COMP1022Q
Introduction to Computing with Excel VBA

Looping Part 3

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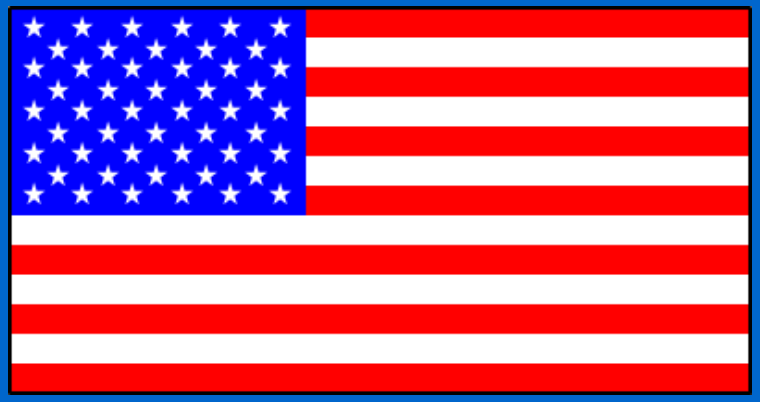
This Presentation

- In this presentation we will look at:
  1. Using for loops with a step value
  2. Using `Exit For` to stop a for loop
  3. Nested for loops
- At the end of this presentation we will show an example using nested for loops to draw the American flag



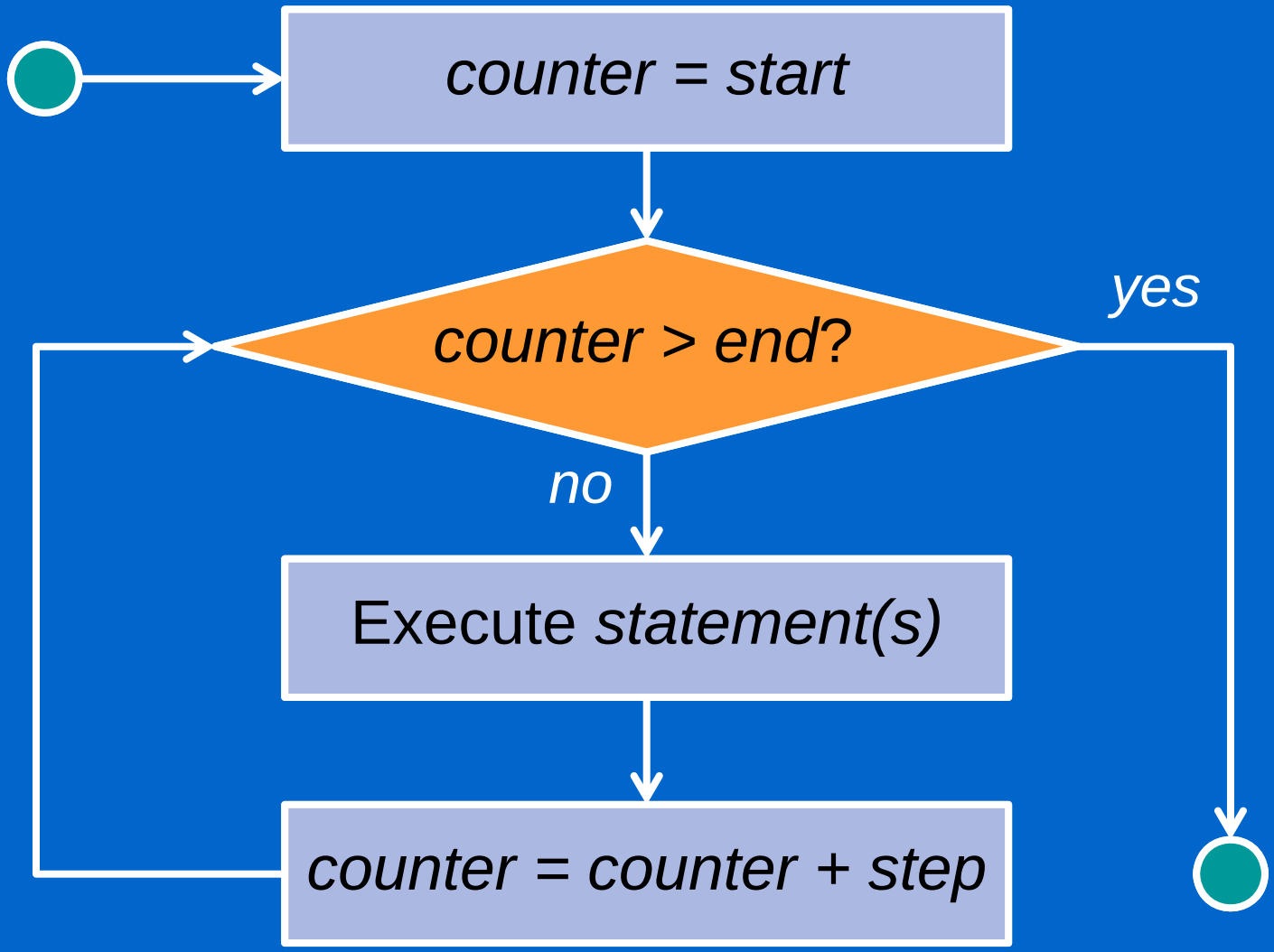
For…Next with Step

- We already know how to use a for loop
- Up to this point the for loop *counter* is always increased by one after the loop content is executed
- Now let's look at using a for loop with a step value

```
For counter = start To end Step step
    . . .statement(s). . .
Next counter
```

- By using a *step* value the *counter* can be increased or decreased by a fixed amount (the step) each time

The Flow of For…Next with Step



An Example of For…Next with Step (1/3)

```
Angle = 0
' Draw squares from small to large
For  Size = 5 To 200 Step 10
    ' Draw a unfilled square
    Set Square = ActiveSheet.Shapes.AddShape( _
        msoShapeRectangle, 195 - Size / 2, _
        200 - Size / 2, Size, Size)
    Square.Fill.Visible = msoFalse

    ' Rotate the square by an angle
    Square.Rotation = Angle

    ' Increase the angle by 10
    Angle = Angle + 10
Next Size
```

