, count_cdef_girls As Integer

    Console.Write("Enter total number of students: ")
    n = Console.ReadLine()

    total = total_a = count_a = total_b = count_b = 0
    total_a_boys = count_a_boys = count_cdef_girls = 0

    For i = 1 To n
        Console.Write("Enter grade for student No " & i & ": ")
        grade = Console.ReadLine()

        Console.Write("Enter gender for student No " & i & ": ")
        gender = Console.ReadLine()

        If grade >= 90 And grade <= 100 Then
            total_a += grade
            count_a += 1
            If gender = "M" Then
                total_a_boys += grade
                count_a_boys += 1
```

```
            End If
        ElseIf grade >= 80 And grade <= 89 Then
            total_b += grade
            count_b += 1
        Else
            If gender = "F" Then
                count_cdef_girls += 1
            End If
        End If
        total += grade
    Next

    If count_a > 0 Then
        Console.Write("Average value of those who got an 'A': ")
        Console.WriteLine(total_a / count_a)
    End If

    If count_b > 0 Then
        Console.Write("Average value of those who got a 'B': ")
        Console.WriteLine(total_b / count_b)
    End If

    If count_a_boys > 0 Then
        Console.Write("Average value of boys who got an 'A': ")
        Console.WriteLine(total_a_boys / count_a_boys)
    End If

    Console.Write("Total number of girls that got less than 'B': ")
    Console.WriteLine(count_cdef_girls)

    Console.Write("Average grade of the whole class: ")
    Console.WriteLine(total / n)
    Console.ReadKey()
End Sub
```

14. Solution

```
Sub Main()
    Dim answer As String
    Dim amount, discount As Double

    Do
        Console.Write("Enter amount: ")
        amount = Console.ReadLine()

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

Chapter 22

22.12 Review Exercises

1. *Solution*

```
Private Sub Form1_Shown(sender As Object, e As EventArgs) Handles MyBase.Shown
    Turtle.Forward(150)
    Turtle.Angle = -130
    Turtle.Forward(50)

    Turtle.X = 0
    Turtle.Y = 150

    Turtle.Angle = 130
    Turtle.Forward(50)
End Sub
```

2. *Solution*

```
Private Sub Form1_Shown(sender As Object, e As EventArgs) Handles MyBase.Shown
    Turtle.Forward(100)
    Turtle.Rotate(90)
    Turtle.Forward(200)
    Turtle.Rotate(90)
    Turtle.Forward(100)
    Turtle.Rotate(90)
    Turtle.Forward(200)
End Sub
```

3. *Solution*

First approach

```
Private Sub Form1_Shown(sender As Object, e As EventArgs) Handles MyBase.Shown
    Turtle.Rotate(30)
```

```
    Turtle.Forward(100)
    Turtle.Rotate(120)
    Turtle.Forward(100)
    Turtle.Rotate(60)
    Turtle.Forward(100)
    Turtle.Rotate(120)
    Turtle.Forward(100)
End Sub
```

Second approach

```
Private Sub Form1_Shown(sender As Object, e As EventArgs) Handles MyBase.Shown
    Turtle.Angle = 30
    Turtle.Forward(100)
    Turtle.Angle = 150
    Turtle.Forward(100)
    Turtle.Angle = 210
    Turtle.Forward(100)
    Turtle.Angle = 330
    Turtle.Forward(100)
End Sub
```

4. Solution

```
Private Sub Form1_Shown(sender As Object, e As EventArgs) Handles MyBase.Shown
    Turtle.Rotate(45)
    Turtle.Forward(141)
    Turtle.Rotate(45)
    Turtle.Forward(100)
    Turtle.Rotate(45)
    Turtle.Forward(141)
    Turtle.Rotate(45 + 90)
    Turtle.Forward(300)
End Sub
```

5. Solution

```
Private Sub Form1_Shown(sender As Object, e As EventArgs) Handles MyBase.Shown
    Dim k, i As Integer

    Turtle.PenSize = 2
    For k = 1 To 2
        For i = 1 To 4
            Turtle.Forward(100)
            Turtle.Rotate(90)
        Next
        Turtle.X -= 100
    Next
End Sub
```

6. Solution

```
Private Sub Form1_Shown(sender As Object, e As EventArgs) Handles MyBase.Shown
    Dim m, n, i As Integer

    For m = 1 To 2
        For n = 1 To 2
            For i = 1 To 4
                Turtle.Forward(100)
                Turtle.Rotate(90)
            Next
            Turtle.X -= 150
        Next
        Turtle.X = 0
        Turtle.Y -= 150
    Next
End Sub
```

7. Solution

```
Private Sub Form1_Shown(sender As Object, e As EventArgs) Handles MyBase.Shown
    Dim size, length, height As Integer

    size = 2
    length = 250
    height = 150

    Turtle.PenSize = size
    Turtle.Forward(height)
    Turtle.Rotate(90)
    Turtle.Forward(length)
    Turtle.Rotate(90)
    Turtle.Forward(height)
    Turtle.Rotate(90)
    Turtle.Forward(length)
End Sub
```

8. Solution

```
Private Sub Form1_Shown(sender As Object, e As EventArgs) Handles MyBase.Shown
    Dim length As Integer = 150

    Turtle.Angle = 90

    Turtle.Forward(length)
    Turtle.Rotate(-120)
    Turtle.Forward(length)
    Turtle.Rotate(-120)
    Turtle.Forward(length)
    Turtle.Rotate(-120)
```

```
    Turtle.Forward(length)
End Sub
```

9. Solution

```
Private Sub Form1_Shown(sender As Object, e As EventArgs) Handles MyBase.Shown
    Dim i As Integer

    For i = 1 To 12
        Turtle.Forward(100)
        Turtle.X = 0
        Turtle.Y = 0
        Turtle.Rotate(30)
    Next
End Sub
```

10. Solution

```
Private Sub Form1_Shown(sender As Object, e As EventArgs) Handles MyBase.Shown
    Dim k, i As Integer

    Turtle.PenSize = 2
    Turtle.Angle = 90
    For k = 1 To 180 Step 60
        For i = 1 To 5
            Turtle.Forward(150 + k)
            Turtle.Rotate(180 / 5 * 4)
        Next
        Turtle.X -= 30
        Turtle.Y += 10
    Next
End Sub
```

11. Solution

```
Private Sub Form1_Shown(sender As Object, e As EventArgs) Handles MyBase.Shown
    Dim k, i As Integer
    Turtle.PenSize = 2
    For k = 1 To 3
        For i = 1 To 4
            Turtle.Forward(100)
            Turtle.Rotate(90)
        Next
        Turtle.Rotate(-30)
    Next
End Sub
```

12. Solution

```
Private Sub Form1_Shown(sender As Object, e As EventArgs) Handles MyBase.Shown
    Dim k, i As Integer
    Turtle.PenSize = 2
```

```
    For k = 1 To 12
        For i = 1 To 4
            Turtle.Forward(100)
            Turtle.Rotate(90)
        Next
        Turtle.Rotate(-30)
    Next
End Sub
```

13. Solution

```
Private Sub Form1_Shown(sender As Object, e As EventArgs) Handles MyBase.Shown
    Dim k, i As Integer
    Turtle.PenSize = 2
    For k = 1 To 8
        For i = 1 To 4
            Turtle.Forward(100)
            Turtle.Rotate(90)
        Next
        Turtle.Rotate(-45)
    Next
End Sub
```

