

Objectives

Program Purpose

- Display each of the number series below:
 1. Multiples of 3,5 or 7
 2. Factors of a selected number
 3. Square numbers up to 100
- Display the series in a 2D grid using a choice of 3 fill characters
- Display a cycling 'Matrix Effect'

Learning Goals

- To practice the use of nested FOR loops
- Use the *Mod* (Modulus) operator
- Use the *CStr()* function
- Use the *Math.SQRT* function
- Use the *Int()* function
- Use *group boxes*
- Use the *button.PerformClick* method

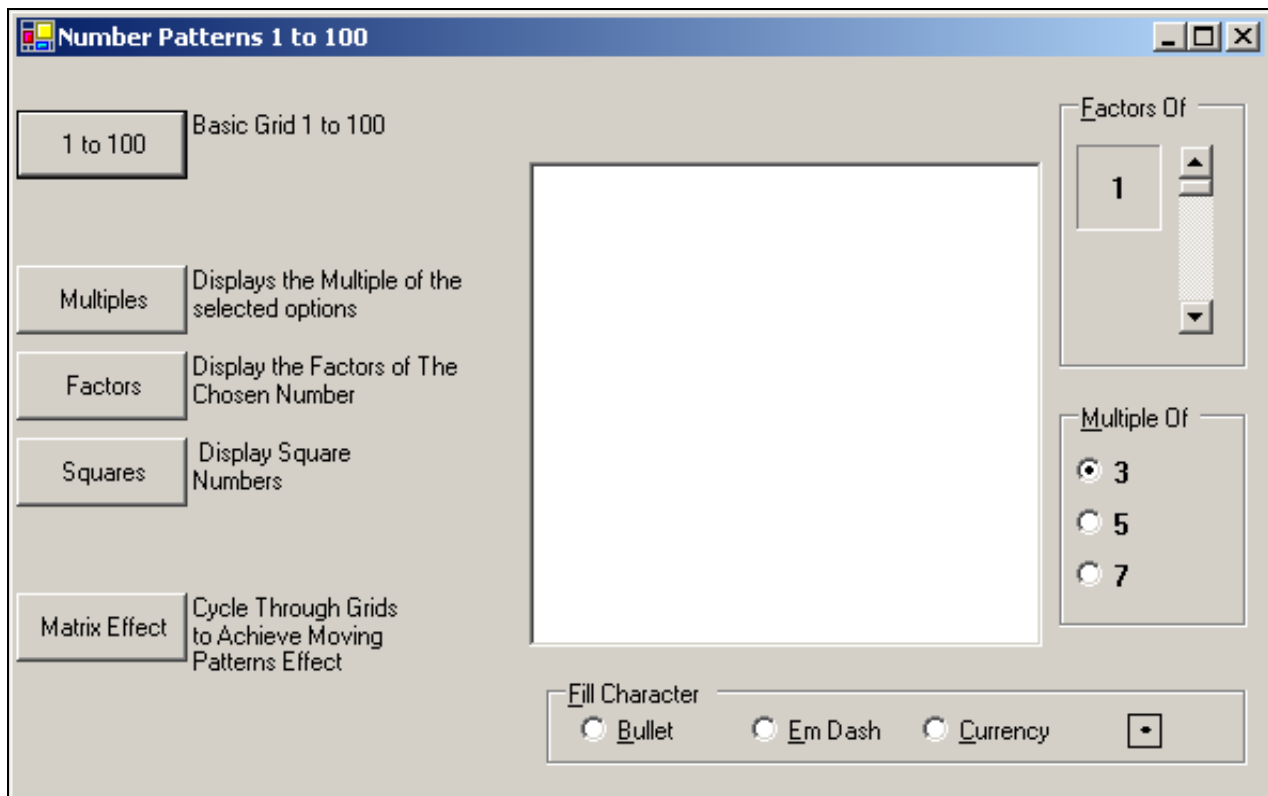
Design Notes

When creating groups of objects, first draw the groupbox (previously called a frame) then copy and paste the radio buttons and other controls **inside** the groupbox. Check the relevant controls are linked to the groupbox by moving it. The controls should move together.

