CSE 2320 Name ____________________________
Test 1
100 points UTA Student ID # ____________________________

Short Answer. 5 points each

1. List the sorts that take $\theta(n^2)$ time in the worst case.
2. Name a stable sort.
3. Give the recurrence that describes the run time of binary search.
4. What is the final h value when using shellsort?
5. How many times does BUILD-HEAP call HEAPIFY if there are n entries in the heap?
6. What are telescoping sums?
7. What is the value of H_3?
8. What is a priority queue?
9. What condition must be true for counting sort to run in linear time? Be precise.
10. Use the limit rule for θ to show that $2n^3 - n^2 + 3n - 1 = \theta(n^3 + 3n^2 - n + 2)$.
11. Explain the run-time for radix sort (either version). Be precise.
12. Why doesn't the decision-tree model apply to radix sort?

Long Answer.

1. Use iteration to show that $T(n) = T(n/2) + n^2$ is in $\theta(n^2)$ 15 points
2. Use substitution to show that $T(n) = T(n/2) + n^2$ is in $\theta(n^2)$ 15 points
3. Demonstrate QUICKSORT on the following input table. Be sure that the input and output for each execution of PARTITION are obvious. 10 points.

5 3 7 2 8 4 1 6 0 9

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Test 2
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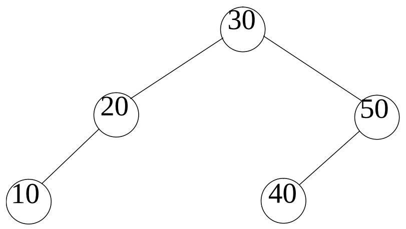
Short Answer. 5 points each

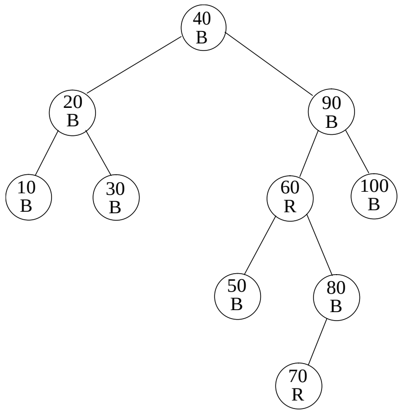
1. Give a situation where a stack is useful.
2. Assign a legal coloring to the following red-black tree.



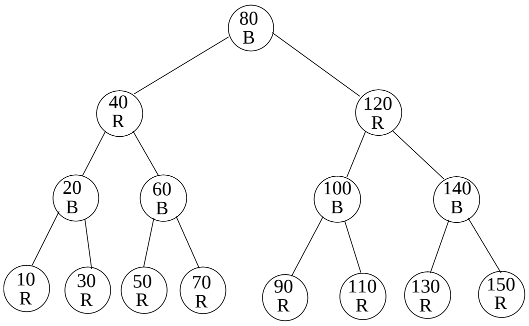
3. What is a doubly-linked list?
4. What indicates that a stack is empty? The stack is implemented using an array.
5. When are ordered linked lists faster than unordered linked lists?
6. Explain how the successor of a node is found in a binary search tree.

Long Answer. 10 points each

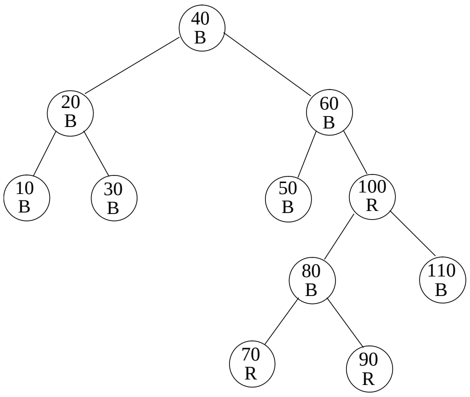
1. How are deletions handled for open addressing?
2. Explain (code or pseudocode) how the nodes in a circular list may be included in a garbage (free) list in constant time.
3. Give the upper bound results for the expected number of probes for open addressing
4. Insert 75 into the following red-black tree. Be sure to indicate the cases that are used.



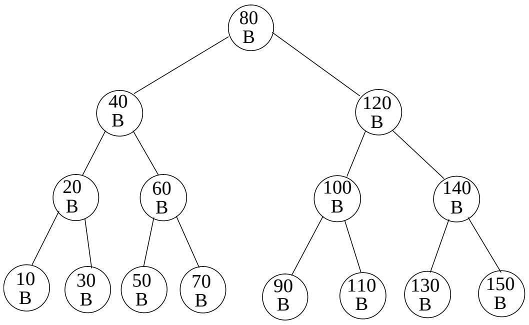
5. Insert 55 into the following red-black tree. Be sure to indicate the cases that are used.