14. Solution

```
Private Sub Form1_Shown(sender As Object, e As EventArgs) Handles MyBase.Shown
    Dim i, k As Integer

    Turtle.PenSize = 1

    'Draw a blue rectangle
    Turtle.Forward(100)
    Turtle.Rotate(90)
    Turtle.Forward(200)
    Turtle.Rotate(90)
    Turtle.Forward(100)
    Turtle.Rotate(90)
    Turtle.Forward(200)

    'Move the turtle to the top left corner of the rectangle
    Turtle.Rotate(90)
    Turtle.PenUp()
    Turtle.Forward(100)
    Turtle.PenDown()

    'Draw the red roof
    Turtle.Angle = 45
    Turtle.PenColor = Color.Red
    Turtle.Forward(141)
```

```
    Turtle.Rotate(90)
    Turtle.Forward(141)

    'Draw the windows
    Turtle.PenColor = Color.Brown
    Turtle.X = 20
    Turtle.Y = 50

    For k = 0 To 1
        Turtle.Angle = 0

        For i = 0 To 3
            Turtle.Forward(40)
            Turtle.Rotate(90)
        Next

        Turtle.Angle = 0
        Turtle.X += 20
        Turtle.Forward(40)

        Turtle.Angle = 90
        Turtle.X -= 20
        Turtle.Y = 70
        Turtle.Forward(40)

        Turtle.X += 80
        Turtle.Y -= 20
    Next

    'Draw the door
    Turtle.X -= 180
    Turtle.Y = 0
    Turtle.Angle = 0

    Turtle.Forward(70)
    Turtle.Rotate(90)
    Turtle.Forward(40)
    Turtle.Rotate(90)
    Turtle.Forward(70)
    Turtle.Rotate(90)
    Turtle.Forward(40)
End Sub
```

15. Solution

```
'Move to poll position
Turtle.X = -300
```

```
For m = 1 To 3
    ' Here goes the code of the previous exersise

    Turtle.Angle = 0
    Turtle.X += 200
Next
```

The final program becomes

```
Private Sub Form1_Shown(sender As Object, e As EventArgs) Handles MyBase.Shown
    Dim i, m, k As Integer

    Turtle.PenSize = 1

    'Move to poll position
    Turtle.X = -300

    For m = 1 To 3
        'Draw a blue rectangle
        Turtle.PenColor = Color.Blue
        Turtle.Forward(100)
        Turtle.Rotate(90)
        Turtle.Forward(200)
        Turtle.Rotate(90)
        Turtle.Forward(100)
        Turtle.Rotate(90)
        Turtle.Forward(200)

        'Move the turtle to the top left corner of the rectangle
        Turtle.Rotate(90)
        Turtle.PenUp()
        Turtle.Forward(100)
        Turtle.PenDown()

        'Draw the red roof
        Turtle.Angle = 45
        Turtle.PenColor = Color.Red
        Turtle.Forward(141)
        Turtle.Rotate(90)
        Turtle.Forward(141)

        'Draw the windows
        Turtle.PenColor = Color.Brown
        Turtle.X -= 180
        Turtle.Y -= 50

        For k = 0 To 1
            Turtle.Angle = 0
```

```
            For i = 0 To 3
                Turtle.Forward(40)
                Turtle.Rotate(90)
            Next

            Turtle.Angle = 0
            Turtle.X += 20
            Turtle.Forward(40)

            Turtle.Angle = 90
            Turtle.X -= 20
            Turtle.Y = 70
            Turtle.Forward(40)

            Turtle.X += 80
            Turtle.Y -= 20
        Next

        'Draw the door
        Turtle.X -= 180
        Turtle.Y = 0
        Turtle.Angle = 0

        Turtle.Forward(70)
        Turtle.Rotate(90)
        Turtle.Forward(40)
        Turtle.Rotate(90)
        Turtle.Forward(70)
        Turtle.Rotate(90)
        Turtle.Forward(40)

        Turtle.Angle = 0
        Turtle.X += 200
    Next
End Sub
```

Chapter 23

23.14 Review Questions: True/False

1. True
2. True
3. True
4. False
5. True
6. False
7. True
8. True
9. False
10. False
11. False
12. True
13. False
14. True
15. False
16. True

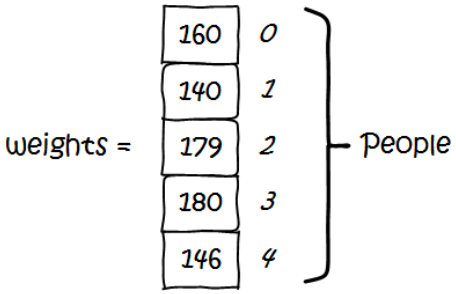
17. False
18. True
19. False
20. True
21. False
22. False
23. True
24. False
25. True
26. True
27. False
28. False
29. True
30. True
31. True
32. False
33. False
34. True
35. False
36. True
37. True
38. True
39. True
40. True
41. True
42. False
43. False
44. True
45. False

23.15 Review Questions: Multiple Choice

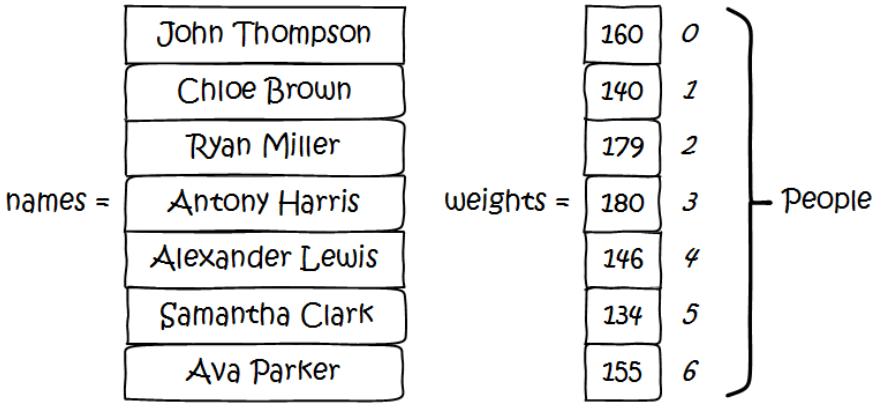
1. c
2. c
3. b
4. d
5. d
6. d
7. c
8. c
9. b
10. b
11. c
12. a
13. a
14. b
15. b
16. a
17. b

