Assignment One
MT4112

Deadline Friday 18th Oct 11:00pm

All work **must** be done in the sub-directory 'assign1' off your home directory. When the assignment deadline has passed you will not be able to write to this directory anymore but you can still read what you have done. The work will then be copied from the 'assign1' directory and then marked.

Question One

Type the answers to question one into a file called 'quest1.txt' in the 'assign1' directory using the 'nano' editor.

- [**a**] Write out the expressions below and for each of the operators, using the numbers $1 \rightarrow n$ (where n is the number of operators) indicate, above the operator, the order in which the operations will be performed (as on page one of handout three).

  ```
  a + b - (c * d) / f + 5.0 ** e

  a + f * ( b - c ) / ( d - 3 ) - e * f

  b * ( c / d ) - ( f + a ) / 3.0 * e

  (( f - e ) * 4 ** c ) * a / d - b

  a ** b ** c + d / ( e + f ) * 2
  ```

- [**b**] Consider following code

  ```
  PROGRAM q1partb

    IMPLICIT NONE

    INTEGER :: a=2,b=5,c=4,f=12
    REAL    :: d=4,e=6

    PRINT*,(d-b)*a/(c-e)-f/6

  END PROGRAM q1partb
  ```

  ---

  1. What do you think the answer printed to the screen will be?
  2. What do you think the 'data type' of the answer will be?
  3. Qualify your answers to 1 and 2 above by creating a table of three columns. The first column holds the operators (top $\rightarrow$ bottom) in the order they would be executed in the expression. The second column holds the numeric result of each operation corresponding to the operator

in the same row of the first column. The third column holds the data type of the numeric result for each operation.

Question Two

You need to write a Fortran code that implements an algorithm to read in a set of data and calculate for that set of data the arithmetic mean and the standard deviation. The data is to be entered from the keyboard into a 'REAL' data type and can be positive, negative or zero. Your code must **also** calculate the mean and standard deviation for the subset of positive values in the data set and the subset of negative values in the data set. Your code MUST adhere to the following,

- Write your code in your directory 'assign1' in a file called 'stats.f90'.

- Declare the appropriate required variables.

- Read in from the keyboard the total number of values in the data set.

- If there are enough values then read in the data and calculate the required summations for the whole data set, the subset of positive values and the subset of negative values.

- Statistics will not be calculated for **any** data set with less than two values.

- Calculate the statistics, the arithmetic mean and the standard deviation for the whole data set, the subset of positive values and the subset of negative values.

- Output your results to a file 'quest2.txt' so they appear in exactly the same form as below but with different numeric results.

- Open your file 'quest2.txt' in the nano editor and after the results generated by your code add a section explaining why using arrays in this code is neither necessary nor a good idea.

```
The mean of the positive subset is        :    2.000000
The std. deviation for positive subset is :    2.828427
The number of positive data values is     :           3
The mean of the negative subset is        :   -2.000000
The std. deviation for negative subset is :    2.828427
The number of negative data values is     :           3
The mean of the full data set is          :   0.0000000E+00
The standard dev. of the full data is     :    2.366432
The number of data values is              :           6
```

- Make sure you use the 'IMPLICIT NONE' statement, comment your code adequately and structure any 'DO' loops and 'IF' structures appropriately.

Please calculate the standard deviation and the arithmetic mean for the following sets of data.

- {-1.2 3.4 -3.2 4.5 -6.4 5.6 -3.6 2.4 -2.5 4.0}

- {35 -34 36 37 -34 33 -32 31 38 -33 35 -37}

The formulae for the mean $(\bar{x})$ population standard deviation (s) are,

$$\bar{x} = \frac{1}{n} \sum_{i=1}^{n} x_i \qquad s = \sqrt{\frac{n \sum_{i=1}^{n} x_i^2 - \left(\sum_{i=1}^{n} x_i \right)^2}{n^2}}.$$

When finished, you should have in your directory 'assign1' the files 'quest1.txt', 'stats.f90' and 'quest2.txt' ready to be marked.