6. Delete 50 from the following red-black tree. Be sure to indicate the cases that are used.



7. Delete 80 from the following red-black tree. Be sure to indicate the cases that are used.



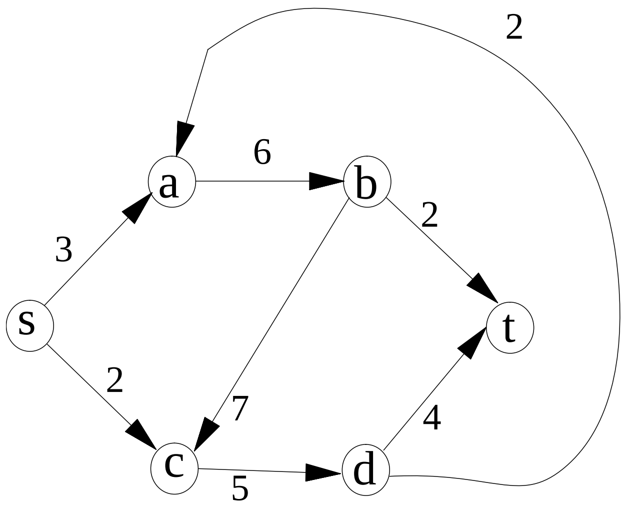
CSE 2320 Name ____________________________
Test 3
100 points UTA Student ID # ____________________________

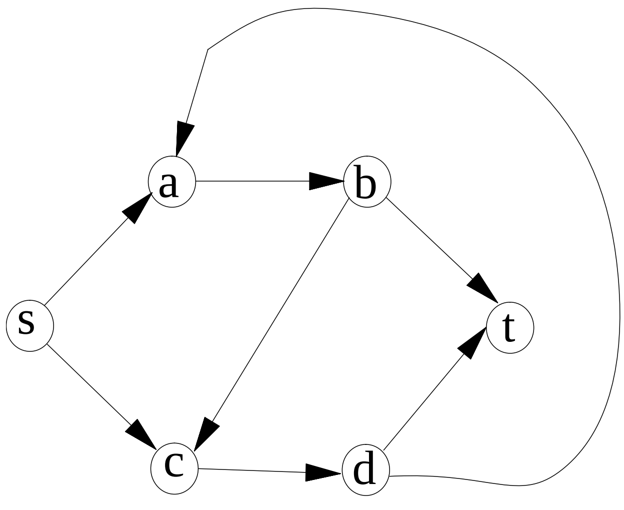
Short Answer. 5 points each

1. List the priority queue based greedy algorithms that were studied.
2. Give the asymptotic time to determine the longest common subsequence of two sequences with lengths m and n.
3. Give the asymptotic time for using KMP string search when the pattern has m symbols and the text has n symbols.
4. What is optimized by the Huffman coding technique? Be precise.
5. What indicates that an edge is a cross edge during depth-first search? Be precise.

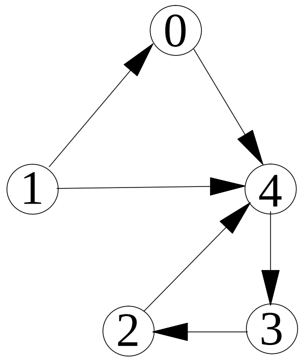
Long Answer. Points for each problem are given in parenthesis

1. What is a minimum cut? How may the Ford-Fulkerson technique be used to find one? (10)
2. Give both KMP fail link tables for the pattern `ababaacaabaa`. (15)
3. Determine a maximum flow in the following network. Be sure to list each augmenting path, the amount of additional flow that it provides, and the residual graph after each augmenting path is recorded. You may choose each augmenting path in any matter that you choose. (15)





4. Use dynamic programming to determine the longest common subsequence of `abcabcabc` and `cbacbacba`. (10)
5. Demonstrate Warshall's algorithm on the successor/predecessor matrix (your choice) for the following graph. (15)



6. What are the entries in the heap (for Prim's algorithm) before and after moving the next vertex and edge into the minimum spanning tree? DO NOT COMPLETE THE ENTIRE MST!!! Edges already in the MST are the thick ones. Edges not in the MST are the narrow ones. You do not need to show the binary tree for the heap ordering. (10)