23.16 Review Exercises

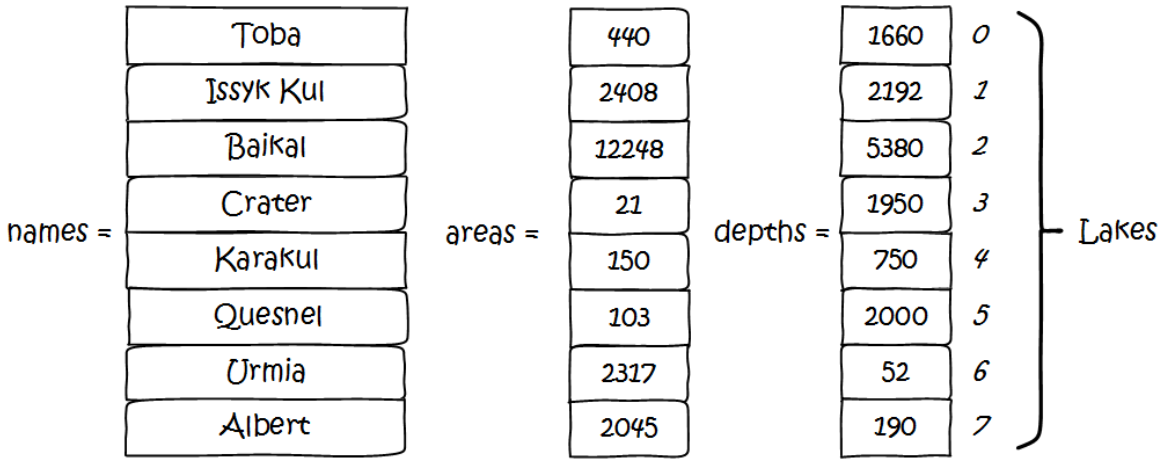
1. Solution



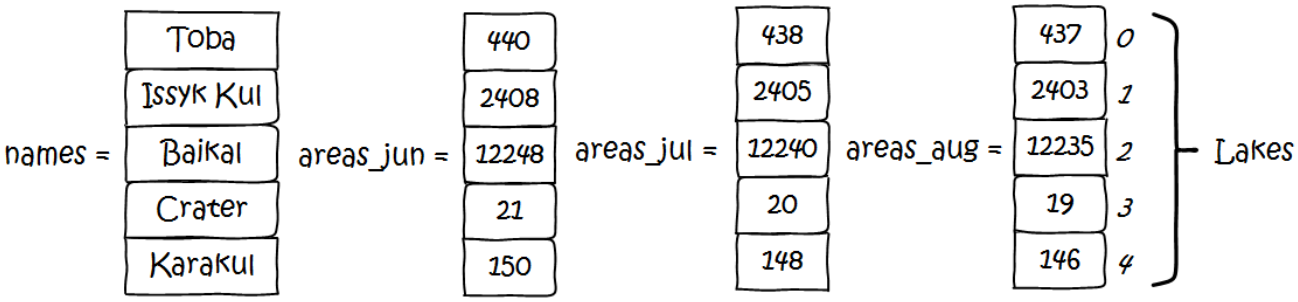
2. Solution



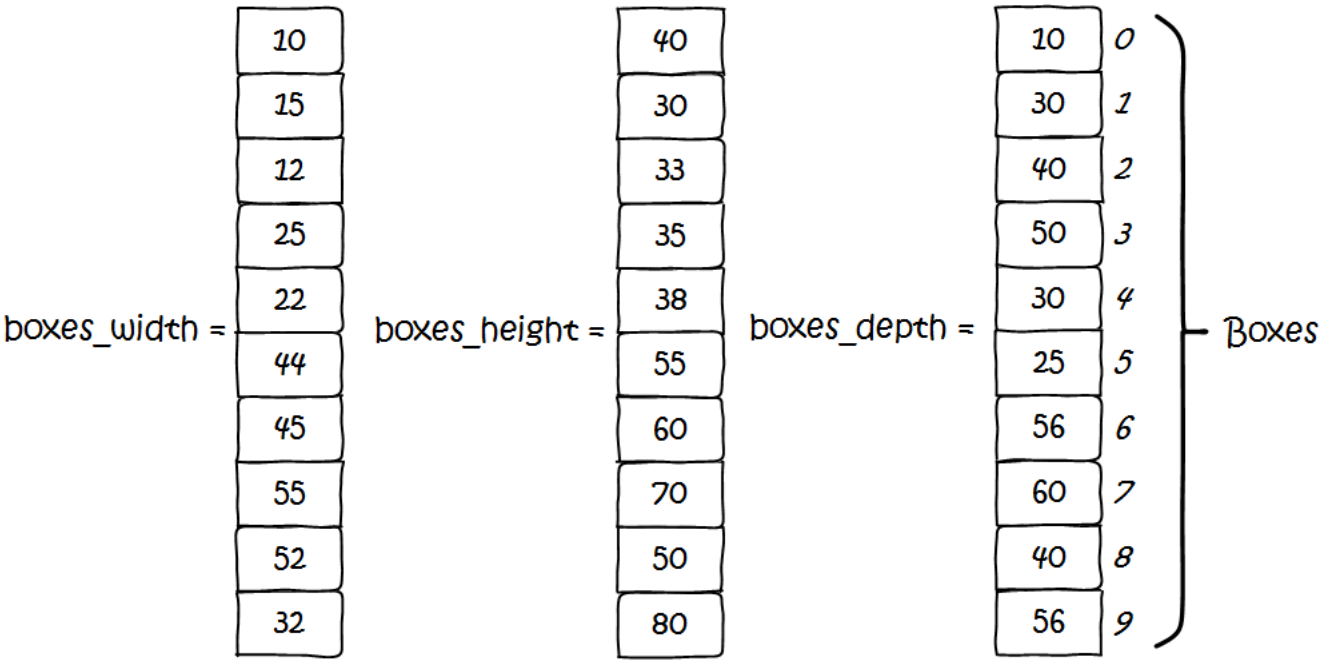
3. Solution



4. Solution



5. Solution



6. Solution

{16, 4, 1}

7. Solution

{4, 5, 11, 20, 10}

8. Solution

{18, 11, 46, 11, 11, 50}

9. Solution

{10, 22, 45, 67, 86, 19}

10. Solution

Navajo

Cherokee

Sioux

11. Solution

```
Const ELEMENTS = 100
Sub Main()
    Dim i As Integer
    Dim a(ELEMENTS - 1) As Double

    For i = 0 To ELEMENTS - 1
        Console.Write("Enter a number: ")
        a(i) = Console.ReadLine()
    Next

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

    Console.ReadKey()
End Sub
```

12. Solution

```
Const ELEMENTS = 80
Sub Main()
    Dim i As Integer

    Dim a(ELEMENTS - 1) As Double
    For i = 0 To ELEMENTS - 1
        Console.Write("Enter a number: ")
        a(i) = Console.ReadLine()
    Next

    For i = 0 To ELEMENTS - 1
        a(i) = a(i) ^ 2
    Next

    For i = ELEMENTS - 1 To 0 Step -1
        Console.WriteLine(a(i))
```

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

13. Solution

```
Const ELEMENTS = 50
Sub Main()
    Dim i As Integer

    Dim a(ELEMENTS - 1) As Integer
    For i = 0 To ELEMENTS - 1
        Console.Write("Enter an integer: ")
        a(i) = Console.ReadLine()
    Next

    For Each element In a
        If element >= 10 Then
            Console.WriteLine(element)
        End If
    Next
    Console.ReadKey()
End Sub
```

14. Solution

```
Const ELEMENTS = 30
Sub Main()
    Dim i As Integer
    Dim total As Double

    Dim a(ELEMENTS - 1) As Double
    For i = 0 To ELEMENTS - 1
        Console.Write("Enter a number: ")
        a(i) = Console.ReadLine()
    Next

    total = 0
    For Each element In a
        If element > 0 Then
            total += element
        End If
    Next
    Console.WriteLine(total)
    Console.ReadKey()
End Sub
```

15. Solution

```
Const ELEMENTS = 50
```

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

    Dim a(ELEMENTS - 1) As Integer
    For i = 0 To ELEMENTS - 1
        Console.Write("Enter an integer: ")
        a(i) = Console.ReadLine()
    Next

    total = 0
    For Each element In a
        If element >= 10 And element <= 99 Then
            total += element
        End If
    Next
    Console.WriteLine(total)
    Console.ReadKey()
End Sub
```

16. Solution

```
Const ELEMENTS = 40
Sub Main()
    Dim i As Integer
    Dim total_pos, total_neg As Double

    Dim a(ELEMENTS - 1) As Double
    For i = 0 To ELEMENTS - 1
        Console.Write("Enter a number: ")
        a(i) = Console.ReadLine()
    Next

    total_pos = 0
    total_neg = 0
    For Each element In a
        If element > 0 Then
            total_pos += element
        ElseIf element < 0 Then
            total_neg += element
        End If
    Next

    Console.WriteLine(total_pos & " " & total_neg)
    Console.ReadKey()
End Sub
```

17. Solution

First approach