Loop counter

Loop body

Add a square with a gradually increasing size from 5 to 200 in increments of 10

Each time the loop is executed we rotate the angle of the newly created square

An Example of For…Next with Step (2/3)

	A	B	C	D	E	F
1	**Drawing a Pattern from Square Shapes Using a For Loop**					
2	*This example draws a pretty shape from a set of squares. These squares are drawn using a for loop. The VBA code is run when you open the worksheet.*					
3						
4						
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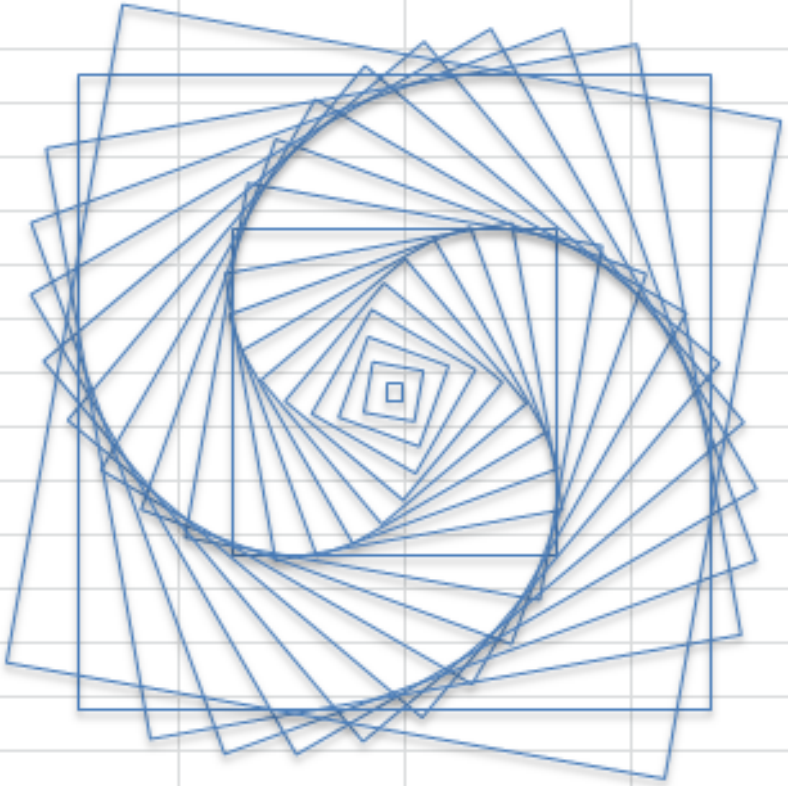
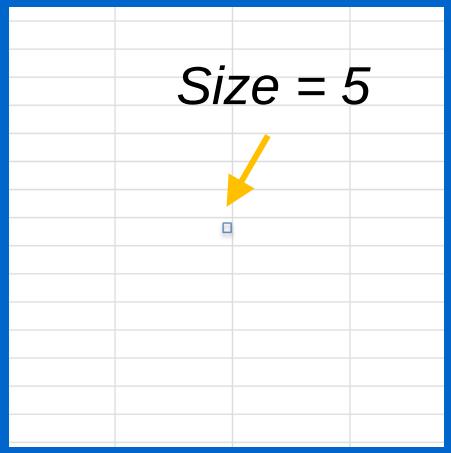
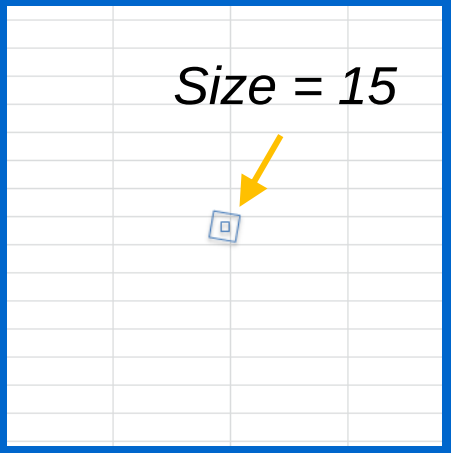
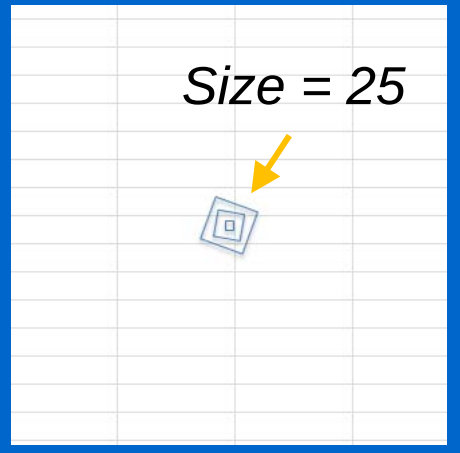


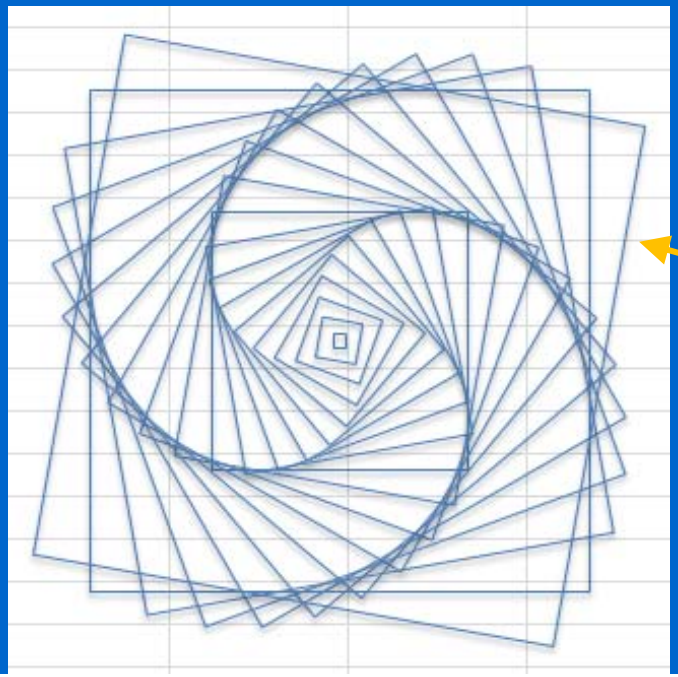
An Example of For…Next with Step (3/3)







