CITY UNIVERSITY
London

BSc Honours Degree in Mathematical Science
Mathematical Science with Statistics
Mathematical Science with Finance and Economics
Mathematics and Finance
Actuarial Science

TEST B

Programming/Information Technology

2011

Time allowed: 90 min

*Full marks may be obtained for correct answers to
ALL FOUR questions. Each question is worth 25 marks.*

Test B: INSTRUCTIONS

This is an open book test. You may use your lecture notes as well as task-and solution-sheets from lab-sessions.

Please note that all material must be brought to the test in printed form. No internet access, the use of books or USB keys are allowed during the test.

Write down your answers in the booklet provided. Please note that the marker will have no access to any work you do in the computer. The only answers that will be graded are those you write down on the answer booklet provided.

To avoid possible accusations of cheating close all applications except Microsoft Excel and the Visual Basic Applications editor before starting this exam.

Students may use the Excel or VBA help functions but should <u>not</u> use any online help option.

1. Consider the following identity:

$$\sum_{k=1}^{n}(-1)^k(k^2 - 1) = \frac{-1 + (-1)^n\left(-1 + n + n^2\right)}{2}. \tag{1}$$

(a) Write, for a given value of n, a VBA code for a user defined function to evaluate the left hand side of equation (1). The code should use a **DO...WHILE** loop structure. **[10]**

(b) Modify your code now to write a subroutine such that when run it first opens an **InputBox** with prompt "enter here the value of n" and title "the sum". Once the value of n is entered, the programme should compute the sum as in part (a) and finally return its value in cell $B1$ of the Excel Worksheet. **[10]**

(c) Write down a user defined function which computes the right hand side of Eq. (1). Define the variable types of the input and output of the function. **[5]**

2. Consider the following set of data:

x-values:	1	2	3	4	5	6	7	8
y-values:	5	11	16	21	26	30	34	41

(a) Assuming that the points above are best fitted by a quadratic polynomial of the form $y = ax^2 + bx + c$, determine the coefficients a, b, c and the value of the regression coefficient squared, r^2. Do this by adding a trendline into a scatter plot. **[10]**

(b) When carrying out part (a), that is plotting your points on a scatter plot and adding a trendline of the form $y = ax^2 + bx + c$, switch on the Macro Recorder so that a code reproducing all your actions is created. In your answer booklet write down the recorded code. **[10]**

(c) Assuming now that the points are best fitted by a line of the form $y = \alpha x + \beta$ use the Excel Built-in functions **SLOPE** and **INTERCEPT** to find the values of α and β. **[5]**

3. Write the code for a subroutine called **sums** which does the following:

   (i) It reads the entries of a matrix A from cells B1:D3 of the Excel Worksheet.

   (ii) It computes the sum of all matrix elements in rows 1, 2 and 3 of A. It carries out these three separate sums by means of a **FOR...NEXT** loop.

   (iii) If all of the three sums are equal to 1, it opens a **MsgBox** with an **OKonly** button, prompt "A is an stochastic matrix" and title "matrix".

   (iv) If at least one of the sums does not equal 1, then it opens another **MsgBox** with an **OKonly** button, prompt "A is not an stochastic matrix" and title "matrix".

   When writing the code make sure to define the variable types of the input and output of your function. **[25]**

4. Write a VBA code for a subroutine that is activated by clicking on a **ToggleButton**. The **ToggleButton** should be called **Tog** and, as we saw in lectures, it takes two possible values: **True** or "clicked on" and **False** or "not clicked on". The subroutine starts with the command line:
   Private Sub Tog_Click()
   and ends as usual with

   End Sub

   The Customized User Form containing the **ToggleButton** should also contain a **TextBox** called **TBox**. Write down a VBA code that does the following:

   (i) If the **ToggleButton** is **True** then a **MsgBox** with an **Okonly** button and a **Warning Query Icon** should open. The **MsgBox** should have title "ToggleButton" and prompt "Toggle is clicked".

   (ii) If the **ToggleButton** is **False** then the message "Toggle is False" should be written inside the **TextBox**.

   [25]

Internal Examiner: Dr O.A. Castro-Alvaredo