RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.Sc. SECOND SEMESTER EXAMINATION, MAY 2014

FIRST YEAR

Date : 23/05/2014

COMPUTER SCIENCE(Honours)

Time : 11 am – 2 pm

Paper : II

Full Marks : 75

[Use a Separate Answer Book for each group]

Group – A

1. Answer **any one** from the following :   [1×5]
   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 column-major order.   [5]
   b) A letter means Push and an asterisk means pop in the following sequence of operations over a stack. Give the sequence of values returned by the pop operations when this sequence of operations is performed on an initially empty stack.
      E A S * Y * Q U E * * * S T * * * I O * N * * *
      Show the stack after each push and pop operations.   [5]

Answer **any three** from the following :

2. a) Briefly, differentiate between ADT and Data-structure.   [3]
   b) Develop an ADT for FRACTION.   [7]

3. a) Write an algorithm to convert and infix expression to postfix expression.   [6]
   b) Convert the following expression from infix to pre-fix form.   [2]
      A / B^C + D * E – A * C
   c) What do you mean by symmetric condition in case of double linked list.   [2]

4. a) Write an algorithm to perform binary search (in recursive way) over a list of sequential elements, write down best case, average case and worst case time complexity of binary search?   [3+2]
   b) Explain how insertion and deletion operations can be performed in O(1) time on circular linked list. [5]

5. a) Critically comment : "Number of inversions measure the unsortedness".   [2]
   b) Give an array which has just been partitioned by the first step of quick sort :
      3, 0, 2, 4, 5, 8, 7, 6, 9
      which of these elements could be the Pivot? Give reasons for your claim.   [8]

6. a) ABC + *CBA – +* is a post fix expression with the assumption A = 1, B = 2 and C = 3. Compute the final value obtained if the expression is evaluated.   [2]
   b) Give the linked representation for the following sparse matrix :   [5]
      $$\begin{pmatrix} 0 & 0 & 11 & 0 & 13 \\ 12 & 0 & 0 & 0 & 0 \\ 0 & -4 & 0 & 0 & -8 \\ 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$
   c) With an example, show how does interpolation search find an element using minimum number of comparisons.   [3]

Group – B

Answer **any four** from the following :

7. a) If f(x) = 4cosx – 6x, find the relative percentage error in f(x), for x = 0, if the error in x = 0·005. [3]
   b) Prove that the sum of Lagrangian functions or co-efficients is unity.   [3]
   c) Find the value of f(x) at x = 0, using appropriate interpolation formula from given following table [4]

x	–1	–2	2	4
f(x)	–1	–9	11	69

8. a) Prove that $\Delta \cdot \nabla = \Delta - \nabla$ where, Δ and ∇ holds their usual meaning. [2]

   b) Explain the geometrical meaning of Simpson's one-third rule. [3]

   c) Evaluate $\int_3^7 x^2 \log x \, dx$ by using trapezoidal rule taking n = 4, correct upto five decimal places. [5]

9. a) Write down the algorithm of Secant Method. [3]

   b) What is the procedural difference between Regula-Falsi and Secant Method? [2]

   c) Find a real root of the equation $f(x) = x^3 - 2x - 5 = 0$ using regular falsi method. Correct upto three decimal places. [5]

10. a) Compute the values of the unknown in the following system of equations by Gauss-Seidel iterative method. [5]
    $4x - y + z = 7$
    $4x - 8y + z = -21$
    $-2x + y + 5z = 15$

    b) Compute y(0·2), from the equation $\dfrac{dy}{dx} = x - y$, given y(0) = 1, taking h = 0·1, by fourth order Range-Kutta Method, correct to five decimal place. [5]

11. a) Define the following terms : [2]
    (i) Basis   (ii) feasible solution

    b) Check whether the vectors (2, 4, 10) and (3, 6, 15) are linearly dependent or not. [2]

    c) The owner of a small machine shop has four machinists available to assign to jobs for the day. Five jobs are offered with expected profit for each machinist on each job as follows :

	A	B	C	D	E
1	62	78	50	101	82
2	71	84	61	73	59
3	87	92	111	71	81
4	48	64	87	77	80

    Find the assignment of machinists to jobs that will result in a maximum profit. (State each step) [6]

12. a) Find the dual of the following linear programming problem : [3]
    Maximize $z = 2x_1 + 3x_2 + 4x_3$
    Subject to $x_1 - 5x_2 + 3x_3 = 7$,
                           $2x_1 - 5x_2 \leq 3$,
                               $3x_2 - x_3 \geq 5$,
                  $x_1, x_2 \geq 0$
    and x_3 is unrestricted in sign.

    b) A steel company has three open hearth furnaces and five rolling mills. Transportation cost (rupees per quintal) for shipping steel from furnaces to rolling mills are shown in the following table : [7]

	M_1	M_2	M_3	M_4	M_5	
F_1	4	2	3	2	6	8
F_2	5	4	5	2	1	12
F_3	6	5	4	7	7	14
	4	4	6	8	8	

    Find the initial basic feasible solution using Vogel's Approximation Method.
    Find also the optimal shipping schedule.

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