Repeat loop
20 times
in total



Size = 195

Using Exit For to Stop a For Loop

- A for loop normally repeats the loop body when the counter is from *start* to *end*

```
For counter = start To end
    . . .loop body. . .
Next counter
```

- If you want to, you can use `Exit For` inside the loop body to immediately stop the loop

```
For counter = start To end
    ...
    Exit For
    ...
Next counter
```

Stop the loop immediately no matter what the value of the loop counter is

A Simple Example of Exit For

- Here is an example which puts a message in the first five rows of a worksheet:

```
For Row = 1 To 10
    Cells(Row, 1) = "Hello, row " & Row

    If Row >= 5 Then
        Exit For
    End If
Next Row
```

The loop normally runs 10 times

Finish the loop immediately when the current row is the fifth row

	A
1	Hello, row 1
2	Hello, row 2
3	Hello, row 3
4	Hello, row 4
5	Hello, row 5
6	

Another Example of Exit For 1/3

- In this example, a table shows your projected savings per year starting from the age of 21 to 70
- When you open the Excel file you are asked to enter the amount of money you need when you retire
- The VBA code then finds the age you can retire by accumulating the savings until the total is more than or equal to what you need

	A	B
4	**Age**	**Savings Per Year**
5	21	HK$ 20,000.00
6	22	HK$ 22,000.00
7	23	HK$ 23,100.00
8	24	HK$ 24,255.00
9	25	HK$ 25,467.75
10	26	HK$ 26,741.14
11	27	HK$ 28,078.19
12	28	HK$ 29,482.10
13	29	HK$ 30,956.21
14	30	HK$ 32,504.02
		⋮
52	68	HK$ 207,553.68
53	69	HK$ 217,931.36
54	70	HK$ 228,827.93

Another Example of Exit For 2/3

- Here is the code:

```
Target = InputBox("How much do you need to stop working?")

Total = 0
For Age = 21 To 70
    OneYear = Range("B5").Offset(Age - 21, 0).Value
    Total = Total + OneYear

    If Total >= Target Then
        Exit For
    End If
Next Age

If Total >= Target Then
    MsgBox "You can retire when you're " & Age & "!"
Else
    MsgBox "You cannot retire even at 70!"
End If
```

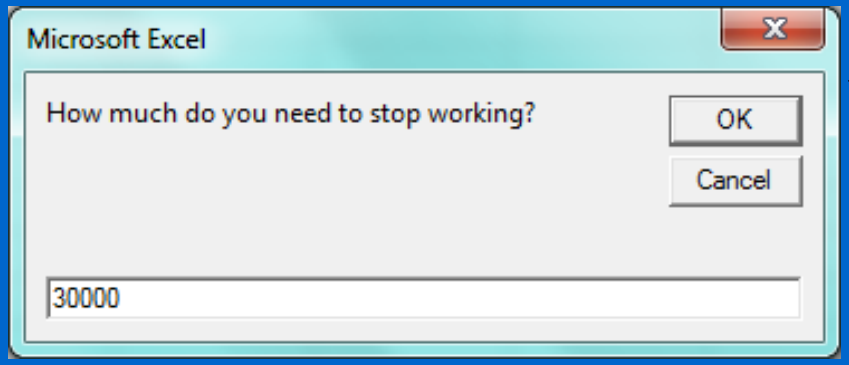
The loop accumulates the savings from the age of 21 to 70

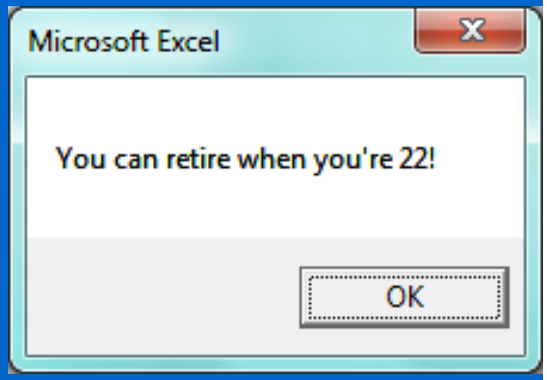
When the total is bigger than or equal to the target there is no need to accumulate the savings so the loop is stopped

Another Example of Exit For 3/3

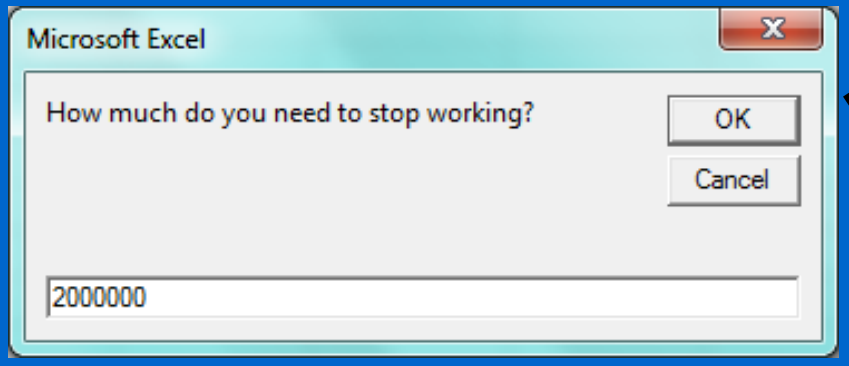
- Let's try the example:

