

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. SECOND SEMESTER EXAMINATION, MAY 2016

FIRST YEAR [BATCH 2015-18]

COMPUTER SCIENCE (Honours)

Date : 18/05/2016

Time : 11 am – 3 pm

Paper : II

Full Marks : 75

[Use a separate Answer Book for each group]

Group – A

Answer any one question from the followings :

[1×5]

1. Given a upper triangular matrix A of size $n \times n$. We want to store the elements of A into a one dimensional array B in chronological order. Let L be the index for array B . The elements of A are accessed by $A_{J,K}$. Establish an address calculation formula for L in terms of J, K & n . 5
2. Each element of an array $\text{arr}[20][50]$ requires 4 bytes of storage. Base address of arr is 2000. What would be the address/location of $\text{arr}[10][10]$ when the array is stored as column-major and row-major order. 2½x2

Answer any three questions from question no. 3 to 7 :

[3×10]

3. a) Given a liner sequential storage of size n . Design an algorithm to maintain a queue & a stack on that storage space at the same time. Illustrate the algorithm with suitable example. 7
- b) Draw the call stack for the following function calls:

```
main()
{
    a = 10;
    c = f(a);
    b = a + g(c);
}
f(a)
{
    d = 20;
    return d+h(d);
}
g(c)
{
    return c * c;
}
h(d)
{
    return d * 2;
}
```

3

4. a) Explain merge sort algorithm. Show how the merge sort algorithm will sort the following array in increasing order: 3+2+2
100, 90, 80, 60, 20, 30, 50, 40
Analyze the time complexity of the merge sort algorithm.
- b) What do you mean by ADT? What is dynamic data structure? 1½x2
5. a) Suppose you are given with two linked list L & P . All the elements of L & P are sorted. Now design an algorithm to find the common elements between these two lists. Analyze its time complexity. 6
- b) Write the algorithm of interpolation search. What is the time complexity of interpolation search? 3+1

6. a) Explain how insertion and deletion operations can be performed in $O(1)$ time on circular linked list. Illustrate with an example. 6
- b) Convert the following infix expression to its equivalent postfix notation by showing the operator stack and output string after reading each input token:

$$A * B + C *(D - E) - F * G$$
 4
7. a) Prove that the worst case time complexity of quick sort is $O(n^2)$. 5
- b) Let S_1 & S_2 be two algorithms to solve a particular problem X . If the time complexity of these two algorithms are in same asymptotic order then how would you judge which algorithm is better? 3
- c) How does tail recursion differ from normal recursive operations? Illustrate with an example. 2

Group – B

Answer any four questions from question no. 8 to 13 : [4×10]

8. a) If $f(x) = 4\cos x - 6x$, find the relative percentage error in $f(x)$ for $x = 0$, if the error in $x = 0.005$. 3
- b) What is the value of $(\Delta - \nabla)x^2$ 2
- c) Evaluate the missing terms in the following table:– 5

$x:$	0	1	2	3	4	5
$f(x):$	0	–	8	15	–	35

9. a) Prove that the sum of Lagrangian function or co-efficients is unity. 3
- b) Find the real root of the equation $x^3 - 2x - 5 = 0$ by using Bi-section method. 5
- c) Explain about the convergency of the method of Bisection iterative process for estimating the root of a given equation. 2

10. a) Evaluate $\int_{0.1}^{0.7} (e^x + 2x)dx$ by Simpson's one-third rule, taking 6 intervals. 4+1

Compute the exact value and find the relative errors in your result.

- b) Solve the system of equation by Gauss-Elimination method 5

$$2x + 2y + z = 12$$

$$3x + 2y + 2z = 8$$

$$5x + 10y - 8z = 10$$

11. a) Use Euler's method to evaluate $y(2)$, correct upto two decimal places from $\frac{dy}{dx} = \frac{1}{2}(x + y)$ with $y(0) = 2$, taking $h = 0.5$. 5

- b) Find the optimal assignment to find the maximum profit for the assignment problem with the profit matrix 5

	I	II	III	IV
A	7	5	4	3
B	8	2	6	4
C	5	3	2	1
D	5	4	1	8

12. a) Reduce the following problem to standard maximization form. 5

$$\text{Maximize } z = 3x_1 + 2x_2 + 5x_3$$

Subject to:

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

$$4x_1 + 2x_2 - 4x_3 \geq 5,$$

$$|2x_1 + 3x_3| \leq 2,$$

Where $x_1, x_2 \geq 0$ and x_3 is unrestricted in sign.

- b) Given the following matrix of the set up costs of the machine when there is a change of item for processing on the machine. Show how to sequence production of five items so as to minimize set up cost per cycle.

5

	A	B	C	D	E
A	∞	2	5	7	1
B	6	∞	3	8	2
C	8	7	∞	4	7
D	12	4	6	∞	5
E	1	3	2	8	∞

13. a) Solve the following Linear Programming Problem by penalty method.

6

$$\text{Maximize } z = -2x_1 + x_2 + 3x_3$$

Subject to:

$$x_1 - 2x_2 + 3x_3 = 2,$$

$$3x_1 + 2x_2 + 4x_3 = 1,$$

Where $x_1, x_2, x_3 \geq 0$

- b) Find the dual problem of the following L.P.P.

4

$$\text{Maximize } z = x_1 + 4x_2 + 3x_3$$

Subject to:

$$2x_1 + 3x_2 - 5x_3 \leq 2,$$

$$3x_1 - x_2 + 6x_3 \geq 1,$$

$$x_1 + x_2 + x_3 = 4,$$

Where $x_1, x_2, x_3 \geq 0$

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