Generating Random Numbers in Visual Basic:

Random number generators are used for all types of applications, including testing, simulation, and games.

*Pseudo*-random numbers can be generated in Visual Basic through the use of the `Rnd()` function:

```vbnet
Module Module1
    Sub Main()
        ' Generate ten random values:
        Console.WriteLine("Ten Random values: ")
        Console.WriteLine()
        For i = 1 To 10
            Dim rValue = Rnd()
            Console.WriteLine("     ", rValue)
        Next
        Console.WriteLine()
        Console.Write("Hit enter to exit the program...")
        Dim dummyValue = Console.ReadLine()
    End Sub
End Module
```

Sample run:

Ten Random values:

0.7055475  
0.533424  
0.5795186  
0.2895625  
0.301948  
0.7747401  
0.01401764  
0.7607236  
0.81449  
0.7090379

Hit enter to exit the program...

Notes:

- The `Rnd()` function returns pseudo-random values between 0 – 1, exclusive
  - These Random values are *uniformly distributed* across the range from 0 – 1, i.e. the number of values less than ½ will equal the number of values that are equal to ½, but less than 1, *over the long run*.

- If the program is run a second time, the output/random values generated are the same – *Try it*
  - Why? The equation used does not change...
  - To change the runs so that each value is different, use the `Randomize()` function...

```vbnet
Module Module1
    Sub Main()
        ' Generate ten random values:
        Randomize() ' Generate a different sequence of numbers each time the program is run
        Console.WriteLine("Ten Random values: ")
        Console.WriteLine()
        For i = 1 To 10
            Dim rValue = Rnd()
            Console.WriteLine("     ", rValue)
        Next
        Console.WriteLine()
        Console.Write("Hit enter to exit the program...")
        Dim dummyValue = Console.ReadLine()
    End Sub
End Module
```

Sample run:

Ten Random values:

0.847851  
0.3252636  
0.5477498  
0.3536189  
0.2035288  
0.7887477  
0.8157449  
0.8242917  
0.2175357  
0.7186509

Hit enter to exit the program...
A simple program to simulate tossing a coin 100 times that outputs the number of heads and tails tossed:

```vba
Module Module1
    Sub Main()
        ' Coin tossing
        Randomize() ' Generate a different sequence of numbers each time the program is run
        Console.WriteLine("Simulate tossing a coin 100 times: ")
        Console.WriteLine()
        Dim heads As Integer = 0
        Dim tails As Integer = 0
        For i = 1 To 100
            Dim rValue = Rnd()
            If (rValue < 0.5) Then ' 0 - 0.5, exclusive => heads
                heads = heads + 1
            Else
                tails = tails + 1
            End If
        Next
        Console.WriteLine("Number of heads: ", heads)
        Console.WriteLine("Number of tails: ", tails)
        Console.WriteLine()
        Console.Write("Hit enter to exit the program...")
        Dim dummyValue = Console.ReadLine()
    End Sub
End Module
```

Sample runs:

Simulate tossing a coin 100 times:

Number of heads: 56
Number of tails: 44

Hit enter to exit the program...

Simulate tossing a coin 100 times:

Number of heads: 45
Number of tails: 55

Hit enter to exit the program...

Simulate tossing a coin 100 times:

Number of heads: 53
Number of tails: 47

Hit enter to exit the program...

Finally to generate random values over a given range use:

```
rndValue = CInt(Math.Floor((upperbound - lowerbound + 1) * Rnd())) + lowerbound
```

More on this next week...