City University
School of Engineering and Mathematical Sciences
Common Part 1

ME1107 Computing

Coursework 3C – Fortran

Q1: In-class exercise questions in week commencing 19/1/09.
Q3: In-class exercise questions in week commencing 26/1/09.
Q6: In-class marking questions in week commencing 2/2/09.
Q2, Q4, Q5:

- Softcopy submission to CitySpace: FORTRAN source files (.f95) and data files (.dat) by 2/2/09.
- Class marking: You should demonstrate your programs to class tutors during your tutorial class in week commencing 2/2/09.
- Marking is based on class marking

Q1 (5 marks) In-class exercise questions on '*formatted input and output'* and *'disk I/O'* in week commencing 19/01/2009. No late submission will be accepted for this question.

Q2 (35 marks) Write a program (CW3C_Q2_your_name.f95) to calculate the equivalent resistance of *n* resistors in parallel. The resistances of *n* resistors are $R_1, R_2, \ldots R_n$. The effective resistance, R_e , of the *n* resistors in parallel is given by:

$$\frac{1}{R_e} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots\ldots\ldots + \frac{1}{R_n}$$

- Write your name and group in comment lines at the beginning of the program
- Program has a name (CW3CQ2)
- IMPLICIT NONE should be used
- The number of resistors, *n*, should be entered at run-time of the program via keyboard; if n is less than 1, the program should ask the user to re-enter a correct number for *n*.
- A Do_loop should be used to input the resistances of the *n* resistors into the program
- 8 digits are used to display the number of resistors, *n*, on the PC monitor screen
- The equivalent resistance of the *n* resistors in parallel is displayed on the PC monitor screen with 2 decimal places
- The resistances of *n* resistors are saved (2 decimal places) in a data file (CW3C_Q2_your_name.dat)
- Display your name and group in the output window (the black DOS window)

How to test the program?

Use the numbers corresponding to the letters of your surname as the values of resistance to test the program.

Open CW3C_Q2_your_name.dat with NotePad. Numbers in the file should be corresponding to the letters of your surname.

How to start?

Use the last question (Q5) in the January class test to help you design the program. Flowchart of the program is given in the test paper. Debug the program after finishing each step.

Step 1: Type in and debug the last question (Q5) of the January class test

Step 2: add your name and group in comment lines and display your name and group in the output window (the black DOS window)

Step 3: modify the output statements using formatted output, i.e. 8 digits for *n* and 2 decimal places for the equivalent resistance.

Step 4: add statements to save the individual resistances into a file

Q3 (5 marks) In-class exercise questions on '*arrays*' and '*matrix operations*' in week commencing 26/01/2009.

Q4 (35 marks) Write a program (CW3C_Q4_your_name.f95) to read data in 'CW3C_Q2_your_name.dat' created by running 'CW3C_Q2_your_name.f95'. The program should

- find out how many numbers in the file (The number should be equal to the number of letters in your surname.)
- calculate the average of the numbers
- find out how many numbers are below the average
- sort the numbers in numerical order starting with the smallest
- save the sorted numbers (2 decimal places) onto a file (CW3C_Q4_your_name.dat).

In addition, the program should include the standard statements:

- Write your name and group in comment lines at the beginning of the program
- Program has a name (CW3CQ4)
- IMPLICIT NONE should be used
- Display your name and group in the output window (the black DOS window)

How to test the program?

Run the program, it should display the number of data in the file (same as the number of letters in your surname); the average value of the data and how many numbers are below the average (check those results with a calculator).

Open CW3C_Q4_your_name.dat with NotePad. Numbers in the file should be sorted in ascending order.

How to start?

Use Prog16 on http://www.staff.city.ac.uk/~ensyy/f9.htm to help you write the program.

Step 1: start a new program with the standard statements

Step 2: declare a real type array which is big enough to store all the numbers corresponding to the letters of your surname

Step 3: add statements to read data from the file 'CW3C_Q2_your_name.dat' and store the numbers in the array; how many numbers in the file can be found during this process; the sum of the numbers can also be calculated

Step 4: calculate the average of the numbers in the array

Step 5: count how many numbers are below the average

Step 6: sort he numbers in ascending order

Step 7: save the sorted numbers (2 decimal places) onto a file (CW3C_Q4_your_name.dat).

Q5 (10 marks) Write a program (CW3C_Q5_your_name.f95) to do multiplication of two-3x3 matrices. In the program, two 3x3 matrices of real numbers are entered via keyboard; and the result of the multiplication of the two 3x3 matrices is displayed on the computer screen (1 decimal place) and saved in a file (CW3C_Q5_your_name.dat).

For example:

$$\begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 1 & 3 & 6 \end{bmatrix} \times \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 1 & 3 & 6 \end{bmatrix} = \begin{bmatrix} 3 & 6 & 10 \\ 6 & 14 & 25 \\ 10 & 25 & 46 \end{bmatrix}$$

Output on screen:

```
 3.0   6.0   10.0
 6.0  14.0   25.0
10.0  25.0   46.0
```

How to start?

Use program segmentations on http://www.staff.city.ac.uk/~ensyy/f11.htm to help you write the program.

Q6 (10 marks) In-class marking questions. In-class marking will be done during your tutorial class in week commencing 2/2/09. No late submission will be accepted for this question.