CHAPTER 13
EXTRA RESOURCES

Additional Resources

1. "For Loop Diagram" (*http://tiny.cc/fordiagram/*): Examine a diagram that shows in detail how For loops work.
2. "Control Variable Warning" (*http://tiny.cc/controlvariable/*): Find out why you shouldn't change the loop's control variable in the loop.
3. "Iteration Count" (*http://tiny.cc/iteration/*): Get more information about how a For loop counts its iterations.
4. "Infinite For Loops" (*http://tiny.cc/infinitefor/*): Learn how to avoid infinite For loops.
5. "Small Basic Reference Documentation: Math Object" (*http://tiny.cc/mathobject/*): Review the Math object's different methods and features.
6. "Multiplication Table Example" (*http://tiny.cc/multiplicationtable/*): Find out how to use nested For loops to create a table.
7. "Small Basic Reference Documentation: ImageList Object" (*http://tiny.cc/imagelist/*): Learn more about the ImageList object's methods.

8. "Multiple Nesting Levels" (*http://tiny.cc/multiple/*): Dig deeper using another example to learn more about multiple nesting levels.

9. "Compound Interest Example" (*http://tiny.cc/interestexample/*): Follow along through this example For loop.

10. "Numbers Triangle Example" (*http://tiny.cc/numberstriangle/*): Learn how to use a nested loop to draw numbers in a triangle shape.

Review Questions

1. What are the two types of loops that Small Basic supports (not counting a GoTo loop)?

2. Write the general form of a For loop.

3. What do you call the set of statements between the For and the EndFor keywords?

4. What kind of loop should you use when you need to run a set of statements a fixed number of times?

5. If you don't use the Step keyword in the For statement, what's the loop counter's default step increment?

6. How would you write a For loop that counts backward, like a rocket countdown?

7. Find the logical error in the following code and fix it. The program is supposed to count backward.

```
For N = 8 To 2 Step 1
    TextWindow.WriteLine(N)
EndFor
```

8. Explain and fix the error in this code:

```
For N = 1 To 5
    TextWindow.WriteLine(N)
End
```

9. Explain and fix the error in this code:

```
For N = 1 Step 2 To 10
    TextWindow.WriteLine(N)
EndFor
```

10. Update the following program to use a For loop:

```
sum = 0
N = 0
Again:
N = N + 1
TextWindow.Write("Enter a number: ")
```

```
num = TextWindow.ReadNumber()
sum = sum + num

If (N <> 10) Then
  Goto Again
EndIf

TextWindow.WriteLine(sum)
```

11. What is a loop within a loop is called?

12. What is the output of the next program? Run the program to verify your answer.

```
For I = 1 To 5
  For J = 1 To 2
    TextWindow.WriteLine(J)
  EndFor
EndFor
```

Practice Exercises

1. What is the output of the following program? Run the program to check your answer.

```
For X = -5 To 5
  For Y = -5 To 5
    If ((Math.Abs(X) + Math.Abs(Y)) <= 4) Then
      TextWindow.Write("*")
    Else
      TextWindow.Write(" ")
    EndIf
  EndFor
  TextWindow.WriteLine("")
EndFor
```

2. The following program finds the average value of *M* numbers entered by a user, where *M* is also entered by the user. Run this program and explain how it works.

```
TextWindow.Write("How many numbers do you want to average? ")
count = TextWindow.ReadNumber()

If (count > 0) Then
  sum  = 0
  For N = 1 To count
    TextWindow.Write("Number " + N + ": ")
    sum = sum + TextWindow.ReadNumber()
  EndFor

  avg = Math.Round(sum / count)
```

```
    TextWindow.WriteLine("Average = " + avg)
EndIf
```

3. Write a program that counts the number of positive, negative, and zeros in a set of numbers entered by a user. Have the program start by asking the user how many numbers they have, and then use a loop to collect the input numbers and process them as needed. (Hint: use three counters, and update them as the user enters their data.)

4. The next program displays all the factors of an integer number, *N*, entered by a user. Run the program and explain how it works.

```
TextWindow.Write("Enter N: ")
N = TextWindow.ReadNumber()

TextWindow.WriteLine("Factors of " + N + ":")
For I = 1 To N
  If (Math.Remainder(N, I) = 0) Then
    TextWindow.WriteLine(I)
  EndIf
EndFor
```

5. Write a program that finds this sum: $1 - 1/2 + 1/3 - 1/4 + 1/5 ... - 1/100$. (Hint: if *S*=1, then the statement *S* = −*S* toggles the sign of *S*.)

