School of Engineering and Mathematical Sciences

Centre for Mathematics

BSc Degrees in Mathematical Science
Mathematical Science with Statistics
Mathematical Science with Computer Science
Mathematical Science with Finance and Economics
Mathematics and Finance

MA1603 Programming/AS1054 Information Technology

Part II progress test

Type here the date of the exam

Group A

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

Write your answers in the booklet provided.

Full marks may be obtained for correct answers to all four questions. Each questions carries 25 marks.

To avoid possible accusations of cheating close all other applications except Excel before starting this exam.

Number of answer books to be provided: One per students
Whether or not calculators etc are permitted: Yes
Any stats tables etc.: No
Whether or not the exam paper can be removed from the exam room: Yes

Time: You have 90 mins to complete this test.

Internal Examiner: Dr. O.A. Castro Alvaredo

EXAM A

1) (25 points) Consider the following sum:

$$\sum_{k=1}^{n} g(k),$$

where $g(k)$ is an arbitrary functions of the integer k.

i) [10 points] Write the VBA code for a subroutine called **sumg** that evaluates the sum above by employing a **DO ... LOOP** structure with **WHILE**. The code should read the value for n from the cell A1 of the Excel Worksheet and display the value of the sum into the cell B1 of the Excel Worksheet.

ii) [5 points] Write now the VBA code for a user defined function that defines the function $g(k) = k^3 + 2k + 1$. Hence evaluate the sum above for $n = 3$ and $n = 9$ by running the subroutine you wrote in the previous section.

iii) [10 points] Write the code of a user defined function of n called **expo** that employs a **FOR ... NEXT** structure to compute the sum above for $g(k) = 3^k$.

2) (25 points) Consider the following set of data

x-values:	1	2	3	4	5	6	7	8	9	10
y-values:	0.3	0.35	0.39	0.43	0.51	0.58	0.62	0.66	0.7	0.72

i) [8 points] Assuming that the points are linearly correlated, meaning that ideally they all lie on the line $y = \alpha x + \beta$, use the Excel built-in functions **SLOPE** and **INTERCEPT** to determine α and β.

ii) [8 points] Use the Excel built-in functions Linest to determine the square of the regression coefficient.

iii) [9 points] Assume now an exponential correlation of the form $y = ae^{bx}$ and by adding a trendline into an XY-chart determine the coefficients a, b and the value of the regression coefficient squared, r^2.

Turn over...

3) (25 points) Write the code for a subroutine called **avproduct** which given a 2 by 2 matrix A and a column vector v computes the product $A \cdot v$:

- The program should read the matrix A from cells A1:B2 of the Excel worksheet and the vector v from cells $A3 : A4$.
- The program should use a **DO ... LOOP** with **UNTIL** structure for the computation of the product.
- When the program is run, it should write "the product vector is:" in cell $D1$ and the entries of the vector resulting from the product $A \cdot v$ into cells $E1 : F1$

Hint: Recall that the product of a matrix A and a vector v gives another vector, that is, if:

$$A = \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} \quad \text{and} \quad v = \begin{pmatrix} v_1 \\ v_2 \end{pmatrix}$$

then the product is the vector

$$A \cdot v = \begin{pmatrix} a_{11}v_1 + a_{12}v_2 \\ a_{21}v_1 + a_{22}v_2 \end{pmatrix}.$$

4) (25 points) Write a VBA code for a subroutine named **signcheck** that checks the sign of the product of two given numbers. The code should have the following structure:

- When run the program should start by opening an InputBox with prompt "Enter here a real number:" and title "First number". Once a number has been entered on this InputBox another InputBox should open with prompt "Enter here another real number:" and title "Second number".
- After the two InputBoxes an **IF** structure should start which would do the following:
  - If the product of the numbers entered before is negative a MsgBox should appear with prompt "the product is negative", title "sign-check" and a single OK button. The value of the product should then be displayed in cell $A1$ of the Excel Worksheet.
  - If the product of the numbers is zero a MsgBox should appear with prompt "the product vanishes", title "sign-check", a single OK button and an **Info Message Icon**. The value of the product should then be displayed in cell $A1$ of the Excel Worksheet.
  - If the product of the numbers is positive a MsgBox should appear with prompt "the product is positive", title "sign-check", a single OK button and a **Critical Message Icon**. The value of the product should then be displayed in cell $A1$ of the Excel Worksheet.
  - Finally, if any of the values entered is not a number, the program should open a MsgBox with prompt "this is not a number", title "sign-check", a single OK button and a **Warning Message Icon**. In this case, a **GOTO** structure, should make the program start again from the beginning.
- Assign variables to all prompts and titles so that, for example, you only have to type "sign-check" once.