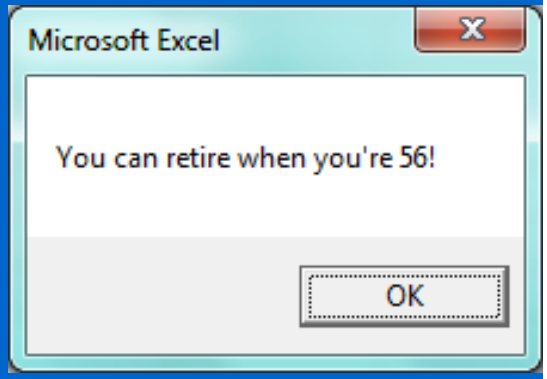
If you need HK$30,000:



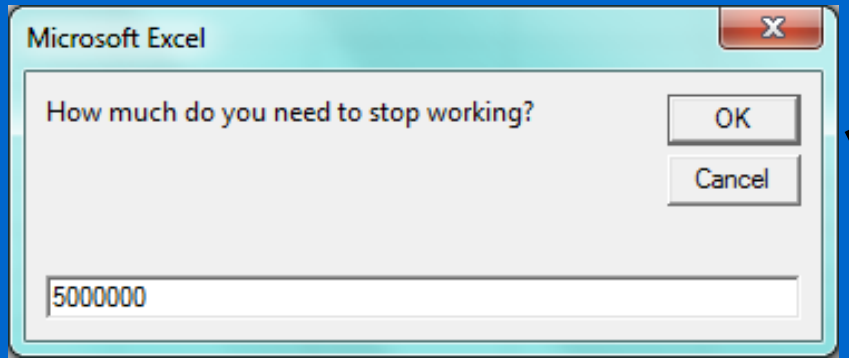


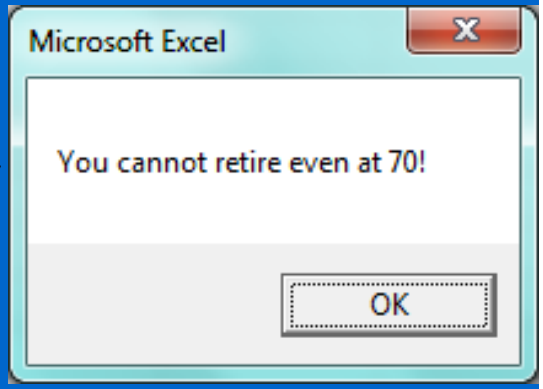
If you need HK$2,000,000:





If you need HK$5,000,000:





Stopping Other Types of Loops

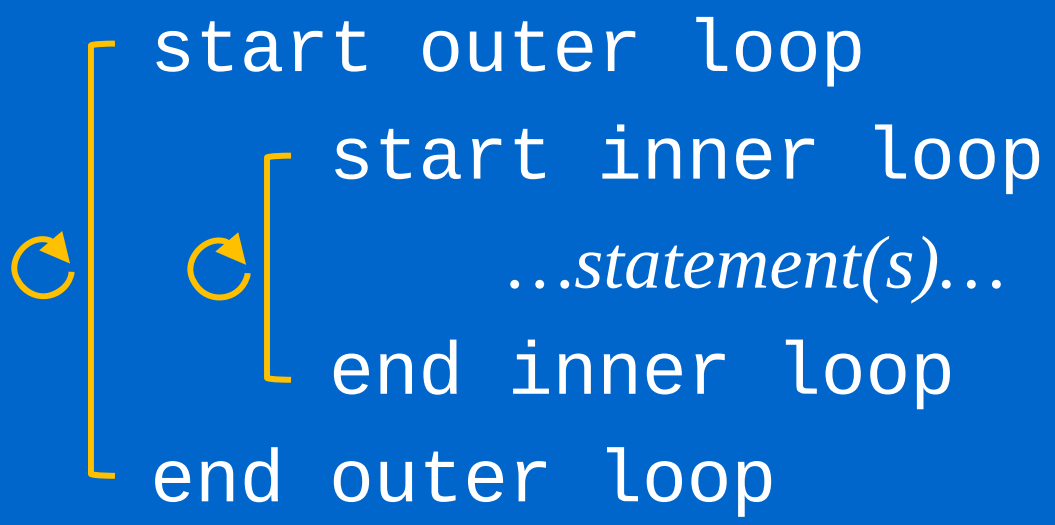
- Using `Exit For` can stop a for loop
- How about stopping other types of loops that we have discussed previously?
- To stop do loops, i.e. `Do While…Loop`, `Do Until…Loop` and so on, you can use `Exit Do`, like this:

```
Do While ...condition...
    ...
    Exit Do
    ...
Loop
```

- However, for while loops, i.e. `While…Wend`, you cannot stop them prematurely

Nested Loops

- A *nested loop* is a loop within a loop

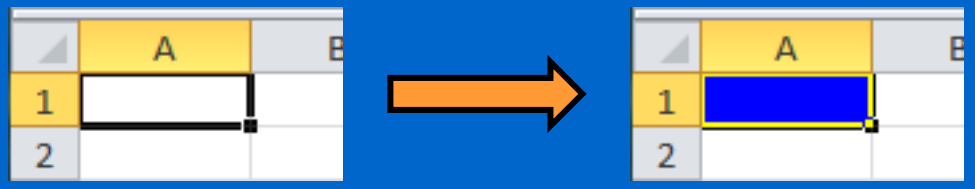


- In the following examples, we will use nested loops to change background colours, generate a chess board and draw the American flag

Cell Preset Colours

- There are 56 preset cell colours in Excel
- You can set the cell colour using a value called *ColorIndex*
- *ColorIndex* has a range of 1 to 56
- For example, you can change the fill colour of a cell using the *Interior* value:

```
' Change the background of A1 to blue
Range("A1").Interior.ColorIndex = 5
```



