

OLLSCOIL NA hÉIREANN
The National University Of Ireland

NATIONAL UNIVERSITY OF IRELAND, GALWAY

SUMMER EXAMINATIONS 1999

FIRST YEAR COMPUTER SCIENCE EXAMINATION

[CS102]

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Time allowed: THREE hours
Answer at least one question from each section
Full marks for **six** questions
Use separate answer books for each section

SECTION A

- Q. 1.** (a) Convert the decimal number 104.65625 to binary form.
Explain what is meant by *Normalising* a binary number.
Using the number above as an example show how floating point numbers may be represented in computer memory.
- (b) Discuss how a frequency dependent coding (such as Huffman Coding) may be used to represent characters. Mention one advantage and one disadvantage of such a coding.
- Q. 2.** (a) Using truth tables, prove the following logical relationships:
- $$\overline{P \cdot Q} = \overline{P} + \overline{Q}$$
- $$P \cdot (Q + R) = (P \cdot Q) + (P \cdot R)$$
- (b) Construct a truth table for a *Half Adder* and draw an electronic circuit which implements a *Half Adder*. Show how a full adder can be constructed from two *Half Adders*.

- Q. 3.** (a) Discuss two of the following electronic circuits: multiplexor, data-latch, astable.
- (b) Explain the terms: micro-code, machine code, assembly language. Discuss what are meant by direct, indirect and indexed addressing.

SECTION B

- Q. 4.** (a) Explain the following: declaration, assignment, data type, header file, preprocessor command. Give an example of each.

- (b) Give examples to illustrate the differences

- (i) between & and &&
- (ii) between + and ++
- (iii) between = and ==

as they are used in C.

- (c) Given the declarations/initializations

```
int p = 1, q = -1, r = 4;
```

calculate the value of:

- (i) `p && (r + 4 * q)`
- (ii) `r *= (p + q)`
- (iii) `(p - -) - (- - q)`

- Q. 5.** (a) Explain the difference between local and global variables in C.
- (b) Write down the code for a function in C which will calculate the factorial $n! = n.(n-1)....3.2.1$ for a positive integer n using:
- (i) Recursion
 - (ii) Iteration
- (c) Compare recursion and iteration by listing some advantages/disadvantages of each.

- Q. 6.** (a) Write a C code fragment to calculate the product AB of the matrices

$$A = \begin{pmatrix} 2 & 1 \\ -1 & 0 \end{pmatrix} \quad B = \begin{pmatrix} -5 & 1 \\ 2 & 1 \end{pmatrix}$$

- (b) Explain what is meant by command line arguments. Write a short program which will detect its own name and print it on the screen.

SECTION C

- Q. 7.** (a) Illustrate and briefly describe the various layers of abstraction in a modern Computer System that make up the User/Computer interface. Describe the **two** main functions of an Operating System.
- (b) Network Architecture can be viewed as a series of layers or levels. What are the advantages of a layered approach to Networks? Briefly describe **one** Network Reference Model.
- (c) The terrestrial phone system is based on the use of twisted pair, coaxial and fibre optic cabling to carry and distribute information. Briefly describe these three transmission media and explain where they might be used in the phone system.

- Q. 8. (a) Discuss the order of precedence of the arithmetical operations
 $!, ^, *, /, +, -$
 in a typical Maple expression. What is the significance of the use of
 the brackets "(" and ")" in the Maple code for arithmetical operations?
 If a, b, c, d, and e are integers, state what rational number is
 represented by the following code:

$$(c - d/b) / a * e + b/c^2.$$

Write the Maple code which represents the following rational number

$$\frac{7^{32} - 6^{47}}{(2^{54} - 3^{41})^2}.$$

- (b) Consider the following sequence of Maple commands and state what
 you think the output will be:

```
f := x -> x^2 + 3*x + 1 ;
f(4);
D(f)(x);
solve(", x);
fsolve("", x);
```

- (c) Identify and correct any *six* errors in the following example of Maple
 code:

```
integrate(arcsin x + x^-2, y = 0 .. pi);
e :: x^3 + 2*x - 4 ::
fsolve(e, 0..4);
```

- Q. 9. (a) Based on your experience so far, compare and contrast the features of
 the windows interfaces of Maple and Mathcad.

- (b) You are to consider the problem of evaluating a simple polynomial
 expression

$$3x^5 + 6x^2 - 2$$

for x taking the values -2.0, -1.8, -1.6, ..., 1.6, 1.8, 2.0.

Explain how this can be achieved in both Maple and Mathcad, and
 state what code you would use in each case.

- (c) What does the acronym PSE stand for? Explain briefly. Discuss how
 either Maple or Mathcad can be viewed as a PSE.