

City University  
School of Engineering and Mathematical Sciences  
Common Part 1

ME1107 Computing

Coursework 3D – Fortran

Q1: In-class exercise questions in week commencing 16/2/09.

Q3: In-class exercise questions in week commencing 23/2/09.

Q6: In-class marking questions in week commencing 2/3/09.

No late submissions will be accepted for in-class exercise or in-class marking questions.

Q2, Q4 and Q5:

- Softcopy submission to CitySpace: FORTRAN source files (.f95) and data files (.dat) by 2/3/09.
- Class marking: You should demonstrate your programs to class tutors during your tutorial class in week commencing 2/3/09.

Q1 (10 marks) In-class exercise questions on '*functions*' in week commencing 16/02/2009.

Q2 (25 marks) Prog17 uses a user-defined function volume(r,h) to compute the volume of a cylinder. Add a new function area(r,h):

$$\text{area}(r,h) = 2*\text{pi}*r*h + 2*\text{pi}*r**2$$

Use this function to calculate the surface area and display the surface area in the main program with 2 decimal places. Save radius, height, volume and surface area into a data file 'CW3D\_Q2\_your\_name.dat'. Save the FORTRAN source file as CW3D\_Q2\_your\_name.f95.

In addition, write your name and group in comment lines at the beginning of the program; and display your name and group in the output window (the black DOS window)

```
Program prog17
IMPLICIT NONE
real radius, height, vol, volume
write(*,*)'Radius of cylinder?'
read(*,*)radius
write(*,*)'Height of cylinder?'
read(*,*)height
!
vol = volume(radius,height)
!
write(*,100)vol
100 format(' ', 'Volume = ', e10.3)
stop
end
!
!-----
Real function volume(r,h)
real r, h, pi, base
pi = 4*atan(1.0)
base = pi*r**2
volume = base*h
return
end
```

### How to test the program?

Test the program with radius = 2 and height = 0.5.

Q3 (10 marks) In-class exercise questions on 'subroutines' in week commencing 23/02/2009.

Q4 (25 marks) Save CW3C\_Q4\_your\_name.f95 as CW3D\_Q4\_your\_name.f95. Modify the program so that the following three tasks are carried out in three subroutines.

- find out how many numbers are below the average (subroutine name: find\_nbelow)
- sort the numbers in numerical order starting with the smallest (subroutine name: sort\_ascending)
- save the sorted numbers (2 decimal places) onto a file (subroutine name: save; data file name: CW3D\_Q4\_your\_name.dat)

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 (CW3DQ4)
- IMPLICIT NONE should be used
- Display your name and group in the output window (the black DOS window)

### How to test the program?

The program reads data from CW3C\_Q2\_your\_name.dat. 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 (same as by CW3C\_Q4\_your\_name.f95).

Open CW3D\_Q4\_your\_name.dat with NotePad. Numbers in the file should be sorted in ascending order same as in CW3C\_Q4\_your\_name.dat.

Q5 (10 marks) Write a FORTRAN program (CW3D\_Q5\_your\_name.f95) to evaluate the integral

$$\int_0^{\pi} x \sin(x) dx$$
 using the trapezoid rule. Find the error of the numerical integration. The exact integration is  $\pi$ .

### How to start?

Use program segmentations on <http://www.staff.city.ac.uk/~ensyy/f15.htm> to help you write the program.

Q6 (20 marks) In-class marking questions. In-class marking will be done during your tutorial class in week commencing 2/3/09. No late submissions will be accepted for this question.