

OLLSCOIL NA hÉIREANN
National University of Ireland, Galway

SEMESTER I (WINTER) EXAMINATIONS 2002

B.A. Degree Examination
 B.A. (International) Degree Examination

ALGORITHMS AND PROGRAMMING (CT472)

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Time Allowed : **Two Hours**

Answer question one and any two other questions

1. (a) Describe what is meant by *sequential processing* of an array, giving an example (10)
 - (b) Develop a piece of code in the C programming language to process the integer array `exam_results[50]` and to report on the number of fails (marks < 40) and the number of honours (marks > 60). You are told that the array has been populated with marks. (10)
 - (c) Develop a piece of code in the C programming language to process the integer array `exam_results[50]` and to find the index of the first failure mark. You are told that the array has been populated with marks. (10)
 - (d) Assume now that the content of the array `exam_results[50]` has been sorted into increasing order. What changes do you make to your code for (b) and (c). (10)
2. (a) Describe the selection sort algorithm for sorting an array `a` of integers. Assume the array contains `size` entries to be sorted. Demonstrate how the algorithm works using the example array of size 6 : (10)

15	9	-3	18	12	-2
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- (b) Develop a piece of code in C to find the index of the smallest element in an integer array `a` containing `size` elements, starting at index `i`. For example, using the above array of size 6, if `i` is 0 then the result should be 2 (since `a[2]` contains the smallest element starting at index 0), but if `i` is 3 then the result should be 5 (since `a[5]` contains the smallest element starting at index 3). (10)
- (c) Use your code from (b) to implement the selection sort algorithm you described in (a). (10)

3. (a) What is an end-of-file controlled loop, and when would it be used? Give the general form of such a loop in the C programming language. (10)
- (b) Develop an algorithm to accept a list of characters, sentinel 'S', and replace each substring containing only 'B's by one 'B'. (10):
 e.g. Input: AAAAABBBBBBBBCCBBBAABBCCCCCS
 Output: AAAAABCCBAABCCCCC
- (c) Reusing your algorithm for (b), develop a program to open a file `data.txt` containing characters, and to create a new file `cmprsb.txt` containing the original data replacing each substring containing only 'B's by one 'B'. (10)
4. (a) Write a note on how strings are represented in C. (5)
- (b) Develop a piece of C code to search a string `str` for the position (index) of the first uppercase letter. You may assume that there is at least one uppercase letter in the string. (10)
- (c) Develop a piece of C code to read a string representing a car registration number, and which displays on screen the county code. 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. You may also assume that the county code is uppercase. Examples of the use of the code are:
 For the input "00 G 2875", the county code "G" should be displayed;
 for the input "94 WX 914", the county code "WX" should be displayed. (15)
5. (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?
- (c) Develop a function in C which takes as input an amount of time in minutes, and converts this to hours and minutes, returning both values. Show how your function would be called. (10)