```
Const ELEMENTS = 20
Sub Main()
    Dim i As Integer
    Dim total As Double

    Dim a(ELEMENTS - 1) As Double
    For i = 0 To ELEMENTS - 1
        Console.Write("Enter a number: ")
        a(i) = Console.ReadLine()
    Next

    total = 0
    For Each element In a
        total += element
    Next

    Console.WriteLine(total / ELEMENTS)
    Console.ReadKey()
End Sub
```

Second approach

```
Const ELEMENTS = 20
Sub Main()
    Dim i As Integer

    Dim a(ELEMENTS - 1) As Double
    For i = 0 To ELEMENTS - 1
        Console.Write("Enter a number: ")
        a(i) = Console.ReadLine()
    Next

    Console.WriteLine(a.Sum() / ELEMENTS)
    Console.ReadKey()
End Sub
```

18. Solution

```
Const ELEMENTS = 50
Sub Main()
    Dim i As Integer

    Dim a(ELEMENTS - 1) As Integer
    For i = 0 To ELEMENTS - 1
        Console.Write("Enter an integer: ")
        a(i) = Console.ReadLine()
```

```
    Next

    For i = 0 To ELEMENTS - 1
        If a(i) < 20 Then
            Console.WriteLine(i)
        End If
    Next
    Console.ReadKey()
End Sub
```

19. Solution

```
Const ELEMENTS = 60
Sub Main()
    Dim i As Integer

    Dim a(ELEMENTS - 1) As Double
    For i = 0 To ELEMENTS - 1
        Console.Write("Enter a number: ")
        a(i) = Console.ReadLine()
    Next

    For i = 0 To ELEMENTS - 1 Step 2
        Console.WriteLine(a(i))
    Next
    Console.ReadKey()
End Sub
```

20. Solution

```
Const ELEMENTS = 20
Sub Main()
    Dim i As Integer
    Dim total As Double

    Dim a(ELEMENTS - 1) As Double
    For i = 0 To ELEMENTS - 1
        Console.Write("Enter a number: ")
        a(i) = Console.ReadLine()
    Next

    total = 0
    For i = 0 To ELEMENTS - 1 Step 2
        total += a(i)
    Next

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

21. Solution

First approach

```
Dim a(99) As Integer
For i = 0 To 99
    a(i) = i + 1
Next
```

Second approach

```
Dim a(99) As Integer
For i = 1 To 100
    a(i - 1) = i
Next
```

22. Solution

First approach

```
Dim a(99) As Integer
For i = 0 To 9
    a(i) = 2 * (i + 1)
Next
```

Second approach

```
Dim a(99) As Integer
For i = 1 To 100
    a(i - 1) = 2 * i
Next
```

23. Solution

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

    Console.Write("Enter N: ")
    n = Console.ReadLine()

    Dim a(n - 1) As Double
    For i = 1 To n
        a(i - 1) = i ^ 2
    Next

    For Each element In a
        Console.WriteLine(element)
    Next
    Console.ReadKey()
End Sub
```

24. Solution

```
Const ELEMENTS = 10
Sub Main()
```

```
    Dim i As Integer

    Dim a(ELEMENTS - 1) As Double
    For i = 0 To ELEMENTS - 1
        Console.Write("Enter a number: ")
        a(i) = Console.ReadLine()
    Next

    For i = 0 To ELEMENTS - 1
        If a(i) = (int)a(i) Then
            Console.WriteLine(i)
        End If
    Next
    Console.ReadKey()
End Sub
```

25. Solution

```
Const ELEMENTS = 50
Sub Main()
    Dim i, count As Integer

    Dim a(ELEMENTS - 1) As Double
    For i = 0 To ELEMENTS - 1
        Console.Write("Enter a number: ")
        a(i) = Console.ReadLine()
    Next

    count = 0
    For i = 0 To ELEMENTS - 1
        If a(i) < 0 Then
            count += 1
        End If
    Next

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

26. Solution

```
Const ELEMENTS = 20
Sub Main()
    Dim i As Integer

    Dim words(ELEMENTS - 1) As String
    For i = 0 To ELEMENTS - 1
        Console.Write("Enter a word: ")
        words(i) = Console.ReadLine()
```

```
    Next

    For Each word In words
        If word.Length < 5 Then
            Console.WriteLine(word)
        End If
    Next
    Console.ReadKey()
End Sub
```

27. Solution

```
Const ELEMENTS = 30
Sub Main()
    Dim i As Integer

    Dim words(ELEMENTS - 1) As String
    For i = 0 To ELEMENTS - 1
        Console.Write("Enter a word: ")
        words(i) = Console.ReadLine()
    Next

    Dim length_limits() As Integer = { 5, 10, 20 }

    For Each length_limit In length_limits
        For Each word In words
            If word.Length < length_limit Then
                Console.WriteLine(word)
            End If
        Next
    Next

    Console.ReadKey()
End Sub
```

28. Solution

```
Const ELEMENTS = 40
Sub Main()
    Dim i, count As Integer

    Dim words(ELEMENTS - 1) As String
    For i = 0 To ELEMENTS - 1
        Console.Write("Enter a word: ")
        words(i) = Console.ReadLine()
    Next

    For Each word In words
        count = 0
```

```
        For Each letter In word
            If letter.ToString() = "w" Then
                count += 1
            End If

            If count = 2 Then
                Console.WriteLine(word)
                Exit For
            End If
        Next
    Next

    Console.ReadKey()
End Sub
```

Chapter 24

24.5 Review Questions: True/False

1. False
2. False
3. True
4. True

24.6 Review Exercises

1. *Solution*

```
Const ELEMENTS_OF_A = 50
Const ELEMENTS_OF_NEW = ELEMENTS_OF_A - 2
Sub Main()
    Dim i As Integer

    Dim a(ELEMENTS_OF_A - 1) As Double
    For i = 0 To ELEMENTS_OF_A - 1
        Console.Write("Enter a number: ")
        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)) / 3
    Next

    For i = 0 To ELEMENTS_OF_NEW - 1
        Console.WriteLine(new_arr(i))
    Next
    Console.ReadKey()
End Sub
```

2. Solution

```
Const ELEMENTS = 15
Sub Main()
    Dim i As Integer
    Dim minimum As Double

    Dim a(ELEMENTS - 1) As Double
    For i = 0 To ELEMENTS - 1
        Console.Write("A - Enter a number: ")
        a(i) = Console.ReadLine()
    Next

    Dim b(ELEMENTS - 1) As Double
    For i = 0 To ELEMENTS - 1
        Console.Write("B - Enter a number: ")
        b(i) = Console.ReadLine()
    Next

    Dim c(ELEMENTS - 1) As Double
    For i = 0 To ELEMENTS - 1
        Console.Write("C - Enter a number: ")
        c(i) = Console.ReadLine()
    Next

    Dim new_arr(ELEMENTS - 1) As Double
    For i = 0 To ELEMENTS - 1
        minimum = a(i)
        If b(i) < minimum Then
            minimum = b(i)
        End If
        If c(i) < minimum Then
            minimum = c(i)
        End If
        new_arr(i) = minimum
    Next

    For i = 0 To ELEMENTS - 1
        Console.WriteLine(new_arr(i))
    Next
    Console.ReadKey()
End Sub
```

