

OLLSCOIL NA hÉIREANN GAILLIMH  
NATIONAL UNIVERSITY OF IRELAND GALWAY

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SEMESTER II EXAMINATIONS 2003

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Exam codes 1IF1, 1PT1, 1BP1, 1BN1  
FIRST YEAR BSc(IT) INFORMATION TECHNOLOGY  
FIRST YEAR ENGINEERING (ELECTRONIC AND COMPUTING)  
FIRST YEAR ELECTRONIC ENGINEERING  
FIRST YEAR SCIENCE (PHYSICS & ASTRONOMY)

**PROGRAMMING (CT103)**

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Time allowed: *three* hours.  
**Attempt question 1 AND *three* other questions.**

1. (a) Write a program that accepts a set of integers from the operator and then calculates the second smallest and second largest and average of that set of numbers.

Sample I-O might be:

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

The second smallest of these numbers is: 4

The second largest of these numbers is: 11

The average of the values is: 7.222

[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\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 for key pieces of code.  
[8]

2. (a) Describe the use of strings in C programming. You should describe the way that strings are represented. Use examples to illustrate your answer.  
[8]
- (b) Write a program that accepts a string from the keyboard and then checks if the string is a palindrome. (A palindrome is a string that reads the backwards and forwards, e.g. ABBA.)  
[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 calculate, and display, the sum and average of the numbers in the file. You can assume that the file only contains integers separated by blank spaces, so you don't need to check for valid input.  
[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 name of the student with the highest overall mark. Hint: Pass two arguments to the function, the array of students and a count of the number of students.  
[8]

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

[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) double 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.

[8]

- (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]