

**DEPARTMENT OF PHYSICS AND ASTRONOMY**

Data Provided: *A formula sheet and table of physical constants is attached to this paper.*

Autumn Semester 2008-2009

PROGRAMMING IN C

2 Hours

Answer ALL questions.

There are a total of 50 marks to be awarded for this paper. The breakdown on the right-hand side of the paper is meant as a guide to the marks that can be obtained from each part of the question.

Please write all answers to questions in your answer booklet and not on the examination paper.

*In the following questions the term “**code fragment**” refers to an incomplete part or section of a computer program.*

1. What is the difference between a *relational* and a *logical* operator?
 Give one example of each. [2]
 State the basic rules of *operator precedence*. [3]
 What does the *dereferencing operator*, *, do? [2]
 What is a *function prototype*? [1]
2. Study the following code fragment and predict the values of **d**, **e**, **f**, **y** and **z** at the *printf* statement. Give real numbers to 2 decimal places. [5]

```
#include <math.h>

double a=13.5,b=0.0013,c=3.14159,d=8.05e3;
double e=72.4,f=0.162;
int u=312,v=2,w=5,x=10240,y=125,z=78;

d = (a+a/c)/(f-d-b/e);
e *= d+f+a/b+c/b+(c/d);
f = sqrt(a-b*c-d)/a;
y += u-(z/w)*y;
z = (u%w)*(z/u)*x;

printf ("d %f e %f f %f y %d z %d",d,e,f,y,z);
```

3. Study the following program carefully and write down exactly what the program outputs.

[4]

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

int main(void)
{
    int i=9, j=1;

    while (i>0)
    {
        if (i%2)
        {
            j+=i;
            j*=i;
            i--;
        }
        else
            i++;
        i--;
        printf("i: %d j: %d\n",i,j);
    }
    system("pause");
    return 0;
}
```

If the *while* loop is changed for a *do-while* loop with the same condition, how will the output change?

If the program is changed such that the starting value of *i* is 10, how will the output change?

[1]

[3]

4. List the 5 problems appearing in the following program that would result in compilation or linker errors. [7]

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

int main(void)
{
    real a=1.23;b=4.56;c=7.89;f;
    int i=10;

    while(i>0);
    {
        e=10.3;
        f=myfunc(a,b);
        printf("root myfunc is: %d\n ",sqrt(f));
        i-=5;
    }
    system("pause");
    return(0);
}

double myfunc(double a, double b)
{
    return(a*b);
}
```

There are further errors in this program which result in neither compilation nor linker errors. Nevertheless they will cause the wrong answer to be output – what are they?

[3]

5. You are writing a program which is to read information from a text file which contains dates and times in the following format:

25-Dec-2007 12:00:01

The relevant code fragment is given below

```
FILE *infile;
int date, hour, min, sec;
char month[3];
//
infile=fopen("datesandtimes.txt","r")
```

Write out the fscanff statement that you now need to read the data in, assuming that you don't need the year information.

[4]

6. Emma is writing a computer program to read 100 student records from a database into an array of structures. The database contains records which look like:

```
Surname StudentNumber Yr1Mark Yr2Mark Yr3Mark
```

Her program is incomplete. So far it looks like this:

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

//TODO I need to define a structure here

int main(void)
{
    const int NUM_STUDENTS=100;

//TODO I need to define my array of structures here

    FILE* database;

    if((database = fopen("students.txt", "r"))==NULL)
    {
        printf("Could not open database file");
        return 1;
    }

    for(i=0; i<NUM_STUDENTS; ++i)
    {
//TODO This is where my fscanf command goes
    }

    fclose(database);

    system("pause");
    return(0);
}
```

Help Emma to complete her program by providing the code to

- define a suitable structure;
- declare an array of structures;
- read the data in using `fscanf`.

[2]

[2]

Emma now decides to order the student records according to their third year marks. In order to do this she decides that she needs a swap function. She reads the following in a text book:

[6]

“If A and B are both structures of the same type it is possible to copy the entire structure A to structure B by simply using the command

$$A = B;$$

i.e. it is not necessary to copy each structure member one by one.”

Using this information write out the swap function that she must use.

[5]

END OF QUESTION PAPER