

OLLSCOIL NA hÉIREANN GAILLIMH  
NATIONAL UNIVERSITY OF IRELAND GALWAY

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SUMMER EXAMINATIONS 2004

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FIRST YEAR BSc(IT) INFORMATION TECHNOLOGY

1IF1

FIRST YEAR ENGINEERING (ELECTRONIC AND COMPUTING)

1BP1

FIRST YEAR ELECTRONIC ENGINEERING

1BN1

FIRST YEAR SCIENCE (PHYSICS & ASTRONOMY)

1PA1

**PROGRAMMING (CT103)**

Professor P. Nixon

Professor G. Lyons

Mr. A. Reilly

Dr. F. Smith

Time allowed: *three* hours.

**Attempt question 1 AND *three* other questions.**

For the questions that require you to write C code, you only need to give the C code and not the usual development notes.

1. (a) Write a program that accepts a set of integers from the operator and then calculates the smallest, largest and average of that set of numbers. Your program should then print out all of the numbers that are less than the average. You should not sort the array of integers.

Sample I-O might be:

Please enter data: 7, 6, 12, 8, 9, 11, 5, 4, 3

The smallest of these numbers is: 3

The largest of these numbers is: 12

The average of the values is: 7.222

The numbers less than average are: 7, 6, 5, 4, 3

[20]

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

```
# include < stdio.h >
void main()
{int i,j;
printf("  ");
for (i=1; i <= 15; i+=1)
{
    printf("%5d",i);
}
printf("\n  +");
for (i = 0; i <= 75; i+=1)
{
    printf("-");
}
for (i = 1; i <= 15; i +=1)
{
    printf("\n%2d ",i);
    for (j = 1; j <=i; j +=1)
    {
        printf("%5d", i*j);
    }
}
printf("\n");
}
```

- (i) What does the program do? Describe the actions of each loop construct.  
[8]
- (ii) What improvements do you think might be made to improve comprehension of the code?  
[4]
- (iii) Rewrite the program using function calls to replace each of the loops.  
[8]

2. (a) Describe the use of strings in C programming. Illustrate your answer with examples that show the difference between string constants and string variables. Describe some of the problems associated with strings.  
[8]
- (b) Write a program that accepts a string from the keyboard and displays the string reversed. For example if the string "hello" was typed in the output from the program would be "olleh".  
[12]
3. (a) Describe some potential problems that a programmer needs to consider when dealing with files. In each case give sample code that ensures that the program does not fail.  
[8]
- (b) Write a program that accepts the name of a text file from the user. The program should then count the number of lower case letters in the file. Sample output might be (where testfile is the name of the file):  
File testfile contained 25 lower case letters.  
Your program should only try to open files that exist.  
[12]
4. A program is required to store the results for students on a course. The details required for each student are, their first name, last name, student number, 4 lab exam marks, 8 assignment marks, an exam mark and an overall mark.
  - (a) Declare a suitable structure student\_t to hold all of the information for a single student. Use this structure to declare a variable of type student\_t.  
[6]
  - (b) Write a function in C to read information into a variable of type student\_t. You must pass the resulting variable back as an argument to the function and not as a global variable.  
[6]
  - (c) Write a function in C to process an array holding the student details, of the whole class, and print out the names of the students who got more than 70%. Hint: Pass two arguments to the function, the array of students and a count of the number of students.  
[8]

5. (a) Describe five different arithmetic operators. For each operator, illustrate its use with a simple expression, in each case say what the expression evaluates to.

What are the differences between relational and logical operators?

[6]

- (b) For each of the following expressions state its value. If the value of any variable is changed state the new value of the variable. If expression cannot be evaluated, explain the reason why:

(i)  $if(x = 5)$

(ii)  $5 == 7$

(iii)  $(7 > 5) \&\&('a' < 'c')$

(iv)  $(5/4) + (5.0/4.0)$

(v)  $a = 5 || 6 || 7$

(vi)  $(a <= 'a') \&\&(a >= 'z')$

[6]

- (c) Describe the use of functions in C. You should describe the various advantages of using functions including (but not limited to) program readability and code reuse.

[8]

6. (a) Illustrate the use of pointers in C by doing the following:

(i) declaring a variable of type integer and a pointer to an integer.

(ii) assign the address of the integer variable to the pointer variable.

(iii) halve the value pointed to by the pointer variable.

[6]

- (b) Write a function that takes two inputs (day and month) representing a date in the year 2004. The function should return the number of days that have elapsed between the first of January 2004 and the given date. You should include the first of January and the given date in your calculation.

[6]

- (c) Use the function you developed in question 6b in a main program that reads two dates (in the year 2004) from the keyboard and calculates the number of days between them.

[6]

- (d) Describe any changes you would have to make to your code if you now wanted it to handle dates in the year 2005.

[2]