

OLLSCOIL NA hÉIREANN, GAILLIMH
NATIONAL UNIVERSITY OF IRELAND, GALWAY

Summer Examinations 1999
First Year Industrial Engineering and Information Systems
First Year Undenominated Engineering

IE109: Computing & Information Systems

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Attempt *five* questions.

Time allowed: **3 hours**

Q1.

- (a) Which of the following are not valid **FORTRAN 77** constants - in each case state why not: **12,345 ; 12.345 ; \$123.45** [2 marks]

Identify which of the following strings cannot be used as standard **FORTRAN 77** variable names - in each case indicate why not:

X1; CIRCUMFERENCE ; DOLLAR; VOL. ; 2XY; F(X) [4 marks]

- (b) State the rule whereby the datatype of a numeric variable may be inferred from the variable's name. [1 mark]

The datatype of valid variable names may be explicitly defined by using *Type Declaration Statements*. Give the general forms of 3 such statements and in each case explain the effect achieved by using the statement. [6 marks]

- (c) List the **FORTRAN** arithmetic operators and state the precedence rules associated with them. [3 marks]

Why is it inadvisable to use mixed-mode arithmetic in assignment statements? [1 mark]
Show/describe how the ALU determines the value assigned to the integer variable **INC** below.

$$\text{INC} = 2.3 + 2/3 - 2*22/7*1.2**2$$
 [3 marks]

Q2.

List the **FORTRAN** *relational* and *logical* operators. [2 marks]

Differentiate between *logical-IF* and *Block-IF* statements/constructs. [2 marks]

Produce **FORTRAN** statements/code to perform the required steps in (i)-(v) below:

- (i) If **TIME** is greater than 5.0, increment **TIME** by 0.5. [1 mark]
(ii) If the difference between **VOLT1** and **VOLT2** is smaller than 6.0, print the values of **VOLT1** and **VOLT2**. [1 mark]
(iii) If the natural logarithm of **X**² is greater than or equal to 3.0, set **TIME** to zero and add **X** to **SUM**. [2 marks]
(iv) If **DIST** is less than 50.0 or **TIME** greater than 10.0, increment **TIME** by 1.0, otherwise increment **TIME** by 0.5. [2 marks]
(v) If **DIST** is greater than 100.0 increment **TIME** by 2.0, if **DIST** is between 50.0 and 100.0(incl.100.0) increment **TIME** by 1.0, otherwise increment **TIME** by 0.5 [2 marks]

Write a **FORTRAN 77** code to accept (from the keyboard), four marks in the range 0-100, for an examination candidate. Your program should then compute the average mark and print a 'Fail', 'Pass', or 'Honours' result, depending on whether the average is less than 40, ≥ 40 but less than 60, or ≥ 60 respectively, but subject to the following two restrictions:
- a candidate with one(or more) marks less than 30, fails; - a candidate with an average mark of 60 or more, but with one(or more) marks less than 40 gets a 'Pass' result. [8 marks]

Q3.

- (a) An employee is paid a basic hourly rate for the first 40 hours and a higher 'overtime' rate for any additional hours worked. A program must be written to accept appropriate input and to output the corresponding (gross) pay for the employee. As a first step, the algorithm to be employed must be detailed in the form of a *flowchart*.

Prepare this flowchart. [NOTE: do not detail the program code] [8 marks]

- (b) What does the term *Top-Down Design* mean to you. [2 marks]

Show how you would use this approach to develop an algorithm for determining the roots of any quadratic equation. [4 marks]

Now use *pseudocode* to detail the algorithm [6 marks]

Q4.

Explain briefly, the role performed by **FORMAT** statements. [3 marks]

Distinguish, in general terms, between

- (i) numeric field descriptors,
- (ii) edit/position descriptors. [2 marks]

List and explain the general forms of three descriptors from each of these classes. [6 marks]

The following segment tabulates $f(x) = x/(x + 1)$, for a series of values between 1 and 10.

```
WRITE(6,100)
DO 10 X = 1.0, 10.0, 0.5
    Y = X/(X+1.0)
    WRITE(6,101)X,Y
10  CONTINUE
    WRITE(6,102)
100  FORMAT(...)
101  FORMAT(...)
102  FORMAT(...)
```

Complete the coding of the **FORMAT** statements above, so that the output is centered on the user's screen and appears exactly as follows:

```
*****
      f(1.0) = 0.500
      f(1.5) = 0.600
           etc.
           .
           .
           etc.
*****
```

[9 marks]

Table 2: $f(x) = x/(x+1)$.