Interface

Create the interface as shown below.

Use 5 buttons, 5 independent labels, 1 list box, 3 group boxes, 1 vertical scroll bar, 2 sets of 3 radio buttons and the additional labels inside the group boxes.



Objects and Properties

Type of Object	Number	Names of Object	Initial Properties of Objects
Form	1	Form1	Text - "Number Patterns - 1 to 100" Start Position - CenterScreen
List Box	1	lstNum	Font - Bold, 12
Labels	5	Label1, Label2, Label3, Label4, Label5	Font - Bold, 10 Text - As shown BorderStyle - None
Buttons	5	btnGrid1to100 btnMultiples btnFactors btnSquares btnMatrixEffect	Font - Bold, 10 Text - As shown
Group Box	1	Group Box1 contains VsbNum lblNum	Text - "Factors Of" Minimum - 1, Maximum - 100 BorderStyle - Fixed3D TextAlign-MiddleCenter
	2	Group Box2 contains rdbBullet rdbEmDash rdbX lblFillChar	Text - "Fill Character" Text - "Bullet" Text - "Em Dash" Text - "Currency" BorderStyle- FixedSingle TextAlign-MiddleCenter
	3	Group Box3 contains rdb3 rdb5 rdb7	Text - "Multiple Of" Text - "3" Text - "5" Text - "7"

Code

**** PUT THE FOLLOWING CODE IN THE GENERAL SECTION OF THE CODE WINDOW ****

```
Public Multiple As Integer
Public FillChar1 As Char
```

Private Sub Pause(ByVal t As Single)

```
Dim Start As Single
```

```
Start = Microsoft.VisualBasic.DateAndTime.Timer
```

```
While Start + t > Microsoft.VisualBasic.DateAndTime.Timer
```

```
System.Windows.Forms.Application.DoEvents() 'allows redrawing of the grid while the loop is being executed
End While
```

End Sub

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Function Factor(ByVal f As Integer, ByVal Num As Integer) As Boolean

```
If Num Mod f = 0 Then
    Return True
Else
    Return False
End If
```

End Function**Function Square(ByVal s As Integer) As Boolean**

```
If Int(Math.Sqrt(s)) = Math.Sqrt(s) Then      'it is a perfect square
    Return True
Else
    Return False
End If
```

End Function**** COPY THE FOLLOWING CODE TO THE APPROPRIATE EVENTS ******Private Sub btnGrid1to100_Click(ByVal ...) Handles btnGrid1to100.Click**

```
Dim i, j As Integer, Row As String

lstNum.Items.Clear()
lstNum.Font = New Font("Courier New", 8, FontStyle.Regular)

For i = 1 To 91 Step 10
    Row = ""

    For j = i To i + 9

        If j < 10 Then
            Row = Row & " " & j
        Else
            Row = Row & " " & j
        End If

    Next

    lstNum.Items.Add(Row)

Next
```

End Sub**Private Sub vsbNum_Scroll(ByVal ...) Handles vsbNum.Scroll**

```
lblNum.Text = vsbNum.Value
btnFactors.PerformClick()
```

End Sub**Private Sub Form1_Load(ByVal ...) Handles MyBase.Load**

'initialise labels, and multiple variable and fill character

```
lblNum.Text = vsbNum.Value
FillChar1 = Chr(149)          'Bullet
lblFillChar.Text = CStr(FillChar1)
Multiple = 3
```

End Sub

Private Sub btnMultiples_Click(ByVal ...) Handles btnMultiples.Click

```
Dim i, j As Integer, Row As String, NextChar As String

IstNum.Items.Clear()
IstNum.Font = New Font("Courier New", 8, FontStyle.Regular)

For i = 1 To 91 Step 10
    Row = ""
    For j = i To i + 9

        If j Mod Multiple = 0 Then          'Set in rdb3.click event
            If j < 10 Then
                NextChar = FillChar1 & CStr(j)
            Else
                NextChar = CStr(j)
            End If
        Else
            NextChar = FillChar1 & FillChar1
        End If

        Row = Row & NextChar

    Next
    IstNum.Items.Add(Row)
Next
```

