GX2777

OLLSCOIL NA hÉIREANN
National University of Ireland, Galway

SEMESTER II
SUMMER EXAMINATIONS 2000/01

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

PROGRAMMING (CT103)

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Time Allowed : **Three Hours**

Answer question one and any three other questions

1. (a) Consider the following piece of C code and answer the questions below:

```
void
fun(int a[], int x)
{
   int i, j, y;
   int z;

   for(i = 0; i < x-1; i += 1)
   {
      y = i;
      for(j = i + 1; j < x; j += 1)
      {
          if (a[j] < a[y])
                y = j;
      }
      z = a[y];
      a[y] = a[i];
      a[i] = z;
   }
}
```

(i) Trace the function using the following array, and an appropriate for x: *(8)*

15	9	-2	6	21

(ii) What does the function do? *(4)*
(iii) Rewrite the function using suitable variable names and appropriate comments. *(8)*

(b) Solve the following problem using the software development method.

As part of a global warming analysis, a research facility tracks outdoor temperatures at the North Pole once a day, at noon, for a year. At the end of each month, these temperatures are entered into a computer and processed. The operator will enter 28, 29, 30 or 31 data items, depending on the month. You may use -500 as a sentinel value after the last temperature, since that is lower than absolute 0. Write a piece of C code that will read the data values for one month and then compute the following information : the average temperature for the month; the number of days in the month on which the noon temperature exceeds 32 degrees Fahrenheit; the number of days in the month on which the noon temperature exceeds the average temperature. You may assume that all inputs are in degrees Fahrenheit. *(20)*

2. (a) Explain what is meant by an end-of-file controlled loop. *(6)*

(b) A file `accounts.dat` contains a list of all valid user account names for a computer system. Develop a piece of code in which a user enters their account name as an eight letter string, and this value is checked against the account names held on file. An appropriate message should be printed if the account name is not found. *(10)*

(c) What, if any, changes would you make in your answer to (b) if you are told that the account file is sorted? *(4)*

3. (a) The following piece of code defines the type box_t which has 5 components: the dimensions of the box, the weight of the box and a description of its contents. Consider the code and answer the questions below *(6)*:

```
typedef struct {
    int length, width, height;
    double weight;
    char contents[35];
} box_t;
```

(i) Where would the code be placed in the source code file?
(ii) What does this piece of code do?
(iii) How many variables of type `box_t` are declared by the definition?

(b) Develop a function in C to read information into a variable of type `box_t`. The function should have the following prototype: *(7)*

```
void readbox (box_t *boxp);
```

(c) Develop a function in C to take a collection of boxes, stored in an array, and compute the total weight of all the boxes. The function should have the following prototype:

```
double total_weight(box_t boxes[], int size);
```

where size gives the number of elements in the array. *(7)*

4. (a) Describe how pointers are used for input-output parameter passing. *(4)*

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

```
void
fun(int x, int *y, int *z)
{
        *y = x * x;
        *z = x * *y;
}
```

(i) Which of the following function calls are legal, giving reasons: *(4)*

- `fun(3, 4, 5);` ?
- `x = fun(x, s, c);` ?
- `fun(in, &s, &c);` ?

(assume the declarations `int x = 5, s = 2, c = 7;`)

(ii) What does the above piece of code do? Illustrate your answer by tracing an example. *(4)*

(c) Develop a function in C to take an amount of money between 1p and 99p, and returns the combination of coins (1p, 2p, 5p, 10p, 20p, 50p) required to make up that amount. Show how your function would be called. *(8)*

5. (a) Develop a function in C to read a list of integers, input from the keyboard, into an array. Reading should stop when two successive inputs have the same value. The function should return the size of the array. The function prototype is: *(6)*

```
int read_array(int inputs[], int maxsize);
```

(b) A restaurant takes bookings for the timeslots 6pm, 7pm, 8pm, 9pm and 10pm. Only 50 guests can be served in each timeslot. Using an array to hold details for each time, develop a piece of code that reads a time and number of guests and checks if the required number of guests can be accommodated at that time. If they can, update the array appropriately, otherwise suggest another suitable time as close as possible to that requested. Give declarations for any variables that you use, and state any assumptions you make. *(14)*

6. (a) Write notes on the treatment of strings in a C program. Include: String I-O; use of the null character; problems with string handling and how they may be overcome. *(6)*

(b) Write a string function that takes as a parameter a character string of unknown length, containing a single word. Your function should translate this string into PigLatin. The translation is performed by removing the first letter of the string, appending it to the end, and concatenating the letters "ay". You may assume that the character array contains enough space for two more characters. For example: *(10)*

```
Please enter your word>  Hello
           Translation> elloHay
```

(c) Suppose you are no longer assured that the character array in (b) will hold the translated string. What changes would you make to your answer to (b)? *(4)*