3. Solution

```
Const MOUNTAINS = 30
Sub Main()
    Dim i, index_of_max, index_of_min As Integer
    Dim maximum, minimum 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

    maximum = heights(0)
    index_of_max = 0
    minimum = heights(0)
    index_of_min = 0
    For i = 1 To MOUNTAINS - 1
        If heights(i) > maximum Then
            maximum = heights(i)
            index_of_max = i
        End If
        If heights(i) < minimum Then
            minimum = heights(i)
            index_of_min = i
        End If
    Next

    Console.WriteLine(heights(index_of_max) & ", " &
                      names(index_of_max) & ", " & countries(index_of_max))
    Console.WriteLine(heights(index_of_min) & ", " &
                      names(index_of_min) & ", " & countries(index_of_min))
    Console.ReadKey()
End Sub
```

4. Solution

```
Const CLASS1 = 20
Const CLASS2 = 25
Sub Main()
    Dim i As Integer
    Dim 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

    Console.Write("Enter a name to search: ")
    needle = Console.ReadLine()

    found = False
    For Each name In names1
        If name = needle Then
            found = True
            Exit For
        End If
    Next


    If found = True Then
        Console.WriteLine("Student found in class No 1")
    Else
        found = False
        For Each name In names2
            If name = needle Then
                found = True
                Exit For
            End If
        Next

        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
```

5. *Solution*

```
Console.Write("Enter username: ")
usr = Console.ReadLine()
Console.Write("Enter password: ")
pwd = Console.ReadLine()

found = False
For i = 0 To 99
```

```
    If usernames(i) = usr Then
        found = True
        Exit For
    End If
Next

If found = True Then
    If usernames(i) = usr And passwords(i) = pwd Then
        Console.WriteLine("Login OK!")
    Else
        Console.WriteLine("Login Failed!")
    End If
Else
    Console.WriteLine("Login Failed!")
End If
```

6. Solution

```
Console.Write("Enter a value to search: ")
needle = Console.ReadLine()

found = False
For i = 0 To 999
    If SSNs(i) = needle Then
        found = True
        Console.WriteLine(SSNs(i) & " " & names(i))
        Exit For
    End If
Next

If found = False Then
    For i = 0 To 999
        If names(i) = needle Then
            found = True
            Console.WriteLine(SSNs(i) & " " & names(i))
        End If
    Next
End If

If found = False Then
    Console.WriteLine("This value does not exist")
End If
```

7. Solution

```
Const STUDENTS = 12
Sub Main()
    Dim i As Integer
    Dim found As Boolean
```

```
    Dim grades1(STUDENTS - 1) As Integer
    Dim grades2(STUDENTS - 1) As Integer
    Dim grades3(STUDENTS - 1) As Integer

    For i = 0 To STUDENTS - 1
        grades1(i) = Console.ReadLine()
        grades2(i) = Console.ReadLine()
        grades3(i) = Console.ReadLine()
    Next

    found = False
    For i = 0 To STUDENTS - 1
        If (grades1(i) + grades2(i) + grades3(i)) / 3 < 70 Then
            found = True
            Exit For
        End If
    Next

    If found = True Then
        Console.Write("At least one student has an average value below 70")
    End If
    Console.ReadKey()
End Sub
```

8. Solution

```
Const STUDENTS = 15
Sub Main()
    Dim i As Integer
    Dim average As Double

    Dim grades1(STUDENTS - 1) As Integer
    Dim grades2(STUDENTS - 1) As Integer
    For i = 0 To STUDENTS - 1
         grades1(i) = Console.ReadLine()
         grades2(i) = Console.ReadLine()
    Next

    For i = 0 To STUDENTS - 1
        Console.WriteLine("Student No " & (i + 1) & ": ")

        average = (grades1(i) + grades2(i)) / 2.0

        If average < 60 Then
            Console.WriteLine("E/F")
        ElseIf average < 70 Then
            Console.WriteLine("D")
```

```
        ElseIf average < 80 Then
            Console.WriteLine("C")
        ElseIf average < 90 Then
            Console.WriteLine("B")
        Else
            Console.WriteLine("A")
        End If
    Next
    Console.ReadKey()
End Sub
```

9. Solution

```
Const PLAYERS = 15
Sub Main()
    Dim i, total As Integer

    Dim points_match1(PLAYERS - 1) As Integer
    Dim points_match2(PLAYERS - 1) As Integer
    Dim points_match3(PLAYERS - 1) As Integer
    Dim points_match4(PLAYERS - 1) As Integer
    For i = 0 To PLAYERS - 1
         points_match1(i) = Console.ReadLine()
         points_match2(i) = Console.ReadLine()
         points_match3(i) = Console.ReadLine()
         points_match4(i) = Console.ReadLine()
    Next

    For i = 0 To PLAYERS - 1
        Console.WriteLine("Player No " & (i + 1))
        total = points_match1(i) + points_match2(i) +
                points_match3(i) + points_match4(i)
        Console.WriteLine(total)
    Next
    Console.ReadKey()
End Sub
```

10. Solution

```
Const HOURS = 24
Sub Main()
    Dim i As Integer
    Dim average As Double

    Dim t_city1(HOURS - 1) As Double
    Dim t_city2(HOURS - 1) As Double
    Dim t_city3(HOURS - 1) As Double
    For i = 0 To HOURS - 1
         t_city1(i) = Console.ReadLine()
```

```
        t_city2(i) = Console.ReadLine()
        t_city3(i) = Console.ReadLine()
    Next

    For i = 0 To HOURS - 1
        average = (t_city1(i) + t_city2(i) + t_city3(i)) / 3
        If average < 10 Then
            Console.WriteLine("Hour: " & (i + 1))
        End If
    Next
    Console.ReadKey()
End Sub
```

11. Solution

```
Const STUDENTS = 12
Sub Main()
    Dim i As Integer

    Dim names(STUDENTS - 1) As String
    Dim grd_lesson1(STUDENTS - 1) As Integer
    Dim grd_lesson2(STUDENTS - 1) As Integer
    For i = 0 To STUDENTS - 1
        names(i) = Console.ReadLine()
        grd_lesson1(i) = Console.ReadLine()
        grd_lesson2(i) = Console.ReadLine()
    Next

    'Create list average
    Dim average(STUDENTS - 1) As Double
    For i = 0 To STUDENTS - 1
        average(i) = (grd_lesson1(i) + grd_lesson2(i)) / 2
    Next

    For i = 0 To STUDENTS - 1
        Console.WriteLine(names(i) & " " & average(i))
    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
```

12. Solution

```
Const ARTISTS = 15
Sub Main()
    Dim i, minimum As Integer

    Dim artist_names(ARTISTS - 1) As String
    Dim song_titles(ARTISTS - 1) As String
    Dim scoreA(ARTISTS - 1) As Integer
    Dim scoreB(ARTISTS - 1) As Integer
    Dim scoreC(ARTISTS - 1) As Integer

    For i = 0 To ARTISTS - 1
        Console.Write("Name for artist No " & (i + 1) & ": ")
        artist_names(i) = Console.ReadLine()

        Console.Write("Song title for artist " & artist_names(i) & ": ")
        song_titles(i) = Console.ReadLine()

        Console.WriteLine("Score for artist " & artist_names(i))

        Console.Write(" gotten from judge A: ")
        scoreA(i) = Console.ReadLine()

        Console.Write(" gotten from judge B: ")
        scoreB(i) = Console.ReadLine()

        Console.Write(" gotten from judge C: ")
        scoreC(i) = Console.ReadLine()
    Next

    Dim total(ARTISTS - 1) As Integer
    For i = 0 To ARTISTS - 1
        minimum = scoreA(i)
        If scoreB(i) < minimum Then
            minimum = scoreB(i)
        End If
        If scoreC(i) < minimum Then
            minimum = scoreC(i)
        End If

        total(i) = scoreA(i) + scoreB(i) + scoreC(i) - minimum
    Next
```

```
    For i = 0 To ARTISTS - 1
        Console.WriteLine(artist_names(i))
        Console.WriteLine(song_titles(i) & ": " & total(i))
    Next
    Console.ReadKey()
End Sub
```

