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B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2014

INFORMATION TECHNOLOGY

IV Semester

IT8401/ALGORITHMICS

(Regulation 2012)

Time: 3 Hours

Answer ALL Questions

Max. Marks 100

PART-A (10 x 2 = 20 Marks)

1. Insertion sort and selection sort algorithms are run on the two arrays : $U=[1,2,3,4,5,6]$ and $V=[6,5,4,3,2,1]$. Which algorithm runs fast on U array and which on V array? Justify your answers.
2. Show that selecting an i^{th} largest element can be done in linear time.
3. Solve the recurrence $T(n) = 9 T(n/3) + n$ using master method.
4. Write the properties of big- Oh notation.
5. List the key ingredients for an optimization problem to be solved using dynamic programming technique.
6. Define the greedy choice property.
7. State the fundamental theorem of linear programming.
8. List the four main reasons by which a linear program is not in standard form.
9. When do you say a language L_1 is polynomial time reducible to language L_2 ?
10. State any one NP complete problem.

Part – B (5 x 16 = 80 marks)

11. i) Explain asymptotic notations in detail with suitable examples.(8)
ii) Develop a recursive algorithm to sort 'n' numbers using quick sort. Solve its recurrence relation using substitution method.(8)
12. a) i) Write an algorithm to perform insertion sort and derive its time complexity.(8)
ii) Write an algorithm to perform binary search on a sorted array. Find its best, worst and average case complexities.(8)
(OR)
b) i) Develop a recursive algorithm to select the maximum and minimum element in an array using divide and conquer approach and derive its time complexity and compare it with the straight forward MaxMin algorithm.(10)
ii) Trace the algorithm for finding max and min using divide and conquer approach for the given list of elements and find how many comparisons have been made.(6)
10, -20, 8, 17, 2, -23, 20, 23
13. a) i) State and explain matrix-chain multiplication problem. Develop an algorithm to

compute an optimal order for multiplying a chain of matrices.(8)

ii) Find an optimal parenthesization of a matrix chain product whose sequence of dimensions is $\langle 5, 10, 3, 2, 4 \rangle$.(8)

(OR)

b) i) Write a brief note on the elements of greedy strategy.(8)

ii) Design an algorithm to generate Huffman code and show the encoding of each character for the following frequency of characters.(8)

A: 8; B: 6; C: 2; D: 5, E: 12

14. a) i) Write an algorithm to perform LU decomposition of a matrix and apply the same for the given matrix.(8)

$$\begin{pmatrix} 4 & -5 & 6 \\ 8 & -6 & 7 \\ 12 & -7 & 12 \end{pmatrix}$$

ii) Explain Knuth-Morris-Pratt pattern matching algorithm and compute the prefix function for the pattern $P = \text{aababaab}$.(8)

(OR)

b) i) Write the necessary algorithms to solve a linear programming problem using SIMPLEX method.(8)

ii) Solve the linear program using SIMPLEX algorithm.(8)

Maximize $-5x_1 - 3x_2$

subject to

$$x_1 - x_2 \leq 1$$

$$2x_1 + x_2 \leq 2$$

$$x_1, x_2 \geq 0$$

15. a) i) What are randomized algorithms? Explain the hiring problem and prove that its randomized version can be solved with a total hiring cost of $O(\ln n)$.(8)

ii) State any one NP complete problem and prove that it is NP complete with all the assumptions made.(8)

(OR)

b) i) Write a brief note on approximation algorithms.(4)

ii) Design an algorithm to solve Travelling salesman problem and compute its approximation ratio.(12)