6. Write a program that displays all the numbers less than 1000 that are evenly divisible by 3, 5, and 7.

7. Write a program that uses a nested For loop that gives you this output:
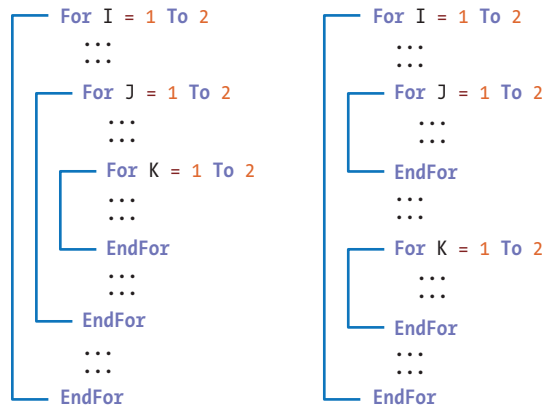
```
B
BB
BBB
BBBB
BBBBB
```

8. Write a program that uses a nested For loop that gives you this output:

```
BBBBB
BBBB
BBB
BB
B
```

9. What's the output of the following program? Run the program to check your answer.

```
For N = 7 To 5 Step -2
  For M = 5 To 9 Step 2
    TextWindow.WriteLine(N + M)
  EndFor
EndFor
```

10. The following figure shows you two ways to nest three `For` loops. Explain the difference between the two.

11. The following program creates a 24-hour digital watch. Run the program and explain how it works.

```
GraphicsWindow.Show()
GraphicsWindow.FontSize = 40

txtID = Shapes.AddText("")

For H = 0 To 23
  For M = 0 To 59
    For S = 0 To 59
      Shapes.SetText(txtID, H + ":" + M + ":" + S)
      Program.Delay(1000)
    EndFor
  EndFor
EndFor
```

12. The following program creates a simple animation by drawing three frames of a moving train in rapid succession. Run the program and explain how it works.

```
GraphicsWindow.FontName = "Courier New"
GraphicsWindow.FontSize = 14
GraphicsWindow.BrushColor = "Black"

xPos = 1
yPos = 100

For N = 1 to 100
  L1 = "|----\"
  L2 = "|   0|"
  L3 = "|----("
  L4 = " ////  "
  DrawFrame()
```

```
  L1 = "|----\"
  L2 = "|   @|"
  L3 = "|-----"
  L4 = " |||| "
  DrawFrame()

  L1 = "|----\"
  L2 = "|   *|"
  L3 = "|----("
  L4 = " \\\\ "
  DrawFrame()
EndFor

Sub DrawFrame
  xPos = xPos + 1
  GraphicsWindow.DrawText(xPos, yPos,      L1)
  GraphicsWindow.DrawText(xPos, yPos + 15, L2)
  GraphicsWindow.DrawText(xPos, yPos + 30, L3)
  GraphicsWindow.DrawText(xPos, yPos + 45, L4)
  Program.Delay(200)
 GraphicsWindow.Clear()
EndSub
```

13. Write a program that draws a pattern like the following image.

14. The following program creates randomly-colored stars in a text window. Run the program and explain how it works.

```
For row = 0 To 20
  For col = 0 To 20
    TextWindow.ForegroundColor = Math.GetRandomNumber(16)
    TextWindow.CursorLeft = col
    TextWindow.CursorTop  = row
    TextWindow.Write("*")
  EndFor
EndFor
TextWindow.WriteLine("")
```

15. Would you like to see all the possible background colors for the graphics window? Run this program and explain how it works.

```
For R = 0 to 255
  For G = 0 to 255
    For B = 0 to 255
      GraphicsWindow.Title = R + "," + G + "," + B
      GraphicsWindow.BackgroundColor = ↵
      GraphicsWindow.GetColorFromRGB(R,G,B)
      Program.Delay(10)
```
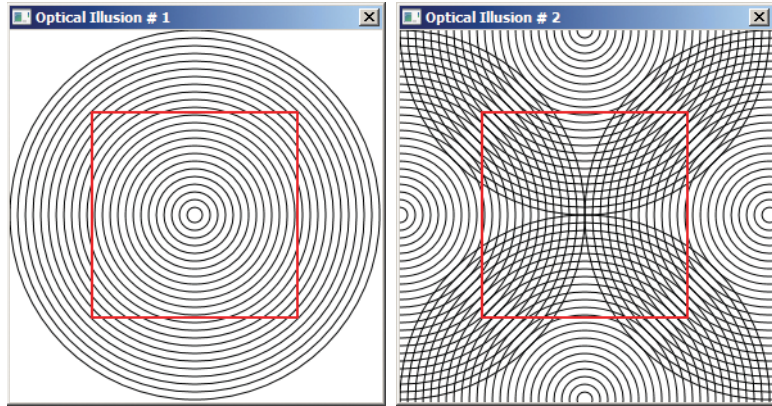
```
        EndFor
      EndFor
   EndFor
```

16. If you draw a square on a background pattern, the square might appear distorted, as shown in the following figures. Write two programs that generate these figures.

17. What is the output of the next program? Run it to check your answer.

```
GraphicsWindow.Width = 8 * 50
GraphicsWindow.Height = 8 * 50
GraphicsWindow.CanResize = 0

GraphicsWindow.BrushColor = "#FFFFFF"
For R = 1 To 8    ' Row counter
  For C = 1 To 8  ' Column counter
    GraphicsWindow.FillRectangle((C - 1) * 50, (R - 1) * 50, 50, 50)
    SwitchBrush()
  EndFor
  SwitchBrush()
EndFor

Sub SwitchBrush
  If (GraphicsWindow.BrushColor = "#FFFFFF") Then
    GraphicsWindow.BrushColor = "#000000"
  Else
    GraphicsWindow.BrushColor = "#FFFFFF"
  EndIf
EndSub
```

18. A farmer has $200 to buy 100 animals (cows, pigs, and chickens). A cow costs $20, a pig $6, and a chicken $1. How many of each animal can he buy? (Hint: use nested For loops to examine the possible combinations.)