

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.Sc. SECOND SEMESTER EXAMINATION, MAY 2015

FIRST YEAR

COMPUTER SCIENCE (Honours)

Paper : II

Date : 21/05/2015

Time : 11 am – 2 pm

Full Marks : 75

[Use a separate Answer Book for each group]

Group – A

Answer **any one** questions from the following :

(1 × 5)

1. Suppose DATA is a sorted array with N elements and ITEM is a given value to be searched from DATA. Write an algorithm for executing binary search over DATA to find the location of ITEM in DATA or inserts ITEM in its proper place in DATA if it is not present. (5)
2. a) “Quick sort algorithm is not stable” – Justify. (2)
b) Compare Bubble sort and insertion sort in terms of their time complexities. (3)

Answer **any three** questions of the following :

[3×10]

3. a) Design a data representation, sequential mapping of n data elements in an array v (1:n) is supplied. n_1 of these data elements are maintained in stack and the remaining $n_2 = n - n_1$ elements are maintained in Queue. Write the algorithm for the above scenario. (7)
b) What are the problems in evaluating an infix expression? What can be the possible solutions? (1 + 2)
4. a) Consider X and Y as two strings. The characters of the strings are the elements of two singly linked list respectively. Suggest an algorithm to find the first character of string X that is not present in the string Y. (4)
b) Let P be a problem and I & R be two algorithmic solution in which first one is non recursive & second one is recursive. Which solution will you choose and why? Consider all possible cases. (3)
c) Given a linked list of integers of odd length. Give an algorithm to extract the content of the middle node of this given list. (3)
5. a) Suppose $a[n][m]$ be a two dimensional array having n number of rows and m number of columns. Establish an address calculation formulae to compute the location of $a[i][j]$ using row-major order. (5)
b) Design an ADT for Integer. (5)
6. a) Consider the following arithmetic expression P, written in postfix notation: (4)
P: 12, 7, 3, -, /, 2, 1, 5, +, *, -
Use the proper algorithm to evaluate the postfix expression.
b) State the disadvantages of link list. How can we insert an element in a circular double linked list in $O(1)$ time? (2+4)
7. a) Sort the following array using a stable non-comparison based sorting algorithm. (5)
6, 0, 2, 0, 1, 3, 4
Give proper illustration in support of your answer.
b) Derive the expression for average case complexity of binary search algorithm. (4)
c) What do you mean by inversion? (1)

Group – B

Answer **any four** questions of the following :

[4×10]

8. a) If h is very small, prove that $\Delta^{n+1} f(x_0) \approx h^{n+1} f^{(n+1)}(x_0)$ (3)

b) Find $f(x)$ and hence find $f(6)$ from the following table: (3+1)

x	0	1	2	3	4	5
$f(x)$	41	43	47	53	61	71

c) What do you mean by interpolation? In which case should we use Newton's Forwards Interpolation? (1+2)

9. a) Evaluate $y = e^{2x}$ for $x = 0.37$ using appropriate interpolation formula from given following table: (4)

x	0.00	0.10	0.20	0.30	0.40
$y = e^{2x}$	1.000	1.2214	1.4918	1.8221	2.2255

b) Give the geometrical interpretation of Simpson's $1/3$ rd rule. (3)

c) Compute the positive root of the equation $x^3 - 9x + 1 = 0$, lying between 2 and 3, by the bisection method, correct to two decimal places. (3)

10. a) Explain the Newton-Raphson Method with geometrical interpretation. (3)

Find also condition for convergency of this method. (2)

b) Give $\frac{dy}{dx} = 1 - \frac{y}{x}$ when $y(2) = 2$, compute $y(2.1)$, by Euler's Modified method, correct up to four decimal places, taking $h = 0.05$. (5)

11. a) Solve the following system of equations by Gauss-Seidel iteration method correct up to 3 significant figures. (5)

$$x_1 + x_2 + 4x_3 = 9$$

$$8x_1 - 3x_2 + 2x_3 = 20$$

$$4x_1 + 11x_2 - x_3 = 33$$

b) What do you mean by basis? Explain with example. (2)

c) Solve the following L.P.P. graphically – (3)

$$\text{Maximize } Z = 3x_1 + 4x_2$$

$$\text{Subject to } x_1 - x_2 \geq 0,$$

$$-x_1 + 3x_2 \leq 3,$$

$$\text{and } x_1, x_2 \geq 0$$

12. a) Find initial basic feasible solution to the following transportation problem using Vogel's Approximation method. (5+2)

	W_1	W_2	W_3	W_4	Availability
F_1	19	30	50	10	7
F_2	70	30	40	60	9
F_3	40	8	70	20	18
Requirements	5	8	7	14	

Also check whether the solution is optimal, otherwise find the optimal basic feasible solution.

b) Three persons are being considered for three open positions. Each person has been given a rating for each position as shown in the following table: (3)

(2)

		Position		
		I	II	III
Person	1	7	5	6
	2	8	4	6
	3	9	6	4

Find the optimal assignments that the sum of ratings for all three persons be maximum.

13. a) Reduce the following linear programming problem in a standard maximization form (4)

$$\text{Minimize } Z = 2x_1 - 3x_2 + 5x_3$$

$$\text{Subject to } x_1 + x_2 + 6x_3 \leq 45,$$

$$4x_1 + 3x_2 = 20,$$

$$|2x_2 + 3x_3| \leq 75,$$

$$x_1, x_2 \geq 0 \text{ and } x_3 \text{ unrestricted in sign.}$$

b) Use two phase method to solve the following (6)

$$\text{L.P.P. Maximize: } Z = 3x_1 - x_2$$

$$\text{Subject to: } 2x_1 + x_2 \geq 2,$$

$$x_1 + 3x_2 \leq 2,$$

$$x_1 \leq 4$$

$$\text{and } x_1, x_2 \geq 0$$

