GX1325

OLLSCOIL NA hÉIREANN
National University of Ireland, Galway

SEMESTER II
SUMMER EXAMINATIONS 1998/99

First University Examination in Information Technology
First University Examination in Engineering (Electronic and Computer)

PROGRAMMING (CT103)

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Time Allowed : **Three Hours**

Answer any five questions
All questions carry equal marks

1. (a) Write a note on what you understand by the term *top-down design*, when applied to software development. *(6)*

   (b) Each year the Department of Traffic Accidents receives accident-count reports from each county across the country. The department summarises the reports by providing a frequency count of the number of counties reporting accident counts in the following ranges: 0-99, 100-199, 200-299, 300-399, 400-499, and 500 or above. The department has asked you to design a program to take the number of accidents reported in each county and to add one to the count for the appropriate range. When the data from all counties have been processed, the resulting frequency counts should be displayed. Use the Software Development Method to design an algorithm for this problem.*(14)*

2. (a) Why is testing a necessary step in software development? Why is it important to write down expected test results before you actually perform a test? *(6)*

   (b) Explain what is meant by coverage testing of loops. Give examples to illustrate your answer. *(6)*

   (c) You are given a program which, you are told, will find the integer average of a list of up to 40 positive integer inputs, where the list is terminated by a non-positive value. What tests would you perform to coverage test this program? *(8)*

3. (a) Give the general form of
(i) a counter controlled loop
(ii) a sentinel controlled loop
Use flow-charts to illustrate your answers. *(6)*

(b) Develop a function in C which takes as argument a positive integer and displays on one line all its factors. For example, if the function is called with the integer 12, the following line should be displayed: *(8)*

```
1  2  3  4  6  12
```

(c) Develop a piece of code in C that reads a list of positive integers, terminated by a non-positive integer, and for each input displays all its factors. An example of the i/o is: *(6)*

```
? 12
1  2  3  4  6  12
? 7
1  7
? 9
1  3  9
? 0
```

4. (a) How can you return more than one value from a function in C? Illustrate your answer with examples. *(6)*

(b) Consider the following piece of code and answer the questions below *(14)*:

```
void fun(int *d1, int *d2)
{
   *d1 = *d1 + *d2;
   *d2 = *d1 - *d2;
   *d1 = *d1 - *d2;
}
```

(i) Which of the following function calls are legal:

- `fun(3, 4);` ?
- `x = fun(x, y);` ?
- `fun(&x, &y);` ?

(assume the declarations `int x = 1, y = 2;`)
(ii) What does the above piece of code do? Illustrate your answer by tracing an example.
(iii) Would the code have the same effect if all the asterisks were removed? Why?

5. (a) Explain how an array is passed as an argument to a function in C.
How can a C function return an array? *(6)*

(b) Develop a piece of C code which reads two 5×5 matrices of type double values, and then displays their matrix product. *(14)*

6. (a) Describe the treatment of strings in the C programming language. Include the following topics in your answer:
   - representation of strings in C
   - the null character
   - common problems with strings
   - input and output of strings
   - string assignment *(10)*

(b) Develop a function in C that takes as argument a string representing a car registration number, and which extracts and displays on the screen the county code. The function should have the following prototype:

```
void extract_county(char *reg);
```

You may assume that the string representing the registration number is made up of a two digit year, followed by a space, followed by a one or two letter county code, followed by a space, followed by one or more digits.
Examples of the use of the function are:
the call `extract_county("98 G 2987");` will cause "G" to be displayed;
the call `extract_county("91 WX 12945");` will cause "WX" to be displayed.*(10)*

7. (a) What is meant by a *cast* in C? Use examples to illustrate your answer. *(4)*

(b) Develop a C function, with prototype

```
char lower(char ch);
```

which takes an uppercase letter and returns its lowercase equivalent. You may assume that you are using the ASCII character set. *(10)*

(c) Develop a piece of code in C which opens a file called input.txt and copies its contents to the screen, replacing any uppercase letters occurring in the file by their lowercase equivalents. You may make use of the function you wrote in part (b). *(6)*

8. (a) A music company requires a software system to handle their music cd's. As part of the development team you are asked to define a C structured data type `track_t`, representing tracks on a cd, with the components `track_title`, `artist_name`, `length`, and `track_id`. Give a declaration of a variable `t1` of this type. Write a function, called `scan_track`, to scan information into a structure of type `track_t`, and show how the function would be called with your variable `t1`. *(12)*

(b) A cd may now be regarded as an array of up to 15 tracks. Write a piece of C code which declares an array representing a cd and which reads in at most 15 track records, storing them in the array. You should make use of your answer to part (a). *(8)*