GX549

OLLSCOIL NA hÉIREANN, GAILLIMH
THE NATIONAL UNIVERSITY OF IRELAND, GALWAY

SUMMER EXAMINATIONS, 1999

FIRST ELECTRONIC ENGINEERING

COMPUTER SYSTEMS AND PROGRAMMING

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Duration of examination: *Three* hours

Instructions: Answer any *Five* questions.
All programs written as part of answers to questions must contain comments.

1. *(a)* Explain the function of the following units in a basic computer system:

(i) microprocessor,
(ii) RAM,
(iii) ROM,
(iv) Peripheral devices,
(v) Address bus,
(vi) Data bus.

Draw a diagram showing the relationship between these various units.

[12 marks]

(b) Various memory locations in a computer system contain the following 8 bit binary values. Assuming that these represent signed integer values, determine the integer values.

(i) 00011000,
(ii) 11111111,
(iii) 00010100,
(iv) 10101000

[4 marks]

(c) The following data needs to be stored by a computer program. State what type of variable should be used to store them .

(i) the value -32,
(ii) the value -5.63756,
(iii) the value -1.9×10^{445},
(iv) the value -182,
(v) the value -32567,
(vi) the value 345821,
(vii) the character 6,
(viii) the character !.

[4 marks]

[pto]

2. *(a)* Determine the binary representation of -45 and 7 using signed short integers and, hence, calculate using binary arithmetic only the result of the following operations and state its decimal value (assume that the result is also a signed short integer).

(i) 7+(-45)
(ii) -45-7
(iii) 7x(-45)

You must show all binary calculations in order to obtain full marks for each section.

[11 marks]

(b) If we denote A=7 and B =-45, then calculate the following bitwise logical operations and state the result as a decimal value (indicate all binary operations used).

(i) A AND B
(ii) NOT A XOR (A OR B)
(iii) A AND NOT(A XOR B)

[9 marks]

3. *(a)* Explain, using examples or diagrams where appropriate, the meaning of the following terms:

(i) Assembly language,
(ii) Machine code,
(iii) Interpreter,
(iv) High Level Language,
(v) Operating Systems,
(vi) Computer Network.

[12 marks]

(b) Write a C program which asks the user to enter a number. The program should then calculate and display the square root of the entered number. The program should be able to handle negative numbers and should calculate and display the square root of the negative number in the standard imaginary number format.

[8 marks]

4. A program to calculate the factorial of a number is given below. A number of deliberate errors (more than **ten**) have been inserted in the program, you are required to identify **ten** of these errors. You are then required to:

(i) Identify and correct each error,
(ii) Indicate whether the error would be detected by the compiler, the linker or if it would cause a run time error.

```
#include <conio.h>

double factorial(int n_value)

void main(void)
{
int value_of_n;
double result;

        clrscr();
        print("\nEnter the value of n : ");
        scanf("%f",value_of_n);
        result=factorial(value_of_n);
        printf("\nFactorial %d is : %10.0lf",value_of_n,result);
```

[pto]

```
double factorial(int value);
{

/ This function calculates and returns the value of value!.

int index;
double fac_value;


        if (value>170)
        {
                return(0);
        if (value=0)
        {
                return(1);
        }
        fac_value=1;
        for (index=1;index<=value;index++);
        {
                fac_value=fac_value*index;
        }
}
```

[20 marks]

5. *(a)* Describe, giving examples, what is meant by the following terms in the context of a personal computer system:

(i) User input\output devices,
(ii) File storage devices,
(iii) Communication devices.

Draw a diagram which illustrates the general structure of a PC system indicate all the devices mentioned above.

[10 marks]

(b) In the context of C programming, explain the function of the *text editor*, the *compiler* and the *linker*. Illustrate your answer by means of a diagram which shows the various types of files created using these tools specifically using the Turbo C programming environment.

[6 marks]

(c) Explain, by giving various examples, what you understand by the terms *case sensitive* and *run time error* in the context of C programming.

[4 marks]

6. *(a)* Outline **two** reasons for the use of functions in C programs.

[4 marks]

(b) Describe, giving examples, what are meant by the terms *function prototype, calling by value* and *calling by reference.*

[6 marks]

(c) Write a C program which firstly fills an array with random values. The random values must be in the range of minus a user specified value and plus a user specified value. The average of the array must then be calculated and displayed. The process of filling the array and calculating the average value **MUST** be written in separate functions which you should make as general as possible (e.g. the array size should be passed to the functions rather than be fixed).

[10 marks]

[pto]

7. A text file on a computer contains numeric values which must be sorted. Each real number in the file is contained a separate line. Write a C program which implements each of the following **as a separate function**:

(i) Asks the user for the name of the file containing the values and opens that file (if possible),
(ii) Reads the values from the file, stores them in an array and then closes the file,
(iii) Uses a bubble sort to sort the array into ascending order,
(iv) Asks the user for the name of the output file and opens that file (if possible),
(v) Writes the sorted array into the output file and then closes that file.

[20 marks]