Blue has a ColorIndex of 5

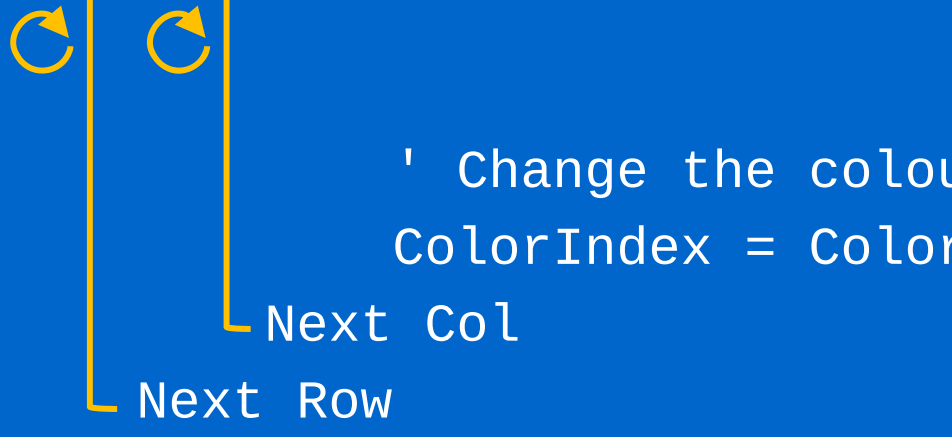
An Example of Nested Loops (1/2)

- This example displays the 56 preset colours in 7 rows using a nested loop

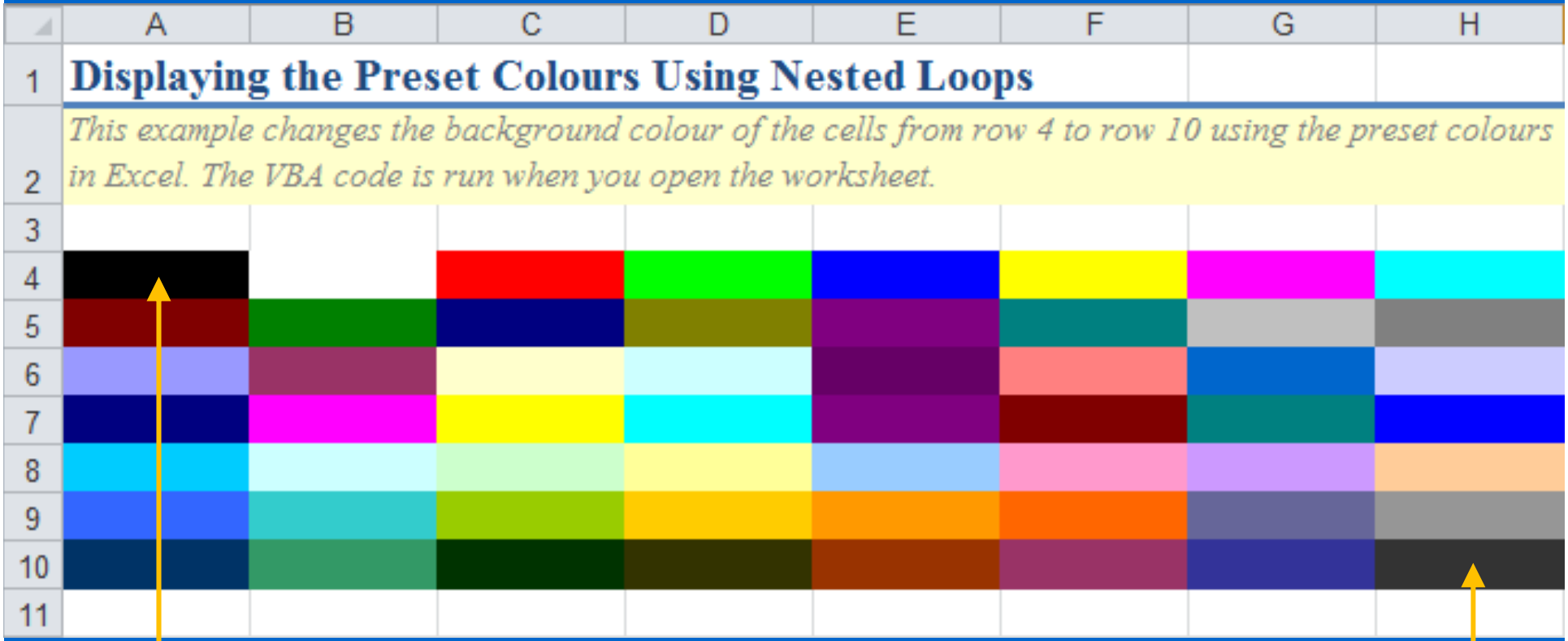
```
ColorIndex = 1
For Row = 4 To 10
    For Col = 1 To 8
        ' Set the interior colour
        Cells(Row, Col).Interior.ColorIndex = _
                                        ColorIndex

        ' Change the colour for the next cell
        ColorIndex = ColorIndex + 1
    Next Col
Next Row
```

7 rows by 8 columns = 56 cells



An Example of Nested Loops (2/2)



ColorIndex = 1 (black)

ColorIndex = 56 (darkgray)

Generating a Chess Board (1/2)