13. Solution

```
Const CITIZENS = 20
Sub Main()
    Dim prod_name1, prod_name2 As String
    Dim i, count_A As Integer

    Dim answers1(CITIZENS - 1) As String
    Dim answers2(CITIZENS - 1) As String

    Console.Write("Enter Product Name 1: ")
    prod_name1 = Console.ReadLine()
    For i = 0 To CITIZENS - 1
        Console.Write("Enter score for product " & prod_name1 & ": ")
        answers1(i) = Console.ReadLine()
    Next

    Console.Write("Enter Product Name 2: ")
    prod_name2 = Console.ReadLine()
    For i = 0 To CITIZENS - 1
        Console.Write("Enter score for product " & prod_name2 & ": ")
        answers2(i) = Console.ReadLine()
    Next

    count_A = 0
    For i = 0 To CITIZENS - 1
        If answers1(i) = "A" Then
            count_A += 1
        End If
    Next
    Console.WriteLine(prod_name1 & " " & count_A)

    count_A = 0
    For i = 0 To CITIZENS - 1
        If answers2(i) = "A" Then
            count_A += 1
        End If
    Next
    Console.WriteLine(prod_name2 & " " & count_A)

    Console.ReadKey()
```

```
End Sub
```

14. Solution

```
Sub Main()
    Dim word As String

    Dim morseAlphabet = New Dictionary(Of String, String) From {
        { "A", ".-" },
        { "B", "-..." },
        { "C", "-.-." },
        { "D", "-.." },
        { "E", "." },
        { "F", "..-." },
        { "G", "--." },
        { "H", "...." },
        { "I", ".." },
        { "J", ".---" },
        { "K", "-.-" },
        { "L", ".-.." },
        { "M", "--" },
        { "N", "-." },
        { "O", "---" },
        { "P", ".--." },
        { "Q", "--.-" },
        { "R", ".-." },
        { "S", "..." },
        { "T", "-" },
        { "U", "..-" },
        { "V", "...-" },
        { "W", ".--" },
        { "X", "-..-" },
        { "Y", "-.--" },
        { "Z", "--.." },
        { " ", "/" }
    }

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

    For Each letter In word
        Console.Write(morseAlphabet(letter.ToString().ToUpper()))
    Next
    Console.ReadKey()
End Sub
```

Chapter 25

25.4 Review Questions: True/False

1. True
2. True
3. True
4. False
5. False
6. True
7. True
8. True
9. True
10. True
11. False
12. True

Chapter 26

26.11 Review Questions: True/False

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

26.12 Review Exercises

1. *Solution*

```
Function find_max(a As Double, b As Double) As Double
    Dim maximum as Double
    If a > b Then
        maximum = a
    Else
        maximum = b
    End If
    Return maximum
End Function
```

2. *Solution*

It displays:

3 is positive

-7 is negative or zero

-9 is negative or zero

0 is negative or zero

4 is positive

3. Solution

```
Function find_sum(a As Double, b As Double, c As Double) As Double
    Return a + b + c
End Function
```

4. Solution

```
Function find_avg(a As Double, b As Double, c As Double, d As Double) As Double
    Return (a + b + c + d) / 4
End Function
```

5. Solution

```
Sub display_max(a As Double, b As Double, c As Double)
    Dim maximum As Double

    maximum = a
    If b > maximum Then
        maximum = b
    End If
    If c > maximum Then
        maximum = c
    End If
    Console.WriteLine(maximum)
End Sub
```

6. Solution

```
Function find_min(a As Double, b As Double) As Double
    Dim minimum As Double
    minimum = a
    If b < minimum Then
        minimum = b
    End If
    Return minimum
End Function

Sub Main()
    Dim x1, x2, x3, x4, temp1, temp2 As Double

    Console.WriteLine("Enter four numbers: ")
    x1 = Console.ReadLine()
    x2 = Console.ReadLine()
    x3 = Console.ReadLine()
    x4 = Console.ReadLine()

    'Display lowest value as follows (1st approach)
    temp1 = find_min(x1, x2)
    temp2 = find_min(x3, x4)
    Console.WriteLine(find_min(temp1, temp2))
```

```
    'Or as follows (2nd approach)
    Console.WriteLine(find_min(find_min(x1, x2), find_min(x3, x4)))
    Console.ReadKey()
End Sub
```

7. Solution

```
Function get_input() As Boolean
    Dim answer As String
    Console.Write("Enter Yes or No: ")
    answer = Console.ReadLine()
    If answer.ToUpper() = "YES" Then
        Return True
    Else
        Return False
    End If
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
    Dim answer As Boolean

    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? ")
        answer = get_input()      'Or you can write...
    Loop While answer = True      'Loop While get_input() = True
    Console.ReadKey()
End Sub
```

Chapter 27

27.2 Review Exercises

1. 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
```

2. Solution

```
Function num_of_days(month As Integer) As Integer
    Dim days As Integer

    If month = 4 Or month = 6 Or month = 9 Or month = 11 Then
        days = 30
    ElseIf month = 2 Then
        days = 28
    Else
        days = 31
    End If
    Return days
End Function

Sub Main()
    Dim i, x, y, total As Integer

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

    Console.Write("Enter a second month: ")
    y = Console.ReadLine()
```

```
    total = 0
    For i = x To y
        total += num_of_days(i)
    Next

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

3. Solution

```
Function dice() As Integer
    Dim rnd = New Random(Guid.NewGuid().GetHashCode())
    Return rnd.Next(1, 7)
End Function

Sub Main()
    Dim i, dice1, dice2, player As Integer

    Dim names(1) As String
    Console.Write("Player 1 enter name: ")
    names(0) = Console.ReadLine()
    Console.Write("Player 2 enter name: ")
    names(1) = Console.ReadLine()

    Dim total(1) As Integer

    For player = 0 To 1
        total(player) = 0
        For i = 1 To 10
            Console.Write(names(player))
            Console.WriteLine(", hit any key to roll the dice!")
            Console.ReadKey()

            dice1 = dice()
            dice2 = dice()
            Console.WriteLine(dice1 & " " & dice2)
            total(player) += dice1 + dice2
        Next
    Next

    If total(0) = total(1) Then
        Console.WriteLine("Tie!")
    ElseIf total(0) > total(1) Then
        Console.WriteLine(names(0) & " wins!")
    Else
        Console.WriteLine(names(1) & " wins!")
```

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

4. Solution

```
Sub bmi(w As Double, h As Double)
    Dim b As Double

    b = w * 703 / h ^ 2
    If b < 16 Then
        Console.WriteLine("You must add weight.")
    ElseIf b < 18.5 Then
        Console.WriteLine("You should add some weight.")
    ElseIf b < 25 Then
        Console.WriteLine("Maintain your weight.")
    ElseIf b < 30 Then
        Console.WriteLine("You should lose some weight.")
    Else
        Console.WriteLine("You must lose weight.")
    End If
End Sub

Sub Main()
    Dim height, weight As Double
    Dim age As Integer

    Console.Write("Enter your weight (in pounds): ")
    weight = Console.ReadLine()

    Console.WriteLine("Enter your age: ")
    age = Console.ReadLine()

    Console.WriteLine("Enter your height (in inches): ")
    height = Console.ReadLine()

    If age < 18 Then
        Console.WriteLine("I can't calculate your BMI. You must be adult!")
    Else
        bmi(weight, height)
    End If

    Console.ReadKey()
End Sub
```

