

NATIONAL UNIVERSITY OF IRELAND, GALWAY
OLLSCOIL NA hÉIREANN

SEMESTER I EXAMINATION 1999/2000

**HIGHER DIPLOMA IN APPLIED SCIENCE
(SOFTWARE DESIGN & DEVELOPMENT)**

CT854 APPLICATION PROGRAMMING

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Time allowed: THREE hours

Answer any FOUR questions
All programs are to be written using C

1. (a) Write a program that accepts an arbitrary amount of numbers from the user. The user should be able to exit the program, i.e. there should be a facility allowing the user to show that they have finished entering numbers. The program should then display:
- the number of numbers entered;
 - the sum of the numbers;
 - the smallest number;
 - the average of the numbers.
- (10 Marks)
- (b) Write a **function** called **is_leap** that receives a year number as an argument and returns a number indicating whether that year is a leap year or not. (NB: a leap year is divisible by 4 but not by 100, or is divisible by 400. So, 1900 is not a leap year but 2000 is). Write a program that uses the **is_leap** function to list all of the leap years between the year 1900 and the year 2100.
- (8 Marks)
- (c) Discuss in general the use of header files in C and outline where you would use the following :
- <stdio.h>
 - <ctype.h>
 - <string.h>
- (7 Marks)

(P.T.O)

2. (a) Write a program that asks the user for a number and displays a table of squares and cubes from 1 up to the number specified. (6 Marks)

- (b) Write a nested loop that will produce the following design.

```
*****
*****
***
**
*
```

(9 Marks)

- (c) What would you expect the output of the following section of code to be?

```
#include <stdio.h>
main()
{
    int i, j;
    printf(" ");
    for (i=1; i <=12; i++)
    {
        printf("%5d", i);
    }
    printf("\n +");
    for (i=0; i<=60; i++)
    {
        printf("-");
    }
    for (i=1; i<=12; i++)
    {
        printf("\n%2d |", i);
        for (j=1; j<=12; j++)
        {
            printf("%5d", i*j);
        }
    }
    printf("\n");
}
```

(10 Marks)

(P.T.O)

3. (a) Describe what is meant by a recursive function, giving an example to illustrate your answer
(5 Marks)
- (b) Write a program that accepts user input from the keyboard and calculates the frequency of occurrence of each of the five vowels (aeiou) in either uppercase or lowercase form. The program should accept input until it encounters the EOF character and then print out results.
(10 Marks)
- (c) Write a program to process strings as follows:
Program should read in the users firstname, middlename and surname. It should then extract the first letter of each and print a greeting to the user using these three initials. It should then concatenate the three names into a single string and print it out backwards.
(10 Marks)
4. (a) Describe the meaning of the term *pointer* in the C language and describe briefly where pointers are used.
(5 Marks)
- (b) You are asked to write C code to process temperatures as follows:
- The temperature is monitored one hundred times and these values (floats) are to be read into an array using the keyboard.
 - Design a *user-defined function* that receives the array and determines the minimum, maximum and average temperatures. Use pointers to ensure that these three results can be accessed back in the calling environment.
 - The three results are printed out in the main function along with the spread of temperatures (minimum – maximum).
(15 Marks)
- (c) Describe what is meant by dynamic memory allocation and show how it is implemented in C.
(5 Marks)

(P.T.O)

5. (a) Briefly explain the need for and use of structures in C. (5 marks)

- (b) A manufacturing company produces fifty (50) different products. The company wishes to computerise its records, storing the following information on each product type.
- Name
 - Cost
 - Stock level

Define a structure type to suit this requirement and show how both the member operator and pointers can be used to access the information on a particular item.

(5 Marks)

- (c) Write code using the structure type defined above to implement the following aspects of the companies system:
- Design and code a user defined function that fills in information on a particular product.
 - Design and code a user defined function that checks the stock level of **all** products and returns the number of products that have a level less than the minimum allowed which is 10.

(15 marks)

6. (a) Explain what the variables argc and argv are used for in the following code fragment.

```
int main(int argc , char *argv[])
```

(5 Marks)

- (b) Write a simple program that echoes all command line arguments.

(5 Marks)

- (c) Write a command line driven program that sorts surnames into two categories. The program reads in lines of text, each containing a surname, from an input file and sorts them as follows:

- If the surname is in the range A to M inclusive, the surname is printed to output file number one.
- If the surname is in the range N to Z inclusive, the surname is printed to output file number two.

Assume that the input file contains only uppercase characters.

(15 marks)