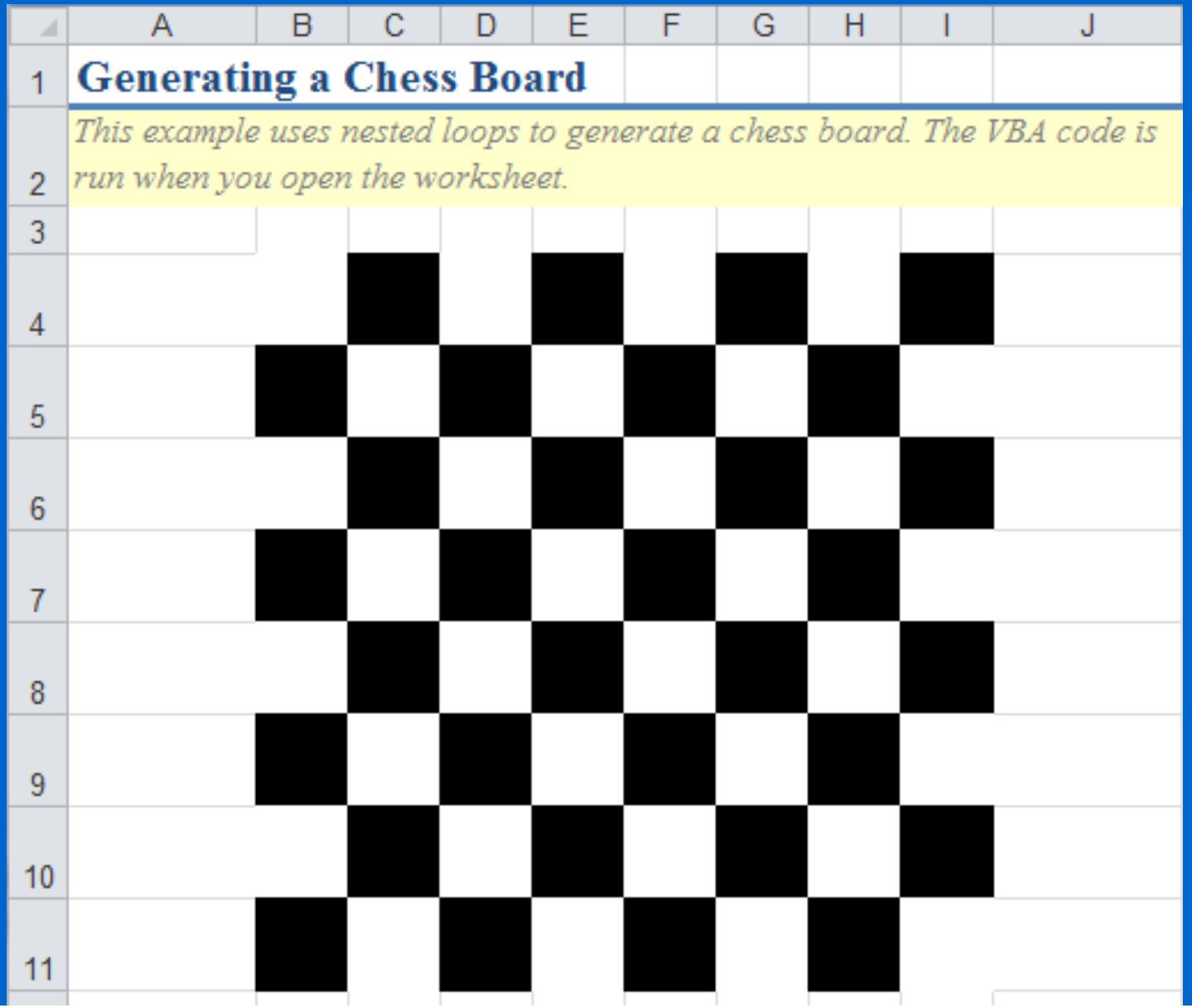
- This example generates a chess board using a nested loop

```
' This example generates a 8x8 chess board
For Row = 4 To 11
    For Col = 2 To 9
        If Row Mod 2 = Col Mod 2 Then
            Cells(Row, Col).Interior.ColorIndex = 2
        Else
            Cells(Row, Col).Interior.ColorIndex = 1
        End If
    Next Col
Next Row
```

8 rows by 8 columns, starting at cell B4

- As you know, the *Mod* operator calculates the remainder of a number divided by a divisor
- *Mod 2* is often used to distinguish between odd/even numbers

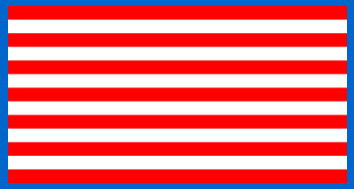
Generating a Chess Board (2/2)



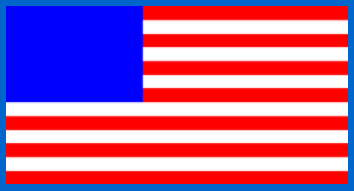
Drawing the American Flag (1/2)

- This example draws the American flag in five steps:

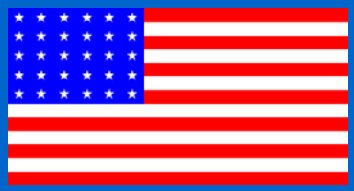
1. Use a loop to draw the red and white strips



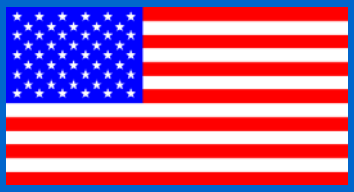
2. Draw the blue background



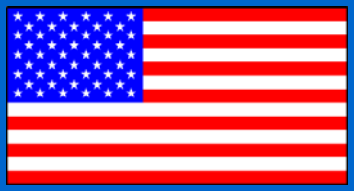
3. Use a nested loop to draw 5 rows of white stars with each row having 6 stars



4. Use a nested loop to draw 4 rows of white stars with each row having 5 stars



5. Finally, draw a border around the flag



Drawing the American Flag (2/2)

