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Roll Number:_____

Thapar Institute of engineering & Technology, Patiala

Department of Computer Science and Engineering

B. E. Auxiliary Exam	Course Code: UCS406 Course Name: Data Structures and Algorithms
Feb 23rd, 2018	Thursday, 17.30 – 20.30 Hrs
Time: 3 Hours, M.Marks: 100	Name of Faculty: Ashish Girdhar

Note: Attempt all parts of a question at one place. Assume missing data, if any.

1	Give the best Big-Oh characterization for each of the following running time estimates with proper explanation (where n is the size of input problem). a. $\log(n) + 10000n^2$ b. $n\log(n) + 20\ n + 0.002n^2$ c. $37n + n\log(n^2) + 5000\log(n)$ d. $n + (n-1) + (n-2) + \cdots .. + 3 + 2 + 1$ e. $2^{10} + 3^5$	10
2	Consider a hash table of size 7with hash function $h(k) = k \bmod 7$. Draw the table that results after inserting in the given order, the following values: 19, 26, 13, 48, and 17 for each of the following cases: a. When collisions are handled by separate chaining. b. When collisions are handled by linear probing. c. When collisions are handled by double hashing using a second hash function $h'(k) = 5 - (k \bmod 5)$	10
3	Define binary search tree with example. A binary search tree contains the numbers 1, 2, 3, 4, 5, 6, 7, 8. When the tree is traversed in pre-order and the values in each node printed out, the sequence of values obtained is 5, 3, 1, 2, 4, 6, 8, 7. Draw the BST and write its post order traversal.	2 8
4(i)	Solve the following relation using Master Method. T(n)=16T(n/4)+n	5
4(ii)	Write the recurrence relation for merge sort. Solve that relation using substitution method.	5
5	Let A= {a/24, b/12, c/10, d/8, e/8} be the alphabets and their frequency distributions. a. Draw the Huffman tree and hence calculate the variable length codes for the alphabets. b. Calculate the average bits required for sending a message using the above calculated codes.	7 3
6	There are four matrices A, B, C, and D of sizes (5×4), (4×6), (6×2), (2×7) respectively. Find an optimal parenthesization for multiplying A×B×C×D using dynamic programming.	10

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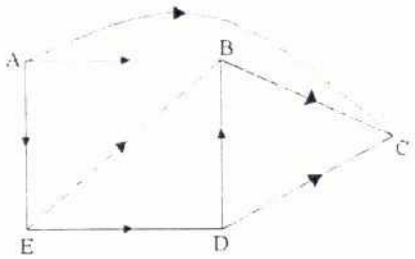
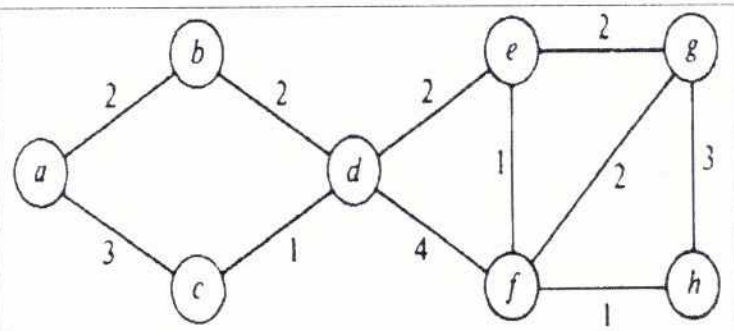
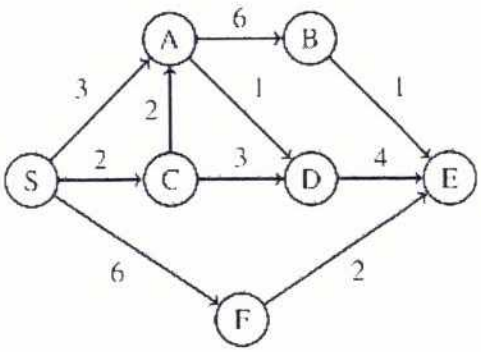
7(i)	Write the algorithm for solving fractional knapsack problem.	5
7(ii)	Illustrate the above algorithm for this scenario and calculate the total value considering the following items and their associated weight and value. Assume that we have a knapsack with max weight capacity, W = 16.	5

ITEM	WEIGHT	VALUE
i1	6	6
i2	10	2
i3	3	1
i4	5	8
i5	1	3
i6	3	5

8(i)		What are the different ways of representing a graph? Represent this graph using those ways.	4
8(ii)	Explain about genetic algorithms in brief.		3
8(iii)	What are the time complexities of finding 8th element from beginning and 8th element from end in a singly linked list? Let n be the number of nodes in linked list, you may assume that n > 8.		3
9		a. Draw Minimum spanning tree of this graph using Prims Algorithm starting from node *a* and calculate weight of MST (show all the steps). b. Write the edges with weights which should be included in MST when using Kruskal Algorithm and calculate total weight.	6 4
10		Write and Run Dijkstra's algorithm on this graph and determine the resulting shortest path tree.	10