Range Forest Officer (Main / Written) Examination, 2021

COMPUTER SCIENCE / APPLICATIONS

Time Allowed: Three Hours | Maximum Marks: 200

Question Paper Specific Instructions

Please read each of the following instructions carefully before attempting questions:

1. There are 08 (eight) questions in all, out of which FIVE are to be attempted.
2. Question Nos.1 and 5 are compulsory. Out of the remaining SIX questions, THREE are to be attempted selecting at least ONE question from each of the two Sections I and II.
3. Answers must be written in legible handwriting. Each part of the question must be answered in sequence and in the same continuation.
4. All questions carry equal marks. The number of marks carried by a question / part is indicated against it.
5. Attempts of questions shall be counted in sequential order. Unless struck off, attempt of a question shall be counted even if attempted partly. Any page or portion of the page left blank in the Answer Booklet must be clearly struck off.
6. Unless otherwise mentioned, symbols and notations have their usual standard meanings. Assume suitable data, if necessary and indicate the same clearly.
7. Re-evaluation / Re-checking of answer book is not allowed.

SECTION-I

1. (a) Find the value of X in the following: (8)

   (i) $(110100)_2 = (X)_{10}$

   (ii) $(1001)_{10} = (X)_2$

   (iii) $(10010100)_2 = (X)_8$

   (iv) $(24.08)_{10} = (X)_2$

   (b) Considering two inputs A and B, write the truth tables for (8)

   (i) A XOR NOT(B)

   (ii) NOT(A) AND NOT(B)

   (c) Discuss any four components of a computer system in brief. (8)

(d) Discuss the attributes of a software product in brief. (8)

(e) Discuss any four hardware components required for the computer networks. (8)

2. (a) Discuss R-S flip-flop and provide its block as well as circuit diagram. Also provide its truth table. (20)

(b) Write an algorithm for finding the largest integer of a given set of integers and also write its program in any language known to you. Apply it on the following data: (20)

2, 18, 7, 21, 5, 12, 9, 11, 43, 13

3. (a) What are the functions of data link layer? Discuss the HDLC and PPP protocols by giving their structures. (20)

(b) Design a B-tree of order 4 for the following data: (20)

6, 3, 23, 9, 10, 13, 2, 7, 4, 12, 14, 8

4. (a) Why do you need the control structures? Write a program to multiply two matrices and apply it to multiply the following matrices A and B: (20)

$$A = \begin{bmatrix} 2 & 5 \\ 6 & -7 \\ -1 & 0 \end{bmatrix} \qquad B = \begin{bmatrix} -1 & 8 \\ 0 & 6 \\ 11 & -2 \end{bmatrix}$$

(b) What do you mean by disk-access time management or disk arm scheduling? Discuss any five disk scheduling policies. (20)

SECTION-II

5. (a) Define the universal Turing machine and how is it related to computation? Discuss in brief. (8)

(b) Prove that a uniform scaling ($s_x = s_y$) and a rotation form a commutative pair of operations but that, in general, scaling and rotation are not commutative operations. (8)

(c) For given system of linear equations AX = B, where A is a square coefficient matrix, B is right hand side vector, X is unknown vector, discuss its solution for different values of *det*(A), i.e., positive, negative and zero. In case A is not a square matrix, what will happen to the solution? (8)

(d) What are the components used in estimating the software cost? Discuss in brief. (8)

(e) Why do you need symbol table and how are the keywords handled in compiler design? Discuss in brief. (8)

6. (a) Discuss the midpoint circle drawing algorithm for a circle centered at an arbitrary point and apply it to draw the circle: $(x - 2)^2 + (y + 1)^2 = 9$. (20)

(b) Discuss different types of knowledge and their representation. (20)

7. (a) What are the factors that affect software costing? Discuss the software cost estimating techniques. (20)

(b) What is Boyce Codd Normal Form (BCNF) in databases? Let the employees in a company work in more than one department. The company maintains the employees' data as shown in the following table: EMPLOYEE-DETAILS. EMP_ID denotes employee's identity, EMP_STATE refers to employee native state, EMP_DEPT refers to the employee's parent department, DEPT_TYPE refers to department type and DEPT_NO_OF_EMP refers department numbers in which an employee works. Convert this table into BCNF. You can use the following information: (20)

Functional dependencies:

EMP_ID -> EMP_STATE

EMP_DEPT -> {DEPT_TYPE, DEPT_NO_OF_EMP}

Candidate key: {EMP_ID, EMP_DEPT}

EMPLOYEE-DETAILS

EMP_ID	*EMP_STATE*	*EMP_DEPT*	*DEPT_TYPE*	*DEPT_NO_OF_EMP*
10	Maharashtra	Finance	D010	N20
10	Maharashtra	Administration	D010	N25
11	Punjab	Production	D015	N10
11	Punjab	Development	D015	N15

8. (a) Consider the language L over {a, b} that contains strings whose lengths are from the arithmetic progression P = {2, 5, 8, 11, . . .} = {2 + 3n | n≥ 0}. That is, L = {x ϵ{a, b}*such that length(x) ϵ P}. Construct a DFA accepting L. (20)

(b) Solve the following initial value differential equation: dy/dx = -2xy, y(0) = 1 with spacing between points h = 0.2 on the interval [0, 1] using the fourth order classical Runge-Kutta method. (20)