

NATIONAL UNIVERSITY OF IRELAND, GALWAY
OLLSCOIL NA hÉIREANN

SEMESTER I (WINTER) 2000 EXAMINATION

MASTER OF SCIENCE (SOFTWARE DESIGN & DEVELOPMENT)

CT519 APPLICATION PROGRAMMING

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Time allowed: THREE hours

Answer **TWO** questions from section A and **TWO** questions from section B

All programs are to be written using C or C++

SECTION A

Q.1.

(i) 5 marks

Write a program that accepts two floats (real numbers) from the keyboard, and then repeatedly doubles the smaller of the two numbers, until it is larger than the other.

(ii) 5 marks

Write a program that simulates coin tossing. For each toss of the coin the program should print **Heads** or **Tails**. The program should toss the coin 100 times, and count the number of times each side of the coin appears. (Hint: use the function rand() from <stdlib.h>, which produces a random integer between 0 and approximately 4 billion.)

(iii) 5 marks

Modify the program so that it also keeps track of the longest unbroken sequence of heads and the longest unbroken sequence of tails.

(iv) 5 marks

What would the output of the following section of code be?

```
int i, j, k;
for (i=0; i<=2; ++i)
    for (j=i; j<i*2; j++)
        for (k=j; k>0; k--)
            printf("%d+%d+%d = %d\n", i, j, k, i+j+k);
```

Q.2.

(i) 6 marks

Write a program that accepts a non-negative integer, call it N, and then prints out the first N lines of the following table:

```
1  2
3  4  5
6  7  8  9
10 11 12 13 14
15 16 17 18 19 20
etc.....
```

(ii) 10 marks

Write a program that accepts 50 integers from the keyboard, and then identifies and prints out the 10th largest of these (i.e. the number that has exactly 9 numbers bigger than it). Your program should **not** sort the entire list of numbers in order to do this.

(iii) 4 marks

Write a program that reads in a word or sentence from the user, then prints it out backwards with any spaces removed.

Sample output:

```
Type a word/sentence> Ice Cream Sundaes
Backwards and de-spaced that is: seadnuSmaerCecI
```

Q.3.

(i) 5 marks

Write a program that calculates and prints the sum of the even integers from 2 to 40.

(ii) 8 marks

Write a **function** called **is_factor** that receives two integers as arguments and returns a number indicating whether the second number is a factor of the first. (Note: a factor of a number is one that divides evenly into it). Try to make this function as speed-efficient as possible.

Write a program that takes in an integer from the keyboard and then uses the **is_factor** function to list all of the factors of that number.

(iii) 7 marks

The Fibonacci series

```
0, 1, 1, 2, 3, 5, 8, 13, 21, ...
```

begins with 0 and 1 and has the property that each subsequent Fibonacci number is the sum of the previous two Fibonacci numbers. Write a program that prints out the first 100 Fibonacci numbers.

SECTION B

Q.4.

(i) 5 marks

Describe the way in which C stores strings. If an array were defined that contained 25 strings each of which can store 40 characters how much storage would be required for the array?

(ii) 5 marks

Write a function `stringcompare` that takes two strings as parameters and returns `-1` if the first one is less than the second one, zero if they are identical and `1` otherwise. **DO NOT** use the `strcmp` function.

(iii) 5 marks

Describe the use of pointers in C. Include in your description definitions of the functions `malloc`, `calloc` and `free`, giving an example of their use.

(iv) 5 marks

Examine the following program, and write down the exact output that it would give:

```
#include <stdio.h>
main()
{
    int x=18, y=6, *a, *b;
    a=&y;
    b=&x;
    printf("%d %d\n", *a, y);
    *b=*a*x;
    *a=x+*b;
    printf("%d %d\n", x, *a);
}
```

Q.5.

(i) 10 marks

Explain how C allows the user to enter "command line arguments".

Illustrate your answer by writing a simple program that uses this approach to obtain the names of two files. Ensure that your code checks that both file names have been given.

(ii) 10 marks

Extend your program developed in (i) to create a program that copies files, e.g.

copy file1 file2

would copy the contents of file1 into file2.

What assumptions have you made about the file types?

Q.6.

(i) *5 marks*

What are enumeration types and why can they be useful? Define an enumeration type to represent the months in a year.

(ii) *5 marks*

Describe the use of `typedef`, highlighting the benefits it gives to the readability of code. Illustrate your answer with an example.

(iii) *10 marks*

Write a program that reads 10 integers from the keyboard and stores them in an array. The elements of the array should then be sorted into ascending order. You should also calculate the sum and average (as a floating point number) of all of the numbers input.