5. Solution

```
Const CARS = 40
Const GAS = 1
```

```
Const DIESEL = 2
Const HYBRID = 3

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(car_type As Integer, rental_days As Integer) As Double
    Dim charge As Double

    If car_type = GAS Then
        If rental_days <= 5 Then
            charge = rental_days * 24
        Else
            charge = rental_days * 22
        End If
    ElseIf car_type = DIESEL Then
        If rental_days <= 5 Then
            charge = rental_days * 28
        Else
            charge = rental_days * 25
        End If
    Else
        If rental_days <= 5 Then
            charge = rental_days * 30
        Else
            charge = rental_days * 28
        End If
    End If
    Return charge
End Function
```

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

    total = 0
    For i = 0 To CARS - 1
        charge = get_charge(rented_car_types(i), rented_days(i))
        Console.WriteLine("Amount to pay, car No " & (i + 1) & ": " & charge)
        total += 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.WriteLine("Total profit: " & total)
    Console.ReadKey()
End Sub
```

Chapter 28

28.8 Review Questions: True/False

1. False
2. True
3. True
4. False
5. False
6. False
7. False
8. True
9. True
10. True
11. True
12. False
13. True
14. False
15. False

28.9 Review Exercises

1. *Solution*

```
Class Trigonometry
    Public Function square_area(side As Double) As Double
```

```
        Return side * side
    End Function

    Public Function rectangle_area(bas As Double, height As Double) As Double
        Return bas * height
    End Function

    Public Function triangle_area(bas As Double, height As Double) As Double
        Return bas * height / 2
    End Function
End Class

Sub Main()
    Dim sqr_side, rctngl_base, rctngl_height, trngl_base, trngl_height As Double

    Dim tr = New Trigonometry()

    Console.Write("Enter square side: ")
    sqr_side = Console.ReadLine()

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

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

    Console.WriteLine(tr.square_area(sqr_side))
    Console.WriteLine(tr.rectangle_area(rctngl_base, rctngl_height))
    Console.WriteLine(tr.triangle_area(trngl_base, trngl_height))
    Console.ReadKey()
End Sub
```

2. Solution

```
Class Pet
    Public f_kind As String
    Public f_legs_number As Integer

    Public Sub start_running()
        Console.WriteLine("Pet is running")
    End Sub

    Public Sub stop_running()
        Console.WriteLine("Pet stopped")
```

```
    End Sub
End Class

Sub Main()
    Dim pet1 = New Pet()
    pet1.f_kind = "dog"
    pet1.f_legs_number = 4

    Dim pet2 = New Pet()
    pet2.f_kind = "monkey"
    pet2.f_legs_number = 2

    pet1.start_running()
    pet2.start_running()
    pet1.stop_running()
    Console.ReadKey()
End Sub
```

3. Solution

```
Class Pet
    Private f_kind As String
    Private f_legs_number As Integer

    'Define the constructor
    Public Sub New(k As string, l As Integer)
        'Initialize properties
        Kind = k
        Legs_number = l
    End Sub

    'Defines a public property
    Public Property Kind As String
        'Define the getter
        Get
            Return f_kind
        End Get
        'Define the setter
        Set
            If value <> "" Then
                f_kind = value
            Else
                Throw New Exception("Cannot be empty")
            End If
        End Set
    End Property

    'Defines a public property
```

```
    Public Property Legs_number As Integer
        'Define the getter
        Get
            Return f_legs_number
        End Get
        'Define the setter
        Set
            If value >= 0 Then
                f_legs_number = value
            Else
                throw new Exception("Cannot be negative")
            End If
        End Set
     End Property

    Public Sub start_running()
        Console.WriteLine("Pet is running")
    End Sub

    Public Sub stop_running()
        Console.WriteLine("Pet stopped")
    End Sub
End Class

Sub Main()
    Dim pet1 = New Pet("dog", 4)

    pet1.start_running()
    pet1.stop_running()

    pet1.Kind = ""          'This will throw an error
    pet1.Legs_number = -3   'This will throw an error

    Console.ReadKey()
End Sub
```

4. Solution

```
Const BOXES = 3

Class Box
    Public f_width As Double
    Public f_length As Double
    Public f_height As Double

    'Define the constructor
    Sub New (w As Double, l As Double, h As Double)
        'Initialize fields
```

```
        Me.f_width = w
        Me.f_length = l
        Me.f_height = h
    End Sub

    Public Sub display_volume()
        Console.WriteLine("Volume: " &
                          (Me.f_width * Me.f_length * Me.f_height))
    End Sub

    Public Sub display_dimensions()
        Console.WriteLine(Me.f_width & " x " &
                          Me.f_length & " x " & Me.f_height)
    End Sub
End Class

Sub Main()
    Dim i As Integer
    Dim w, l, h As Double

    Dim list_of_obj(BOXES) As Box 'Create an array

    For i = 0 To BOXES - 1
        Console.Write("Enter width: ")
        w = Console.ReadLine()
        Console.Write("Enter length: ")
        l = Console.ReadLine()
        Console.Write("Enter height: ")
        h = Console.ReadLine()

        'add each new object to the array
        list_of_obj(i) = New Box(w, l, h)
    Next

    For i = 0 To BOXES - 1
        list_of_obj(i).display_dimensions()
        list_of_obj(i).display_volume()
    Next
    Console.ReadKey()
End Sub
```

5. Solution

```
Const BOXES = 3

Class Box
    Private f_width As Double
    Private f_length As Double
```

```
    Private f_height As Double

    'Define the constructor
    Sub New(w As Double, l As Double, h As Double)
        'Initialize properties
        Width = w
        Length = l
        Height = h
    End Sub

    'Define public property Width
    Public Property Width As Double
        'Define the getter
        Get
            Return f_width
        End Get
        'Define the setter
        Set
            If value > 0 Then
                f_width = value
            Else
                throw new Exception("Cannot be negative or zero")
            End If
        End Set
    End Property

    'Define public property Length
    Public Property Length As Double
        'Define the getter
        Get
            Return f_length
        End Get
        'Define the setter
        Set
            If value > 0 Then
                f_length = value
            Else
                throw new Exception("Cannot be negative or zero")
            End If
        End Set
    End Property

    'Define public property Height
    Public Property Height As Double
        'Define the getter
        Get
            Return f_height
```

```
        End Get
        'Define the setter
        Set
            If value > 0 Then
                f_height = value
            Else
                throw new Exception("Cannot be negative or zero")
            End If
        End Set
    End Property

    Public Sub display_volume()
        Console.WriteLine("Volume: " &
                          (Me.Width * Me.Length * Me.Height))
    End Sub

    Public Sub display_dimensions()
        Console.WriteLine(Me.Width & " x " &
                          Me.Length & " x " & Me.Height)
    End Sub
End Class

Sub Main()
    Dim i As Integer
    Dim w, l, h As Double

    Dim list_of_obj(BOXES) As Box  'Create an array

    For i = 0 To BOXES - 1
        Console.Write("Enter width: ")
        w = Console.ReadLine()
        Console.Write("Enter length: ")
        l = Console.ReadLine()
        Console.Write("Enter height: ")
        h = Console.ReadLine()

        'add each new object to the list
        list_of_obj(i) = New Box(w, l, h)
    Next

    For i = 0 To BOXES - 1
        list_of_obj(i).display_dimensions()
        list_of_obj(i).display_volume()
    Next
    Console.ReadKey()
End Sub
```

6. Solution

```
Class Cube
    Public f_edge As Double

    'Define the constructor
    Public Sub New(edge As Double)
        Me.f_edge = edge    'Initialize field
    End Sub