End Sub**Private Sub rdb3_Click(ByVal ...) Handles rdb3.Click, rdb5.Click, rdb7.Click**

```
If rdb3.Checked Then
    Multiple = 3
ElseIf rdb5.Checked() Then
    Multiple = 5
Else
    Multiple = 7
End If

btnMultiples.PerformClick()
```

End Sub**Private Sub btnFactors_Click(ByVal ...) Handles btnFactors.Click**

```
'Check for factors of the number displayed in lbIstNum
Dim i, j As Integer, Row As String, NextChar As String

IstNum.Items.Clear()
IstNum.Font = New Font("Courier New", 8, FontStyle.Regular)

For i = 1 To 91 Step 10
    Row = ""
    For j = i To i + 9

        If Factor(j, Val(IstNum.Text)) Then      'Use User Defined Function
            If j < 10 Then
                NextChar = FillChar1 & CStr(j)
            Else
                NextChar = CStr(j)
            End If
        Else
            NextChar = FillChar1 & FillChar1
        End If

        Row = Row & NextChar

    Next
    IstNum.Items.Add(Row)
Next
```

End Sub

Private Sub rdbBullet_CheckedChanged(ByVal ...) Handles rdbBullet.CheckedChanged

```
FillChar1 = Chr(149)      'Bullet
lblFillChar.Text = FillChar1
```

End Sub**Private Sub rdbEmDash_CheckedChanged(ByVal ...) Handles rdbEmDash.CheckedChanged**

```
FillChar1 = Chr(151)      'Em Dash
lblFillChar.Text = FillChar1
```

End Sub**Private Sub rdbX_CheckedChanged(ByVal ...) Handles rdbX.CheckedChanged**

```
FillChar1 = Chr(164)      'Currency Sign
lblFillChar.Text = FillChar1
```

End Sub**Private Sub btnSquares_Click(ByVal ...) Handles btnSquares.Click**

```
'Check for factors of the number displayed in lblNum
Dim i, j As Integer, Row As String, NextChar As String

lstNum.Items.Clear()
lstNum.Font = New Font("Courier New", 8, FontStyle.Regular)

For i = 1 To 91 Step 10
    Row = ""

    For j = i To i + 9

        If Square(j) Then      'Use User Defined Function
            If j < 10 Then
                NextChar = FillChar1 & CStr(j)
            Else
                NextChar = CStr(j)
            End If
        Else
            NextChar = FillChar1 & FillChar1
        End If

        Row = Row & NextChar
    Next

    lstNum.Items.Add(Row)
Next
```

End Sub**Private Sub btnMatrixEffect_Click(ByVal ...) Handles btnMatrixEffect.Click**

```
Dim i As Integer
vsbNum.Maximum = 4000      'Must be greater than the maximum possible random number generated below
Randomize()

For i = 1 To 40
    Pause(0.1)
    vsbNum.Value = i * Int(Rnd() * 100 + 1)      'returns random number between 1 and 100
    lblNum.Text = vsbNum.Value
    btnFactors.PerformClick()
Next

vsbNum.Maximum = 100      'reset maximum value of scroll bar for other functions
```

End Sub

Suggestions for Consolidation and Extension

1. Increase the options for multiples. Either use more radio buttons or change to a scroll bar.
2. Modify the *FillChar* radio button click event so that the list is redrawn automatically rather than the user having to click on the specific buttons each time.
3. Modify the *matrix effect* so that more numbers appear. Can you make them appear to drop on the screen? Where would you start?

Questions

1. Look up '*Microsoft.VisualBasic.DateAndTime.Timer*' in the *help files*. What value does it return?
2. Look up '*Cstr()*' in the help files. What does it do exactly?
3. Explain what the '*btnMultiples.PerformClick()*' code does.
4. What is the main difference between the function *Square* and the Sub *Pause*?
5. What is the main similarity between the function *Square* and the Sub *Pause*?