



**DEPARTMENT OF PHYSICS AND ASTRONOMY**

**Autumn Semester 2009-2010**

**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. In the statement `int main(void)` what is meant by “(void)”? [1]
- What does `*`, the *dereferencing operator*, do? [2]
- Explain the difference between the two following statements:  
`y = --x;`  
`y = x--;` [2]
- What is a *library*? What does *linking* to a library mean? [2]
- Explain the concept of *recursion*. [2]
- What do the `malloc()` and `free()` operators do? [2]

2. Study the following program carefully and write down exactly what it outputs. [5]

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

int main(void)
{
    int i=1, j=5;
    do
    {
        switch (j%5)
        {
            case (1):
            case (2):
                i+=2;
            case (3):
                i=j/i;
                --j;
                break;
            default:
                i-=j;
                --j;
                break;
        }
        printf("i: %d j: %d\n",i,j);
    } while (j>0);

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

3. The following is the model solution for this year’s first formal assessment on perfect numbers. Five compilation errors have been introduced into the program. List them. [5]

```

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

int main (void)
{
    const int  istart = 400;
    const int  ifinish = 10000;
    int sum;i;

    for (i=istart; i<=ifinish; i++);
    {
        sum=0; // initialise sum
        for (j=1; j<i; j++)
        {

/* if j is a proper divisor of i add to "sum"
        if ( i%j = 0) sum+=j;
        }
// after looping check for perfect number
        if ( sum == i )
            print("%f is a perfect number\n",i);
        }
        system(pause);
        return 0;
    }
}

```

There are three further errors in this program which result in neither a compilation error nor a linker error. What are they?

[6]

4. Study the following code fragment and predict the values of **r**, **s**, **t**, **u**, **k** and **l** at the *printf* statements.

[6]

```

double r=504.67,s=3.4e-5,t=1.1208,u=23.5;
int i=2905,j=35,k=-8,l=5034;

r = (t+r/s/u-u*u);
s *= s+u/t+r/t-r;
t *= --u;
u = sqrt(r-t/s);
k = (i/j)*u;
l += k-(i%l)*j;

printf ("r: %f s: %f t: %f u: %f",r,s,t,u);
printf ("k: %d l: %d",k,l);

```

5. You are writing a program which is to read information from a database belonging to a frequent flyer programme. Each record contains the following information:

*Frequent flyer number (integer, maximum 10 digits)*

*Flight code (character string, 2 characters and up to 4 digits)*

*Date of flight (formatted as dd-mm-yyyy)*

*Departure airport (character string, 3 characters)*

*Arrival airport (character string, 3 characters)*

*Frequent flyer miles earned (integer, maximum 5 digits)*

A typical record thus looks like:

6723185064 BA005 01-09-2009 LHR NRT 7667

Design and write a suitable structure to store this information.

[3]

Write out a short code fragment to parse all this information into eight appropriate variables (assuming that date, month and year are separate variables) according to the structure you have just designed. Include the file handling commands assuming that the database is named *fflyer.dbase*.

[6]

6. Predict the output produced by the following code fragment:

```
int xdigit = 145;
double alpha = 0.01287;
char scientist[8] = "Einstein";
//
printf("%-5d\n", xdigit);
printf("%+3d\n", xdigit);
printf("%f\n", alpha);
printf("%7.3f\n", alpha);
printf("%6.1e\n", alpha);
printf("%-.4s\n", scientist);
printf("%-11.8s\n", scientist);
printf("%7.5s\n", scientist);
```

[8]

**END OF QUESTION PAPER**