    Public Sub display_volume()
        Console.WriteLine("Volume: " & Me.f_edge ^ 3)
    End Sub

    Public Sub display_one_surface()
        Console.WriteLine("One surface: " & Me.f_edge ^ 2)
    End Sub

    Public Sub display_total_surface()
        Console.WriteLine("Total surface: " & 6 * Me.f_edge ^ 2)
    End Sub
End Class

Sub Main()
    Dim edge As Double

    Console.Write("Enter edge length of a cube: ")
    edge = Console.ReadLine()

    Dim cube1 = New Cube(edge)

    cube1.display_volume()
    cube1.display_one_surface()
    cube1.display_total_surface()
    Console.ReadKey()
End Sub
```

7. Solution

```
Class Cube
    Private f_edge As Double

    'Define the constructor
    Public Sub New (edj As Double)
        Edge = edj    'Initialize property
    End Sub

    'Define public property Edge
    Public Property Edge As Double
```

```
        'Define the getter
        Get
            Return f_edge
        End Get
        'Define the setter
        Set
            If value > 0 Then
                f_edge = value
            Else
                throw new Exception("Cannot be negative or zero")
            End If
        End Set
    End Property

    Public Sub display_volume()
        Console.WriteLine("Volume: " & Me.Edge ^ 3)
    End Sub

    Public Sub display_one_surface()
        Console.WriteLine("One surface: " & Me.Edge ^ 2)
    End Sub

    Public Sub display_total_surface()
        Console.WriteLine("Total surface: " & (6 * Me.Edge ^ 2))
    End Sub
End Class

Sub Main()
    Dim edge As Double

    Console.Write("Enter edge length of a cube: ")
    edge = Console.ReadLine()

    Dim cube1 = New Cube(edge)

    cube1.display_volume()
    cube1.display_one_surface()
    cube1.display_total_surface()
    Console.ReadKey()
End Sub
```

8. Solution

```
Sub display_menu()
    Console.WriteLine("1. Enter radius")
    Console.WriteLine("2. Display radius")
    Console.WriteLine("3. Display diameter")
    Console.WriteLine("4. Display area")
```

```
    Console.WriteLine("5. Display perimeter")
    Console.WriteLine("6. Exit")
End Sub

Class Circle
    Private f_radius As Double = -1

    'Define public property Radius
    Public Property Radius As Double
        'Define the getter
        Get
            If f_radius > 0 Then
                Return f_radius
            Else
                throw new Exception("Radius is not set")
            End If
        End Get
        'Define the setter
        Set
            If value > 0 Then
                f_radius = value
            Else
                throw new Exception("Cannot be negative or zero")
            End If
        End Set
    End Property

    Public Function get_diameter() As Double
        Return 2 * Radius
    End Function

    Public Function get_area() As Double
        Return 3.14 * Radius ^ 2
    End Function

    Public Function get_perimeter() As Double
        Return 2 * 3.14 * Radius
    End Function
End Class

Sub Main()
    Dim choice As Integer
    Dim radius As Double

    Dim circle1 = New Circle()

    Do
```

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

        If choice = 1 Then
            Console.Write("Enter radius: ")
            radius = Console.ReadLine()
            circle1.Radius = radius
        ElseIf choice = 2 Then
            Console.WriteLine("Radius: " & circle1.Radius)
        ElseIf choice = 3 Then
            Console.WriteLine("Diameter: " & circle1.get_diameter())
        ElseIf choice = 4 Then
            Console.WriteLine("Area: " & circle1.get_area())
        ElseIf choice = 5 Then
            Console.WriteLine("Perimeter: " & circle1.get_perimeter())
        End If
    Loop While choice <> 6
End Sub
```

9. Solution

```
Class Info
    Private f_user_text As String

    Public Property User_text As String
        'Define the getter
        Get
            Return f_user_text
        End Get
        'Define the setter
        Set
            If value <> "" Then
                f_user_text = value
            Else
                throw new Exception("Cannot be set to empty")
            End If
        End Set
    End Property

    Public Function get_spaces_count() As Integer
        Dim count As Integer = 0
        For Each character In User_text
            If character.ToString() = " " Then
                count += 1
            End If
        Next
        Return count
```

```
    End Function

    Public Function get_words_count() As Integer
        Return Me.get_spaces_count() + 1
    End Function

    Public Function get_vowels_count() As Integer
        Dim count As Integer = 0
        For Each character In User_text
            If "aeiou".IndexOf(character) > -1 Then
                count += 1
            End If
        Next
        Return count
    End Function

    Public Function get_letters_count() As Integer
        Return User_text.Length - Me.get_spaces_count()
    End Function
End Class

Sub Main()
    Dim inf = New Info()

    Console.Write("Enter a text: ")
    inf.User_text = Console.ReadLine()

    Console.WriteLine("Text: " & inf.User_text)
    Console.WriteLine("Spaces: " & inf.get_spaces_count())
    Console.WriteLine("Words: " & inf.get_words_count())
    Console.WriteLine("Vowels: " & inf.get_vowels_count())
    Console.WriteLine("Total number of letters: " & inf.get_letters_count())
    Console.ReadKey()
End Sub
```

10. Solution

```
Sub display_menu()
    Console.WriteLine("1. Encryption/Decryption key")
    Console.WriteLine("2. Encrypt a message")
    Console.WriteLine("3. Decrypt a message")
    Console.WriteLine("4. Exit")
End Sub

Class EncryptDecrypt
    Private f_encr_decr_key As Integer = -1
    Private f_alphabet As String = " abcdefghijklmnopqrstuvwxyz" 'Space is
                                                                'a valid character!
```

```
    Public Property Encr_decr_key As Integer
        'Define the getter
        Get
            If f_encr_decr_key <> -1 Then
                Return f_encr_decr_key
            Else
                throw new Exception("Key is not set")
            End If
        End Get
        'Define the setter
        Set
            If value >= 1 And value <= 26 Then
                f_encr_decr_key = value
            Else
                throw new Exception("Must be between 1 and 26")
            End If
        End Set
    End Property

    Public Function encrypt(message As String) As String
        Dim new_letter As String, Return_value As String = ""
        Dim index, new_index As Integer

        For Each character In message
            index = Me.f_alphabet.IndexOf(character)
            new_index = index + Encr_decr_key
            If new_index >= 27 Then
                new_index -= 27
            End If
            new_letter = Me.f_alphabet(new_index).ToString()
            Return_value += new_letter
        Next
        Return Return_value
    End Function

    Public Function decrypt(enc_message As String) As String
        Dim new_letter As String, Return_value As String = ""
        Dim index, new_index As Integer

        For Each character In enc_message
            index = Me.f_alphabet.IndexOf(character)
            new_index = index - Encr_decr_key
            If new_index < 0 Then
                new_index += 27
            End If
            new_letter = Me.f_alphabet(new_index).ToString()
            Return_value += new_letter
```

```
        Next
        Return Return_value
    End Function
End Class

Sub Main()
    Dim text As String
    Dim choice As Integer

    Dim ed = New EncryptDecrypt()

    Do
        display_menu()

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

        If choice = 1 Then
            Console.Write("Enter encryption/decryption key: ")
            ed.Encr_decr_key = Console.ReadLine()
        ElseIf choice = 2 Then
            Console.Write("Enter message to encrypt: ")
            text = Console.ReadLine()
            Console.WriteLine("Encrypted message: " & ed.encrypt(text))
        ElseIf choice = 3 Then
            Console.Write("Enter message to decrypt: ")
            text = Console.ReadLine()
            Console.WriteLine("Decrypted message: " & ed.decrypt(text))
        End If
    Loop While choice <> 4
End Sub
```