

(PartII) Lab-session 1¹

1) Verify the following identity:

$$\sum_{a=1}^n (2a-1)^3 = n^2(2n^2-1) \quad (1)$$

- a) Write three different versions of a function depending on n , which reproduces the left hand side of equation (1). Use for this the DO ... LOOP structure with the WHILE, UNTIL and EXIT DO commands.
- b) Write a function depending on n , which reproduces the right hand side of this equation.
- c) Use the Excel spreadsheet to verify that all four functions give the same result.

2) Approximate the following identity:

$$\sum_{n=1}^{\infty} (-1)^{(n+1)} \frac{x^n}{n} = \ln(1+x) \quad \text{for } -1 < x \leq 1 \quad (2)$$

- a) Terminate the sum in (2) at some large value, say a , i.e. $\sum_{n=1}^{\infty} \rightarrow \sum_{n=1}^a$ and use the DO ... LOOP structure to write a function depending on a and x which approximates the left hand side of (2). The function should give out an error message, such as "*The series does not converge for this value of x*" when x is not in the range $-1 < x \leq 1$.
 - b) Use the Excel spreadsheet to compute $\ln(1+x)$ and verify the approximation.
- 3) Write a function depending on p , which involves a nested DO...LOOP structure and verify the identity

$$\sum_{k=1}^p \sum_{l=1}^k \sum_{m=1}^l m^2 = \frac{1}{120} p(1+p)(2+p)(3+p)(3+2p) \quad (3)$$

in a similar way as in task 1.

4) DO...LOOP structures can also be used efficiently to fill in data into an Excel spreadsheet. To see this enter the subroutine "Fill" into the VBA editor. The subroutine (Macro) can be activated as follows:

1. Open the Excel spreadsheet
2. Select *Tools*
3. Select *Macro*, then *Macros*
4. Select *Run*

⇒ This will fill in 10 columns and rows with entries $\text{rownumber} * \text{columnnumber}$.

More on Macros and subroutines in the next lecture.

¹The lecture material is still available at:
<http://www.staff.city.ac.uk/~fring/ExcelVBA/index.html>.

```
Sub Fill()  
  Range("A1").Select  
  m = 0  
  Do While m < 10  
    n = 0  
    Do While n < 10  
      ActiveCell.Offset(m, n).Value = (n + 1) * (m + 1)  
      n = n + 1  
    Loop  
    m = m + 1  
  Loop  
End Sub
```