

OLLSCOIL NA hÉIREANN, GAILLIMH
NATIONAL UNIVERSITY OF IRELAND, GALWAY

Summer Examinations 2000

First Year Industrial Engineering and Information Systems

First Year Management Engineering with Language

First Year Undenominated Engineering

IE109: Computing & Information Systems

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Prof. O'Kelly,
Dr. Sheil.

Attempt *five* questions.

Time allowed: **3 hours**

- Q1. (i)** List the **FORTRAN** arithmetic operators and state the precedence rules associated with them. [2 marks]

What is meant by *mixed mode* arithmetic? [2 marks]

Determine the output which would be produced by running the following program. [6 marks]

```
X1 = -1.0**2
X2 = 2/3*6.0
X3 = 1.0/4*4
PRINT*,X1,X2,X3
M = 5
N = 3
Z = N
X1 = M/N
Y = M
Z = N
X2 = Y/Z
X3 = M/Z*N
PRINT*,X1,X2,X3
I = M/Z*N+Y/Z-M/N*Z
PRINT*,I
STOP
END
```

- (ii) Describe the general functions performed by program statements belonging to each of the following statement groups/classes: *Arithmetic Assignment Statements, Specification Statements, Input/Output Statements, Format Statements*. [4 marks]

Write a short interactive program incorporating one or more statements from each of the above classes. State the task(s) which your program is intended to perform. [6 marks]

- Q2.** Write short definitive notes on each of the following: *top-down design, pseudocode, flowcharts*. [6 marks]

Why use a formal systematic approach to program development/testing? [2 marks]

List the key steps involved in one such program development procedure, which you have been introduced. [2 marks]

Illustrate this procedure by using it to develop a **FORTRAN 77** program to determine the sum to n terms of a geometric progression. Note: $s_n = \frac{a(1 - r^n)}{1 - r}$. [10 marks]

Q3. State the general form of the **DO** statement

[2 marks]

Derive the Newton-Raphson iterative equation:

[6 marks]

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)},$$

for solving the equation $f(x) = 0$.

Write a program which employs the the Newton-Raphson method to determine $\sqrt[3]{c}$, $c > 0$. Your program should request values for c and a starting value x_0 . It should then perform and print the results of 10 iterations.

[12 marks]

Q4. Describe briefly how arrays are named/declared in **FORTRAN 77** programs.

[4 marks]

Write a **FORTRAN** segment to:

- (a) prompt the user to enter any 10 decimal values,
- (b) sort these values into numerical order,
- (c) output the sorted values.

[16 marks]

Q5. Write a technical essay in which you describe the facilities which exist in **FORTRAN 77** for handling character data.

[20 marks]

Q6. What is meant by *modular programming*?

[2 marks]

Describe how *function subprograms* are written and used/called.

[4 marks]

Simpson's Rule is sometimes used to approximate the integral of a function over a fixed interval. This rule states that

$$\int_a^b f(x)dx \cong \frac{b-a}{6} \left\{ f(a) + 4f\left(\frac{a+b}{2}\right) + f(b) \right\}.$$

Write a **FORTRAN** segment which employs this approximation. You should assume that the function to be integrated is coded as the function subprogram **FUNCT(X)** and your code should include a prompt to the user to enter values for the integration limits.

[10 marks]

Specify the coding of **FUNCT(X)** when $f(x) = \ln|x^2|$.

[4 marks]

Q7. Differentiate between *direct* and *sequential* datafile access.

[4 marks]

The formatted disk datafile **PARTS.DAT** contains inventory information. Individual records are structured as follows:

<u>Field Contents</u>	<u>Datatype</u>	<u>Columns</u>
Part number	integer	1 - 5
Part Name	character	7 - 26
Unit Value	real	28 - 33
Quantity in Stock	integer	35 - 37

Write a **FORTRAN** program which accesses this file to produce:

- (i) a list of parts(numbers and names) for which stock level has fallen below 10;
- (ii) the total value of current stock.

Note: the **READ** statement used must contain an *end-of-file* argument. [16 marks]