

THE OPEN UNIVERSITY OF SRI LANKA

B.Sc. DEGREE PROGRAMME 2007/2008



* FINAL EXAMINATION 2008

PSU 2180 / PSE 4180 COMPUTING FOR SCIENTIFIC STUDIES USING 011
FORTRAN

DURATION : TWO & HALF HOURS (2 1/2 HR)

Date : 08 - 07 - 2008

Time : 1.30 pm - 4.00 pm

Answer ALL Questions in Section A and only THREE Questions in Section B

SECTION A

(Total marks for SECTION A is 40)

1. Which of the following are acceptable as integer variables, real variables or neither? Give reasons for the last category.

(a) P/Q (b) LIMA (c) SEN (d) ACB34Y (e) GB^Q

2. Write the following as Fortran real constants in standard exponential form

(a) 34,333 (b) -4.0×10^{-4} (c) -0.354 (d) 0.000078
(e) 3×10^8

3. Write a FORTRAN expression corresponding to each of the following mathematical expressions

(a) $\sqrt{\frac{a}{(b+c)^2}} - z$ (b) $\frac{\frac{a}{b} + c}{a + \sqrt{\frac{b+d}{c}}} x$ (c) $(1 + a/b)^{\frac{1}{2}} - \frac{ub}{c} + d^3$

(d) $5 - 2e^x + \ln y$ (e) $\sqrt{(a^2 + b^2 - 2ab \sin \theta)} + \sqrt{\frac{pq \tan \theta}{r}}$

4. Write an equivalent algebraic expression for each of the following FORTRAN expressions

(a) $P = \sin(X + (Y ** 2)/Z)$ (b) $R = 5.0 * \log(X + Y) + (X + Z) ** 1.5$
(c) $\exp(A) - R/S + \cos(A + R/S)$ (d) $\text{MOD}(A, B) + \text{ABS}((A - B)/C * D)$
(e) $\text{SQRT}(X ** 2/Z ** 2 + A) + A * \sin(C)$

5. Using FORTRAN intrinsic functions write a single statement to perform the following

(a) Let X equal to the inverse trigonometric sine of Y
(b) Let X equal to the integer part of Y
(c) Let X equal to the remainder when A is divided by B
(d) Let Y equal to absolute value of the maximum of A, B, C
(e) Let Z equal to the minimum of A, B, C, D and E

6. Rewrite the following procedure so that it uses no GO TO statement
- ```

 IF (X.GE.1) GO TO 20
 Y = 1.786*X + 1.0
 GO TO 100
20 IF (X.GE.2) GO TO 30
 Y = 4.67*X - 1.679
 GO TO 100
30 IF (X.GE.3) GO TO 40
 Y = 12.689*X - 18.076
 GO TO 100
40 IF (X.GE.4) GO TO 50
 Y = 34.567*X - 83.453
 GO TO 100
50 Y = 93.815*X - 32.097
100 CONTINUE

```
7. An input line contains the following data, starting from column 1  
123bbbb456bbb-789  
where b represents a blank space.  
The line is read by the following statement  
READ (\*,5, END = 200) A, B, C  
For each of the following FORMAT statements what values are stored for A, B,  
and C?
- 5 FORMAT (I6, 2F6.0).
  - 5 FORMAT(F5.2, I6, F6.3)
  - 5 FORMAT(F7.4, F6.4, F5.0)
  - 5 FORMAT(F5.4, 1X, F4.2, 2X, F5.1)
8. What is wrong with the following subroutine calls to subroutine CALC?
- CALL CALC(2,5.63,ANSWER)
  - CALL CALC(2.,5.63,NUM)
  - CALL CALC(2.0\*5.63,VALUE)
  - CALL CALC(2.0,5.63,3.7)
- ```

SUBROUTINE CALC(X,Y,Z)
Z = SQRT(X*X + Y*Y)
RETURN
END

```
9. Write FORTRAN statements for the following instructions
- If A equals B read a new value for A, otherwise write the value of A
 - If X is at least 0.001 but less than 0.1, set N equal to -4
 - If INPUT is negative read a new value of INPUT and repeat this step
 - While M is greater than N multiply N by M

10. Find the output of the following program

```

REAL A, B, C, D, E
  A = 100.0
  B = 25.0
  C = 120.0
D = PROD(A,B,C)
CALL SQAVE(A,B,C,E)
PRINT*, A,B,C,D,E
STOP
END
FUNCTION PROD(A,B,C)
  REAL A,B,C
  PROD = A*B*C
  RETURN
END
SUBROUTINE SQAVE(X,Y,Z,P)
  REAL X,Y,Z,P,SU
  SU = X**2 + Y**2 + Z**2
  P = SU/5.0
  RETURN
END

```

SECTION B

Answer Any THREE Questions.

(20 marks will be allocated to each question in Section B)

1. (a) Write a program to evaluate the square root of a number using the formula $B = 1/2 (X/A + A)$ where B is a better approximation to the square root of X than A. The first approximation should be taken as $X/2$ and the procedure should be repeated until the difference between A and B is less than 10^{-8} .
- (b) Write a program which reads a year and determines whether it is a leap year. Print out an appropriate message indicating whether the year input is or is not a leap year.
(If a year is a leap year the number must be divisible by 400 or 4 exactly provided it is not also divisible by 100)
2. Write a program which reads examination marks of 100 students for 4 different subjects into an array of 4 columns and 100 rows. Your program should also facilitate to find out how many of the marks are GRADE A (> 70%), how many are GRADE B (60% – 69%), how many are GRADE C (50% – 59%), how many are GRADE D (40% – 49%) and how many are failures (< 40%) for each of the subject. Print the results and draw a flowchart before programming.

3. In a garment store every time a sale of an item made a record is created in a computer data file with the amount of sale and the item. The item is identified by a code and the code is as follows:
- 1 = sale of a children's wear 2 = sale of a ladies' wear
3 = sale of a men's wear
- Write a program to compute the total sale of items in a given day and the balance of each item in the store (Assume that the total number of each item available in the store is known at the start of the day)
4. Write a program which reads in a date as 3 integers (day, month and year) and computes the day three weeks from this date.
(Set up an array dimensioned with 12 elements which holds the number of days in each month)
5. (a) Write a subroutine that takes two one-dimensional integer arrays each of different sizes as specified by integer arguments and produces a resultant array comprising all the input values in numerical order. The subroutine should also return the size of the output array. It may be assumed that the input arrays are already sorted into numerical order. The output array should not contain the same value twice.
(b) Show how this subroutine can be called from a main program that reads the two arrays in and prints out the results.
(c) Show how the subroutine can be used repeatedly with a main program that merges n arrays (where n is read in as data)