

THE OPEN UNIVERSITY OF SRI LANKA

B.Sc. DEGREE PROGRAMME 2006/2007

FINAL EXAMINATION 2007

PSU 2180 / PSE 4180 COMPUTING FOR SCIENTIFIC STUDIES USING  
FORTRAN

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



041

Date : 29 - 06 - 2007

Time : 2.00 pm - 4.30 pm

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

### SECTION A

Total marks for SECTION A is 40

- Which of the following are acceptable as integer variables, real variables or neither? Give reasons for the last category.  
(a) A78B (b) A+78B (c) NIM (d) &BCD (e) COV\_E
- Write the following as correct FORTRAN constants or statements  
(a) 34,333 (b)  $-4.0 \times 10^{-4}$  (c) 4E-2 (d) 4.5E+2.5  
(e) N = 12.6E+02
- Write a FORTRAN expression corresponding to each of the following mathematical expressions  
(a)  $5x^2y - 6xy - 8$  (b)  $\frac{\frac{a}{b} + c}{a + \sqrt{\frac{b+d}{c}}} x$  (c)  $(1 + a/b)^{\frac{n}{2}}$   
(d)  $e^x + \log_{10} y$  (e)  $\sqrt{a^2 + b^2 + 2ab \cos \theta}$
- Write an equivalent algebraic expression for each of the following FORTRAN expressions  
(a)  $(X + (Y ** 2) / Z)$  (b)  $\text{LOG}(X + Y) + Z * 3$  (c)  $\text{EXP}(A - B) - C / D ** 3$   
(d)  $\text{ABS}((A - B) / C * D)$  (e)  $\text{SQRT}(X ** 2 / Z ** 2 + A) + A * \text{SIN}(C)$
- Using FORTRAN intrinsic functions write a single statement to perform the following  
(a) Let N equal to the nearest integer of Y  
(b) Let X equal to the nearest integer of Y  
(c) Let X equal to the remainder when A is divided by B  
(d) Let Y equal to square root of 3245  
(e) Let Z equal to the minimum of A, B, C, D and E

6. Assume that you have a program in which the following declarations and data statements appear

```

INTEGER COLOR, LIME, STRAW, YELLOW, RED, ORANGE
REAL BLACK, WHITE, GREEN, BLUE, PURPLE, CRAYON
COLOR = 2
BLACK = 2.5
CRAYON = -1.3
STRAW = 1
RED = -3
PURPLE = 0.3E1

```

For each of the following statements determine the value assigned

- (a)  $WHITE = COLOR * 2.5 / PURPLE$
- (b)  $GREEN = COLOR / PURPLE$
- (c)  $BLUE = (COLOR + STRAW) / (CRAYON) + 0.3$
- (d)  $LIME = PURPLE ** COLOR + RED / CRAYON$
- (e)  $YELLOW = 1.0 * STRAW / COLOR + 0.5$

7. An input line contains the following data, starting from column 1  
34678-2789+908765432

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?

- (a) 5 FORMAT (2F5.0, F10.4)
- (b) 5 FORMAT(F5.2, I6, F10.3)
- (c) 5 FORMAT(F5.4, 6X, F10.9)
- (d) 5 FORMAT(F5.4, 1X, F4.2, 2X, F5.1)
- (e) 5 FORMAT(2X, I3, 7X, 2I4)

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.OR.NOT.B
- (b) .NOT.(A.AND.B)
- (c) A.AND.(B.OR.C)
- (d) .NOT.A.OR.NOT.B

9. Write FORTRAN statements for the following instructions

- (a) A is less than each of X, Y, Z
- (b) X is between A and B (where A is not necessarily less than B)
- (c) X is not between A and B
- (d) If X is between 1 and 10 set N equal to 100, if X is more than 10 but not more than 20 set N equal to 200, otherwise set N equal to 0

10. Let  $X = 10.0$ ,  $START = 3.0$  and  $YNEW = 0.0$  as shown in the program below. What will be the value of  $YNEW$  as printed by the program? Show the calculation for all the intermediate steps and keep the accuracy of the calculation to 4 decimal places.

```

REAL X, Y, YNEW, START, ERRLIM
PARAMETER (ERRLIM = 0.001)
X = 10.0
START = 3.0
Y = START
YNEW = (Y + X/Y)/2.0
  DO 10 I = 1, 2
    IF (ABS(YNEW - Y).GT. ERRLIM) THEN
      Y = YNEW
      YNEW = (Y + X/Y)/2.0
    END IF
  10 CONTINUE
STOP
END

```

### SECTION B

Answer any **THREE** Questions.

1. (a) Write a FORTRAN program to read the lengths  $a$ ,  $b$ , and  $c$  of the sides of a triangle and compute the area  $A$  of the triangle using
 
$$A = \sqrt{s(s-a)(s-b)(s-c)} \text{ where } s = \frac{a+b+c}{2}$$
- (b) The formula for the velocity of a body dropped from rest is  $v = gt$  where  $g = 9.81 \text{ m/s}^2$  is the acceleration due to gravity and  $t$  is time. Write a program to calculate  $v$  at 10s intervals (starting with  $t = 0$ ) for a tennis ball dropped from a building that is 600m tall. Use the formula  $t = \sqrt{2s/g}$  to determine the total time (where  $s = 600 \text{ m}$ ) and limit your time accordingly. Your program should print a table of values for  $t$  and  $v$ .
2. Draw a flow chart and write a FORTRAN program for the following problem. You are given marks of students in a given course. You are to compute the average of these marks and then assign grades to each student according to the following rule.
 

If a student's mark  $M$  is within 10 points above or below of the average, assign the student a grade of SATISFACTORY. If  $M$  is more than 10 points higher than the average, assign the student a grade of OUTSTANDING. If  $M$  is more than 10 points below the average, assign the student a grade of UNSATISFACTORY. The output from your program should consist of a labeled 3-column list containing the name, exam mark and grade of each student.

3. Suppose a data file contains ID numbers (5 digits) and names (last name first and initials) of students in a given course unit. Write a FORTRAN program to read this data file and sort it according to the ascending order of students' ID numbers and print the sorted data.

4. The character values for Roman numerals are

M	1000
D	500
C	100
L	50
X	10
V	5
I	1

Write a FORTRAN program to read in an integer and print the integer and its Roman numeral representation.

5. (a) Write a function subprogram ROUND which, given a real number X and an integer P, will return the value of X rounded to the nearest P decimal places. (E.g. If X = 350.1253, then ROUND (X,2) will return the value 350.13)
- (b) Assume the existence of a main program containing a call to a subroutine SEARCH:

CALL SEARCH (BUFFER, N, KEY, FOUND, INDEX)

Write a subroutine SEARCH to compare each of the N elements in the integer array BUFFER to the data item in KEY. If a match is found, SEARCH is to set logical variable FOUND to true and set INDEX to be the index of the element in the array BUFFER. If no KEY is found FOUND is to be set false and INDEX is set to be 0.

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