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Fourth Semester MCA Degree Examination, June/July 2016
Analysis and Design of Algorithms

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions.

- 1 a. Compare the orders of growth of \log_2^n and \sqrt{n} . (04 Marks)
 b. Write a short note on the fundamental data structures used in the design of algorithms. (06 Marks)
 c. Explain the asymptotic notations used in the analysis of algorithms with examples. (06 Marks)
 d. Consider the following recursive algorithm for computing the sum of the first n cubes.
 $S(n) = 1^3 + 2^3 + 3^3 + 4^3 + \dots + n^3$
 Algorithm s(n)
 if (n == 1)
 return 1
 else
 return s(n - 1) + n * n * n
 end of if
 end
 setup and solve a recurrence relation for the number of times the algorithm's basic operation is executed. (04 Marks)
- 2 a. Explain the algorithm for selection sort. If A is an array of size n, obtain an expression for the number of key comparisons. (10 Marks)
 b. Using bubble sort algorithm arrange the letters of the word 'QUESTION' in alphabetical order. (06 Marks)
 c. Discuss the best, worst and average case efficiencies in linear search. (04 Marks)
- 3 a. Explain and design the binary search algorithm. Using decision tree show the time complexity for successful and unsuccessful searches. (10 Marks)
 b. Write and explain quick sort algorithm with example. Explain the programming technique used in this. (10 Marks)
- 4 a. Write an algorithm for DFS. With an example, explain how DFS can be used to solve topological sorting problem. (10 Marks)
 b. What is breadth first search traversal? Starting at vertex 'a' traverse the graph shown in Fig. Q4(b), using BFS technique. (04 Marks)

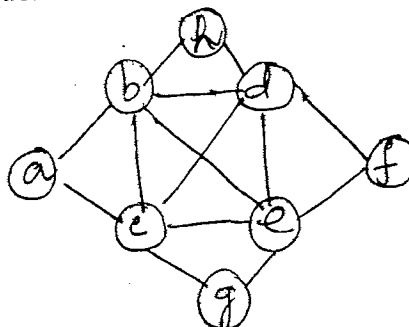


Fig. Q4(b)

- c. Explain decrease and conquer technique. Also explain the major variations of decrease and conquer. (06 Marks)

- 5 a. Explain Horspool's algorithm. Apply it to search for the pattern 'BARBER' in the text 'I MET JIM IN THE BARBER SHOP'. (10 Marks)
 b. Explain the sorting by counting algorithm with example. (06 Marks)
 c. Write a short note on hashing. (04 Marks)
- 6 a. Explain the algorithm for computing binomial coefficient using dynamic programming. (06 Marks)
 b. Write Warshall's algorithm. Apply the algorithm to find the transitive closure of the graph shown in Fig. 6(b). (04 Marks)

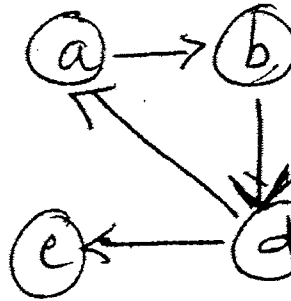


Fig. Q6(b)

- c. Write a short note on dynamic programming. (10 Marks)
- 7 a. What is greedy technique? Explain Prim's algorithm and apply it for the graph shown in Fig. Q7(a) to find the minimum spanning tree. (10 Marks)

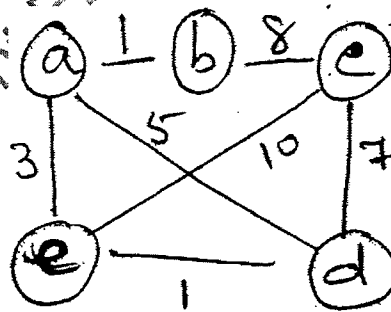


Fig. Q7(a)

- b. Construct a Huffman tree for the following data and obtain its Huffman code.

Character	A	B	C	D	E
Probability	0.4	0.1	0.2	0.15	0.15

(10 Marks)

- 8 a. Explain how branch and bound technique can be used to solve travelling salesperson problem. (08 Marks)
 b. Write a short note on :
 i) n-queen's problem
 ii) state space tree
 iii) Backtracking. (06 Marks)
 c. Apply back tracking to solve the following instance of the subset sum problem :
 $s = \{5, 7, 8, 10\}$ and $d = 15$. (06 Marks)