	A	B	C	D	E	F
1	**Drawing the American Flag**					
2	*This example draws the American flag when you open the worksheet. The code uses simple loops and nested loops to draw the shapes in the flag.*					
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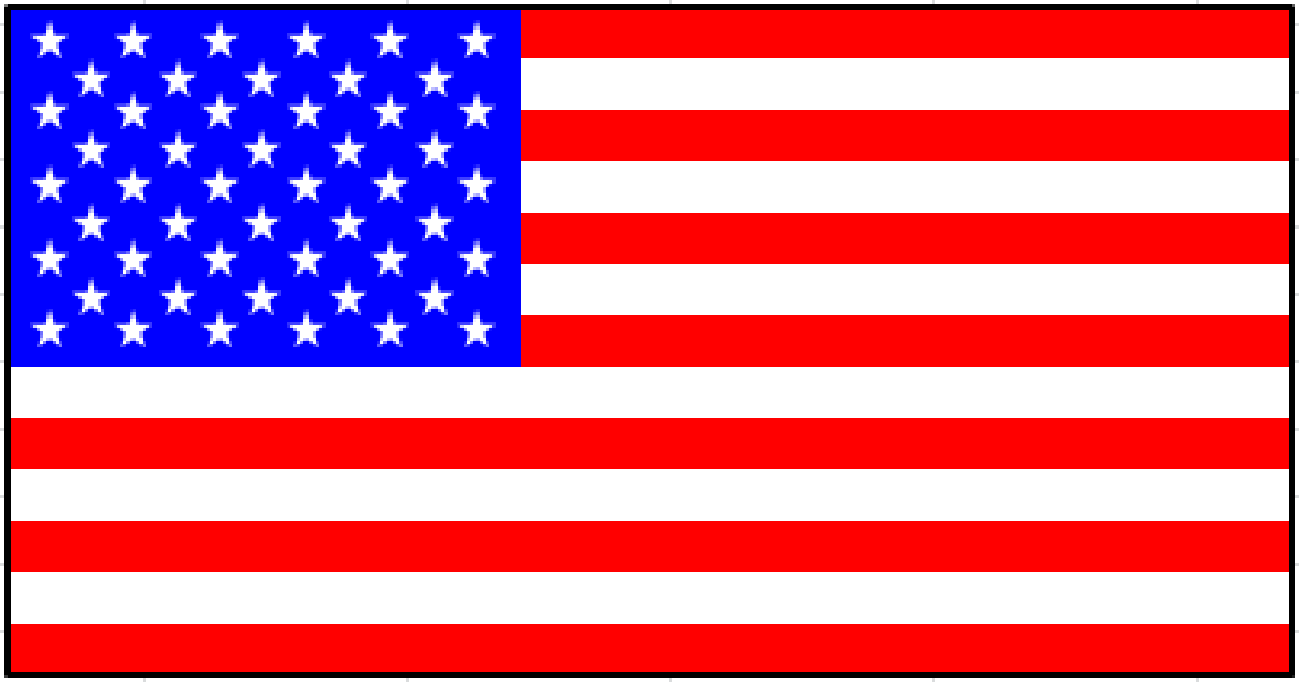
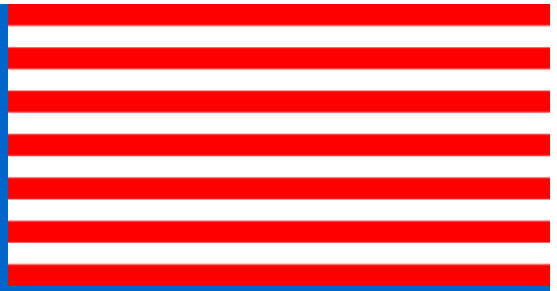
15						



Drawing the Strips (1/2)

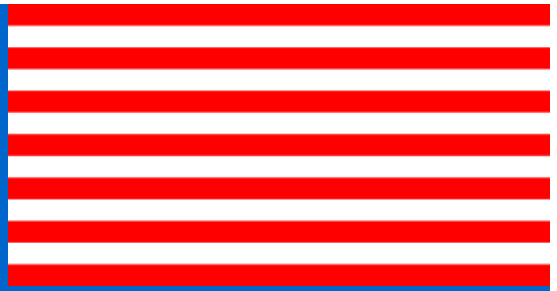


- Let's draw the flag one step at a time
- First we will draw the strips at the back
- There are a total of thirteen red and white strips
- We can use a for loop, which runs thirteen times, to draw thirteen strips, like this:

Loop counter = 1 *Loop counter = 2* *Loop counter = 3* ... *Loop counter = 13*

- When the loop counter is odd we fill the strip with white, otherwise, we fill the strip with red

Drawing the Strips (2/2)



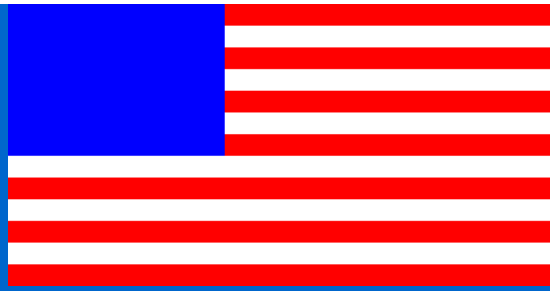
```
' Step 1 - draw the red and white strips
StripY = FlagY
For StripNo = 1 To 13
    ' Draw a rectangle for the strip
    Set Strip = ActiveSheet.Shapes.AddShape( _
        msoShapeRectangle, FlagX, StripY, _
        FlagWidth, FlagHeight / 13)

    ' Set the alternate colour of the strip
    Strip.Line.Visible = msoFalse
    If StripNo Mod 2 = 0 Then
        Strip.Fill.ForeColor.RGB = vbWhite
    Else
        Strip.Fill.ForeColor.RGB = vbRed
    End If
    StripY = StripY + FlagHeight / 13
Next StripNo
```

The loop runs thirteen times

Draw one strip

Set the fill colour of the shape based on the strip count

Drawing the Blue Background



- Drawing the blue area does not require the use of loops because it is a simple blue rectangle:

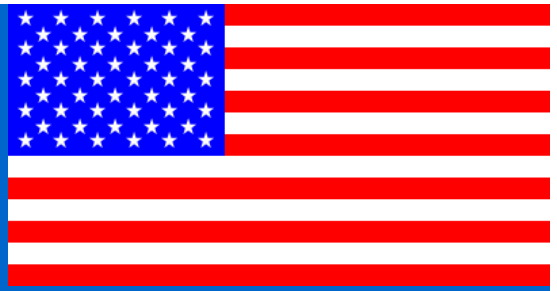
```
' Step 2 - draw the blue area
Dim Union As Shape

' Draw the blue rectangle
Set Union = ActiveSheet.Shapes.AddShape( _
    msoShapeRectangle, FlagX, FlagY, _
    UnionWidth, UnionHeight)
```

