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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)

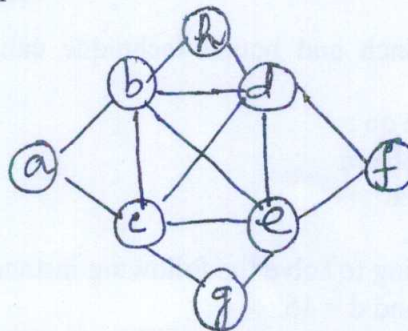


Fig. Q4(b)

- 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)

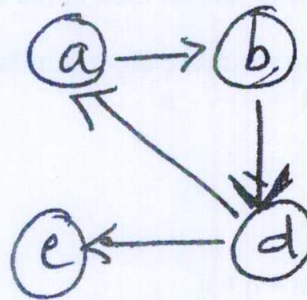


Fig. Q6(b)

- 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)

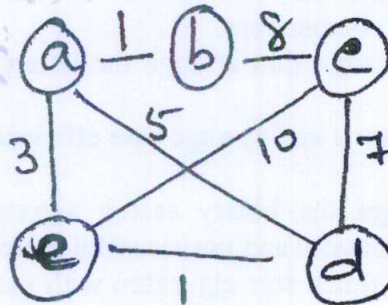


Fig. Q7(a)

- 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

- 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)