

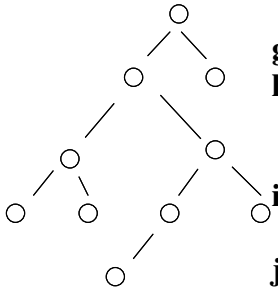
B. Math III Year
2006-07 Final Examination – CS III Algorithms and Data Structures
(Max. marks: 50 and Time 3 hours)

Notes:

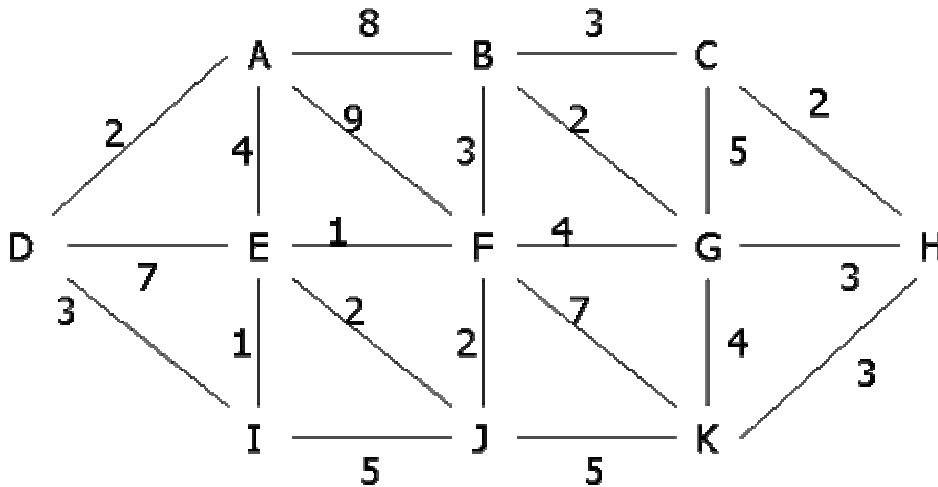
1. Don't write long essays. Instead, spend time on thinking about the questions and then give brief answers.
2. If you face a dilemma, make an assumption, write it in the paper, and then give an answer that is consistent with your assumption.
3. Good luck!

Q1 [10 Marks: 1 Mark for each part] For “a” to “g”, state true/false

- a. If $f(n)+g(n)$ is $O(n^2)$ then $f(n)$ is $O(n^2)$.
- b. If $f(n)$ is $O(n^2)$ and $g(n)$ is $O(n^2)$ then $f(n)/g(n)$ is $O(1)$.
- c. Prim's and Kruskal's algorithms will always give the same minimum spanning tree for a given connected graph.
- d. Given a binary tree with integer data, an inorder traversal of the tree will output the data in sorted order.
- e. In a threaded binary tree the right pointer of the largest value node is null.
- f. To determine if two binary search trees are identical trees, one could perform an inorder tree walk on both and compare the output lists.
- g. The adjoining tree (on the left) can not be a red-black tree.
- h. Select the correct words from the brackets: With MergeSort, the data comparisons are all done (after/before) the recursive calls complete, whereas with QuickSort the data comparisons are all done (after/before) the recursive calls are made.
- i. BFS is likely to use _____ as a data structure while a DFS algorithm is likely to use _____
- j. The order of searching in an AVL tree is _____



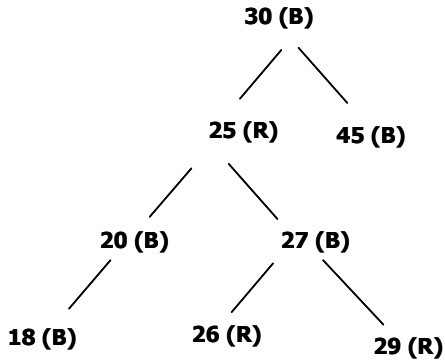
Q2 [4 + 4 Marks] (a.) Use Prim's algorithm to find a minimum spanning tree (MST). (b.) Now use Kruskal's algorithm to find the MST. In both cases, show your reasoning and if you make any assumptions then state them clearly.



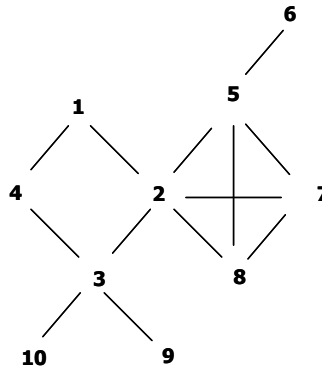
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Q3 [10 Marks] Obtain a closed form expression for the order of the average time taken for a quicksort algorithm. If you make any assumption about the algorithm then state them clearly.

Q4. [7 Marks] The figure below is a Red-Black tree. Add a node 28 to this tree. Show your step-wise work and also draw the final tree. State the reasons for changes you are making to the original tree.



Q5. [4 + 4 Marks] For the graph below create (a) the BFS and (b) DFS parent-node trees. Do your rough work elsewhere and draw only the final trees in the empty panels.



Q6. [Distribution of 7 marks: 1 (data structure) + 4 (algorithm logic) + 2 (addressing error conditions)] Create an algorithm along with data structure definition (using the pseudocode conventions learnt in the class) that will:

1. Accept words from the screen.
2. Put them in a circular linked list and assign the starting position.
3. Print the list once the word entry is over.
4. Accept a number which is less than or equal to the number of elements in the list.
5. Delete that element from the list and print the new list

Your algorithm is expected to take care of common error conditions that one is expected to encounter while executing this program.