National Institute of Technology, Hamirpur
Department of Computer Science and Engineering
B.Tech. CSE (Section-I)(End-Term Examination)
CS-201 Data Structure

Time: 3 hrs   Max. Marks 50

Instructor: Nitin Gupta

For all the problems, if you include any new algorithm in your solution, please also include a brief English description of what the algorithm does.

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1. (10 Marks) Write algorithms to implement a LINEAR queue using both array and linked list. Don't forget to consider overflow and underflow conditions for both implementations. Do you need a circular queue while implementing it with linked list. If yes, then provide the application of such a queue, if no, then explain why?

2. (10 Marks) Draw the binary tree T with node labels a, b, c, d, e, f and g for which the in-order and post-order traversals result in the following sequences.

   Inorder : K, G, D, L, H, M, B, A, E, C
   Preorder: A, B, D, G, K, H, L, M, C, E

   Next, let a Set A contains first six elements when the above tree is traversed using Breadth First Search (BFS) and a set B contains first six elements while traversing it with DFS. What will be the value of $A - B$? Explain step by step in detail.

3. (10 Marks) We have learned about implementing a priority queue using Linked List, array and heaps. Can you think about implementing the priority queue using a Binary Search Tree. What advantage in terms of time complexity it will give you in INSERTION operation against the other methods?

4. (10 Marks) Suppose the table T has 15 memory locations, $T[1], T[2]...T[15]$, and suppose a file F consists of 12 records with following hash addresses:

Record:	Z	Y	X	E	D	C	B	A	P	Q	R	S
H(k):	1	5	11	4	11	2	8	4	2	7	4	9

   Suppose the 12 records are entered into table T using Linear Probing in the above order. Then show how the file F appears in memory. Find the average number of S of probes for a successful search and average number of U of probes for an unsuccessful search. Explain

with example that how a deletion in the above case can disrupt the future searches. What kind of advantage/disadvantage you can observe if quadratic probing is applied here?

5. (10 Marks) Define Graph. What is adjacency matrix and show various adjacency matrices to implement directed graph, undirected graph and a weighted graph having atleast 5 nodes. Which type of matrix will be created while implementing an undirected graph? Can an adjacency matrix be created for a weighted multi-graph? Create an adjacency list representation of one of the above graphs created by you of your choice.

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