THE OPEN UNIVERSITY OF SRI LANKA
B.Sc/B.Ed Degree Programme/Continuing Education Programme
APPLIED MATHEMATICS - LEVEL 04
PCU2140/PCE4140 – Computing for Scientific Studies using FORTRAN
FINAL EXAMINATION 2012/2013

DURATION: TWO HOURS.

DATE: 06.12.2013	TIME: 1.30pm - 3.30pm

Answer **ALL** Questions **in Section A** and **only TWO** questions **in Section B.**
Marks allocation: **40** marks for **Section A** and **60** marks for **Section B.**

Non programmable calculators are permitted.

SECTION A

Answer all questions in this section.

1. State whether each of the following is acceptable as an integer variable, a real variable or neither. If you decide as the last category, give reasons.

    a) ID-NO   b) AGE   c) OWNER   d) PROFIT   e) YEAR*

2. The only type declaration statement a program has is
    IMPLICIT CHARACTER*7 (A-E), CHARACTER*4 (M)
    In the above program, state whether the name MALINDA can be assigned for the variable name given in each case or not. If not, give reasons.

    a) ANNUAL   b) EXAM1   c) MASS   d) CREDIT1   e) MONTH

3. Write down FORTRAN expressions for each of the following mathematical expressions given in the usual notation.

    a) $\sqrt{2xy} + x^2$ b) $\log_{10}(|xy| - x)$ c) $\sin(ax + b) + x$ d) $(4 + x^2)/x$

    e) $\dfrac{(x + y)}{(x - y)}$

4. Write down equivalent mathematical expressions for the following FORTRAN expressions.

    a) (2*FLOAT(X-3))**2   b) 2.0/X+X/Y   c) (2.0+X/Y)**(X)

    d) ATAN(X)-(X+Y)   e) (X*Y)**3+2/X

5. A program has the following statements. State whether in each of the computations labelled (a) to (d) assigns the correct value for the GRADE.

INTEGER GRADE
REAL A, B
A = 8.0
B = 2.5

a) GRADE = A+B
b) GRADE = A-B
c) GRADE = AxB
d) GRADE A/B

6. A program has the following statements. State whether each of the statements labelled as (a), (b),(c),(d),(e),(f),(g) is correct or not. If the statement is not correct, state how you would correct it.

```
        INTEGER  SUM, CREDIT
        REAL GPA

        (a) SUM = 0.0
        (b) READ *,CREDIT
        (c) IF (CREDIT .LE. 0)  THEN PRINT*, 'WRONG INPUT'
        (d) DO 10 I=1,9,2
        (e) PRINT*,'SUM IS',SUM
        (f)  SUM = SUM+CREDIT
10      CONTINUE
        (g) GPA=SUM/4
11      STOP
        END
```

7. A program has the following statements. Write down the values assigned for the variables labelled X1,X2,X3,X4 and X5. If no value is assigned due to an error in the statement, clearly state what the error is.

```
        INTEGER I,J,K,SUM,X2,X3
        REAL A,TEMP,X1,X4,X5
        A=6.8
        TEMP = 20.0
        I=3
        J=I+1
        K=J+1
        X1=FLOAT*I
        X2=J/A
        X3=NINT(A)
        X4=INT(A)/A+TEMP
        X5=2.0*REAL(I)
        STOP
        END
```

8. Assuming that A, B and C are logical variables determine the values of the following logical expressions for all possible values of A, B and C.
   - a) (A . AND. B) .OR. C
   - b) .NOT.A .AND. ,NOT.B
   - c) (A .AND. B). OR. (.B.AND.C)
   - d) (A .OR. B) .OR.(A .OR. C)
   - e) .NOT. ((A .OR. B) .AND. C)

9. Let A, B, C be real variables and I be an integer variable. Write FORTRAN statements to execute the following instructions.
   - a) If the value of A is greater than the value of B, print the error message that " the input values are wrong".
   - b) To assign the square of the value of A divided by the value of B to the variable C.
   - c) To add 5 to A and then divide by B and assign the answer to the variable C.
   - d) To assign the absolute value of the difference between A and B to the variable C.

10. An input line contains the following data, starting from column 1.
    10010234
    Write statements needed to read this line of data and make the assignments given in each of the following statements.

    - a) input the value 10010 to the variable M and the value 23.4 to the variable I.
    - b) input the value 100.102 to the variable B and the value 34 to the variable J.
    - c) input the value 10010 to the variable K and the value 2.34 to the variable Y.

3

SECTION B

Answer any TWO questions from this section

1. A researcher collected information on the student identification number, day school attendance and the final mark of each student offering a mathematics course, Student identification number is a record with three digits. Day school attendance is a record with 1 digit with codes 1, 2 and 3 representing the categories of no attendance, poor attendance and fairly good attendance respectively. The mark for the course is an integer ranging from 0 to 100 with 0 recorded as 000, 1 recorded as 001 etc. The information on the three variables is recorded in a data file as a number with 7 digits with first three digits standing for the identification number, fourth digit representing the category for day school attendance and the last three digits representing the final mark for the course. As an example, the second column of the following table gives the data records for two students which are as described in the third column.

| Example | Data record | Description of the data | | |
		Identification number	Attendance	Final mark
1.	0012014	001	Poor	14
2	0373099	037	Fairly good	99

Suppose the data file has 250 rows representing the records of 250 students.

Write a FORTRAN program to read the data and to compute the average marks of students belonging to the three categories of day school attendance.

2. A student had to find the largest element of a 3x3 matrix in an intermediate step in solving a problem. Write a FORTRAN programme to carry out the following three instructions.

   1. Read the nine elements and store in a matrix called A.

   2. Find the row number and the column number and the value of the largest element in A.

   3. Multiply the absolute value of the largest element by ten and assign the value to the variable called Y.

3. Write a FORTRAN program to compute the following four partial sums and print each one of them together with the identification number. The program should be written in general terms so that by a simple change in the input values we should be able to use the program to compute the partial sum for any identification number n. If the value of any of the sums is greater than 0.5, the program should also print the corresponding identification number and the statement that "the sum is greater than 0.5".

Identification number	partial sum
1	$1 - \dfrac{1}{2}$
2	$1 - \dfrac{1}{2} + \dfrac{1}{4}$
3	$1 - \dfrac{1}{2} + \dfrac{1}{4} - \dfrac{1}{8}$
4	$1 - \dfrac{1}{2} + \dfrac{1}{4} - \dfrac{1}{8} + \dfrac{1}{16}$

4. The marks of 100 students with identification numbers from 1 to 100 for two tests called OBT and NBT are to be stored separately into two arrays labelled OBT and NBT such that the element at the position k in each array gives the mark of the student with identification number k for the corresponding test.

Write a FORTRAN program to carry out the following three instructions.

1. Store the data in a 100X3 matrix labelled MARKS such that the first column gives the identification number, the second and third columns gives the marks for the OBT and the NBT respectively.

2. Compute the value of the variable called CAM by taking the weighted average of marks of OBT and NBT with a weight of 0.6 for the best mark out of the two and 0.4 for the other.

3. Print the student identification number, OBT mark, NBT mark and CAM for the 100 students.

5