Draw a rectangle for the blue area

```
Union.Line.Visible = msoFalse
Union.Fill.ForeColor.RGB = vbBlue
```

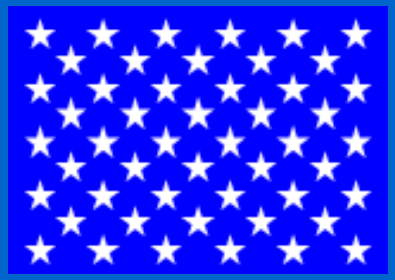
The area is filled with blue without any border

Drawing the Stars (1/3)

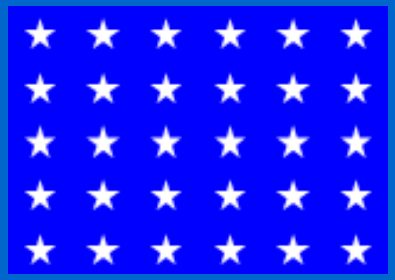


- Then we will draw 50 stars on top of the blue area
- Looking at the arrangement of the stars you can separate them into two groups, like this:

50 stars

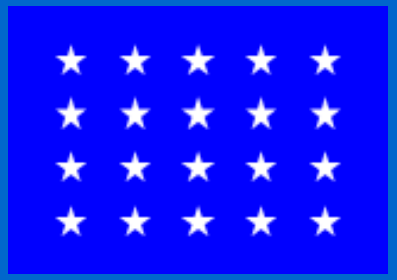


5 rows of 6 stars



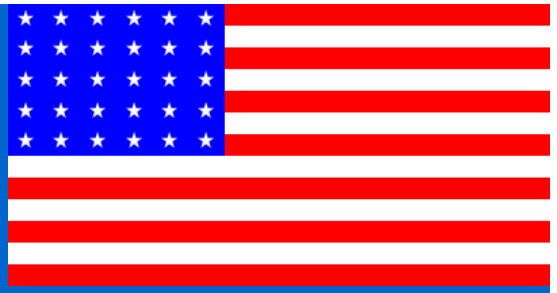
+

4 rows of 5 stars



- Each of the groups can be drawn using a nested loop
- The outer loop handles the rows whereas the inner loop handles the columns

Drawing the Stars (2/3)

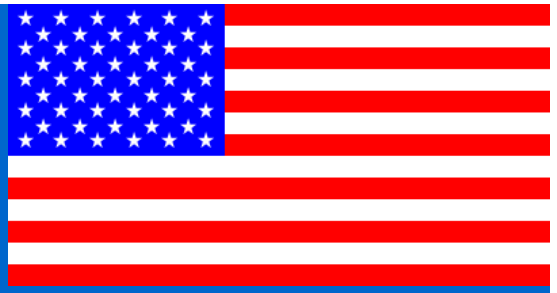


```
' Step 3 - draw the 5 rows of 6 stars
StarY = FlagY + 3
For Row = 1 To 5
    StarX = FlagX + 5
    For Col = 1 To 6
        ' Draw the white star
        Set Star = ActiveSheet.Shapes.AddShape( _
            msoShape5pointStar, StarX, StarY, _
            StarSize, StarSize)
        Star.Line.Visible = msoFalse
        Star.Fill.ForeColor.RGB = vbWhite

        StarX = StarX + StarSpacingX
    Next Col
    StarY = StarY + StarSpacingY
Next Row
```

Draw 5 rows of 6 stars

Draw a solid white star

Drawing the Stars (3/3)



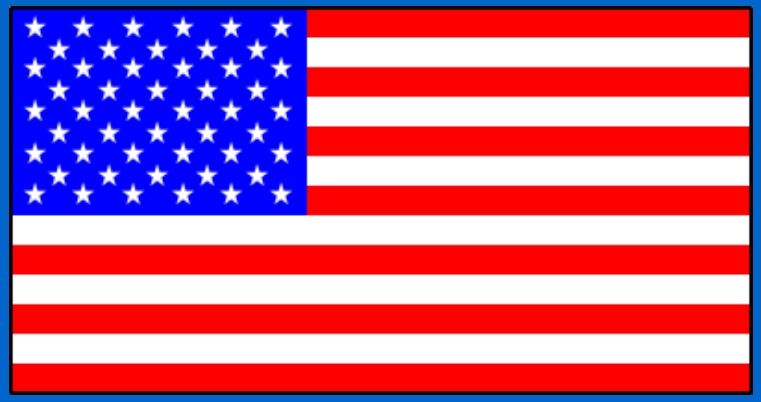
```
' Step 4 - draw the 4 rows of 5 stars
StarY = FlagY + 12
For Row = 1 To 4
    StarX = FlagX + 15
    For Col = 1 To 5
        ' Draw the white star
        Set Star = ActiveSheet.Shapes.AddShape( _
            msoShape5pointStar, StarX, StarY, _
            StarSize, StarSize)
        Star.Line.Visible = msoFalse
        Star.Fill.ForeColor.RGB = vbWhite

        StarX = StarX + StarSpacingX
    Next Col
    StarY = StarY + StarSpacingY
Next Row
```

Draw 4 rows of 5 stars

Drawing the Border

- Finally, we draw the flag border using an unfilled rectangle:

```
' Step 5 - draw the flag border
Dim Flag As Shape

' Draw the border of black colour
Set Flag = ActiveSheet.Shapes.AddShape( _
    msoShapeRectangle, FlagX, FlagY, _
    FlagWidth, FlagHeight)
Flag.Fill.Visible = msoFalse
Flag.Line.ForeColor.RGB = _
    vbBlack
Flag.Line.Weight = 1.5
```



Specify a black border with a thickness of 1.5 for the shape