

2021

COMPUTER SCIENCE

PAPER-I

Time Allowed — 3 Hours

Full Marks — 200

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answers may be given either in English or in Bengali but all answers must be in one and same language.

Answer Question No. 8 and any six questions from the rest.

1. (a) What is divide-and-conquer recurrence relation? Give a divide-and-conquer recurrence relation for binary search for an element in a search sequence of size n . 5+10=15
 (b) What are meant by $O(n)$ and $\Omega(n)$? Prove that if $f(n) = a_m \cdot n^m + a_{m-1} \cdot n^{m-1} + \dots + a_1 \cdot n + a_0$, then $f(n) = O(n^m)$.
 Check whether $n \in \Omega(n^2)$ or not. 5+5=15

2. (a) State Trapezoidal rule. Also obtain the error formula. Why is it called Trapezoidal rule? 5+10=15
 (b) Find the inverse of the co-efficient matrix of the system $\begin{bmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 1 \\ 6 \\ 4 \end{bmatrix}$ by the Gauss-Jordan method with partial pivoting and hence solve the system. 15

3. (a) Describe a full-adder. Give its truth table. Implement it with 2-input NAND gates. 15
 (b) State and prove De Morgan's Laws. Explain how an OR gate may be constructed with AND and NOT gates. 15

4. (a) State and explain
 (i) Kirchhoff's laws,
 (ii) Thevenin's Theorem. 15
 (b) When a circuit is called resonant? Find expression for series-resonant and parallel-resonant circuits. 15

5. (a) Define Recursion. Write a recursive algorithm for obtaining terms of a Fibonacci sequence F. 10
 (b) What is a binary tree? What do you mean by in-order, pre-order and post-order traversals? Explain. Given below the in-order and pre-order traversal strings of a binary tree, reconstruct the binary tree.
 In-order sequence D G B H E A F I C
 Pre-order sequence A B D G E H C F I 8+8+4=20

6. (a) A manufacturer produces two types of models M_1 and M_2 . Each M_1 model requires 4 hours of grinding and 2 hours of polishing, whereas each M_2 model requires 2 hours of grinding and 5 hours of polishing. The manufacturer has 2 grinders and 3 polishers. Each grinder works for 40 hours a week and each polisher works for 60 hours a week. Profit on an M_1 model is Rs. 3.00 and on an M_2 model is Rs. 4.00. Whatever is produced in a week is sold in the market. How should the manufacturer allocate his production capacity to the two types of models so that he may make maximum profit in a week? Formulate Mathematically. 20
- (b) Solve graphically the following L.P.P.
Maximize $z = 3x_1 + 2x_2$
Subject to the constraints $-2x_1 + x_2 \leq 1$
 $x_1 \leq 2$
 $x_1 + x_2 \leq 3$
 $x_1, x_2 \geq 0$ 10
7. (a) With the aid of diagrams, explain the meaning of the following operational modes of a communication channel.
(i) simplex (ii) half-duplex (iii) duplex (iv) broadcast (v) multicast (vi) asymmetric and symmetric 20
- (b) Explain what is meant by the term 'data transparency' and how it may be achieved using
(i) character stuffing,
(ii) bit stuffing. 4+3+3=10
8. Write short notes on (any two): 10×2=20
- (a) Simplex Method
(b) Karnaugh Map Method
(c) Newton-Raphson's Method
(d) Reciprocity theorem
(e) Modeme

For Classroom / Online guidance / coaching of WBCS Prelims , Main Exam by experts and officers and Interview by IAS / WBCS Gr A Officers/ Toppers, WBCS Prelims and Main Mock Test (Classroom & Online), Optional Subjects, Studymaterials, Correspondence Course etc. Call WBCSMadeEasy™ at Toll Free no 1800 572 9282 or 8274048710 Or 9674493673 or mail us at mailus@wbcsmadeeasy.in (Our centers as of now - College Street 8585843673, Garia/ HO 8274048710, Siliguri - 9051265991. Medinipur 8274972589)