Dublin City University  
School of Electronic Engineering

EE105: Software Engineering 2  
Laboratory Test  

2002-2003

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The examination consists of two separate exercises. Marks will be divided equally between the two exercises.

The two exercises are related, but can be attempted independently (i.e., you do not have to complete the first in order to attempt the second, or vice versa). It is strongly recommended that you plan your allocation of time between the two exercises carefully in advance, and stick to this allocation during the exam.

When you have completed this test, your report should be emailed to the address:

ee105-exam@list.eeng.dcu.ie

Do not email multiple copies of the report. If you experience difficulties in emailing the report, please ask for help from an invigilator.

A report template is available for you to download and use as the basis for your report.

1 Exercise 1: Analysis (50%)

The volume of a sphere of radius \( r \) can be calculated as:

\[
V = \frac{4}{3}\pi r^3
\]

The surface area of the same sphere can be calculated as:
\[ A = 4\pi r^2 \]

The program `sphere.c` is meant to calculate the volume and surface area of a sphere. The program should behave as follows:

- prompt for a value for \( r \)
- query the user as to whether to calculate the volume or surface area of the corresponding sphere
- calculate the required value and exit

The program has various defects. You are required to correct all defects you can identify. For all changes that you make, the report should contain a clear statement of the change and a specific explanation of your rationale for the change. Of course, if you are making several similar or related changes, you may discuss these as a unit.

When you have reached the point where you think the program should work, then you should test it, and report on these tests. Carry out, and report on, further corrections if necessary.

**Note carefully that you must not simply present a version of the program rewritten from scratch. You are required to identify the specific defects in the program you have been given.**

2 Exercise 2: Synthesis (50%)

The file `indata.txt` contains a number of lines, each containing a single number. In each case, the number denotes the radius \( r \) of a sphere. You are required to develop a program which will read the data from this file or any similarly formatted file, and for each radius output the corresponding volume and surface area as calculated using the formulas in Section 1.

The program must conform to the following guidelines:

1. The program should be divided into at least THREE functions
2. The program should use FILE POINTERS for all file INPUT and OUTPUT

3. The program may use GLOBAL variables if you wish

4. The program should demonstrate good coding practices with regard to spacing, indentation, etc.

Test this program rigorously. Record all test results.
File Listing: sphere.c

#include <stdio.h>
#include <stdlib.h>

#define PI 3.141593

void calc_volume(double rad)
{double volume;

V = (4 * PI * rad * rad)/3;
printf("The volume is: \%f\n",volume);
return;}

void calc_area(double rad){
    double area;
    area = 4 * PI * rad * rad;
    printf("The surface area is: \%f\n",area);
    return;}

int main(void){
    double r;
    int choice;

    printf("Please enter a value for r: "); scanf("\%f",&r);

    printf("To calculate the volume enter: 1\n");
    printf("To calculate the surface area enter: 2\n");
    scanf("\%d",choice);

    if(choice = 1)calc_volume(r);
    else calc_surf_area(r);

    return(EXIT_SUCCESS);}
File Listing: indata.txt

0.0
1.0
42.0
4.2
0.99999
999.999
0.00001