

CSCI 311 – Data Structures – Sample Final Problems

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Name _____

100 points possible. Points are listed before each problem in parentheses.

READ AND FOLLOW ALL TEST DIRECTIONS CAREFULLY. SHOW ALL WORK. TEST IS OPEN BOOK AND NOTES. SPREAD OUT WITH AT LEAST ONE SEAT BETWEEN YOU AND YOUR NEIGHBOR. NO TALKING OR GAZING AT OTHERS EXAMS. EXPLAIN ALL ASSUMPTIONS. FIVE PAGES TOTAL. ATTACH WORKSHEETS IF ANY AT THE BACK OF THE EXAM.

A. (20 points) Perform the heapsort algorithm in array form to completion on the max heap given in the array below.

Answer to A)

| | | | | | | | | | | | | | | | | |
|-------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| index | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| value | 75 | 51 | 44 | 39 | 22 | 33 | 21 | 35 | 30 | 10 | 8 | 9 | 12 | 5 | 3 | 31 |

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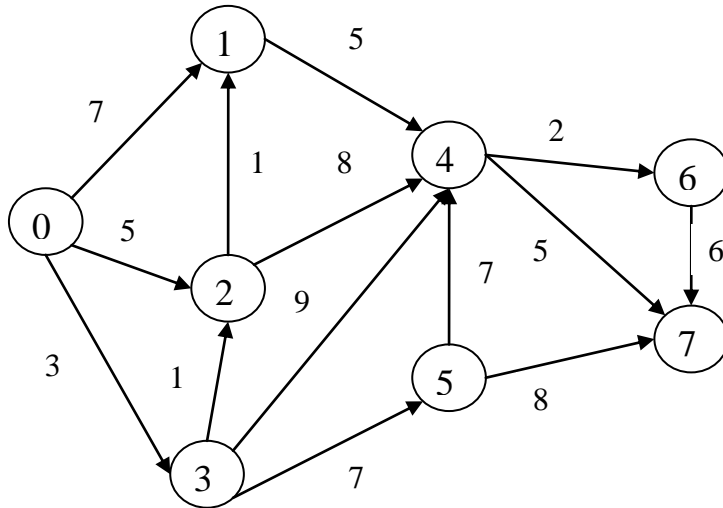
B. (10 points) Use the list of values below in top to bottom order and insert them into an initially empty Digital Search Tree:

| | |
|-----|--------|
| bit | 543210 |
| A | 001001 |
| B | 001011 |
| C | 110001 |
| D | 101111 |
| E | 101101 |

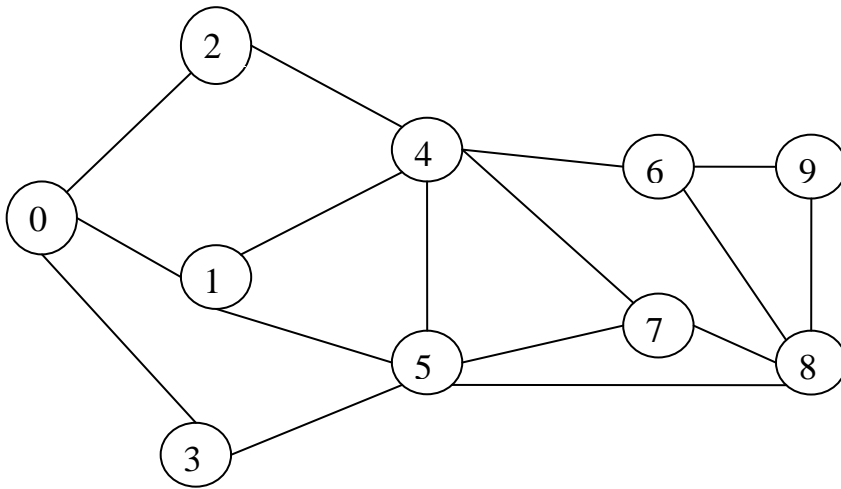
C.(10 points) Use the list of values below in top to bottom order and insert them into an initially empty Patricia Tree.

| | |
|-----|--------|
| bit | 543210 |
| A | 001001 |
| B | 001011 |
| C | 110001 |
| D | 101111 |
| E | 101101 |

D. (20 points total) For the weighted digraph pictured below, with vertex 0 as the source:
 Perform Dijkstra's shortest path algorithm to find the shortest path from vertex 0 to all other vertices. Trace the algorithm as demonstrated in class, using the technique in Kruse's book and notes. When you are done, be sure to give the actual shortest paths that you found, along with the shortest path lengths. At each iteration, show the edge chosen with a hatch-marked line, and show d , the distance array with its current contents. Also show the set S of vertices that have been marked as having the shortest path found.



E. (16 points, 8 for each subpart) For the directed graph shown below, use the code discussed from Kruse's book to give your answer. Have each traversal start at vertex 0:



a) depth first traversal:

b) breadth first traversal:

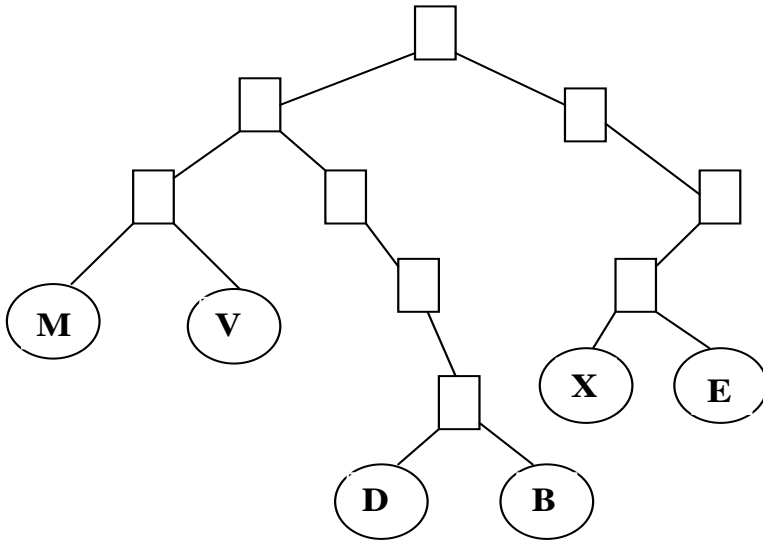
F. (14 points) Insert the following values into an initially empty B+ tree of order 3. Do not rotate values to delay splits:

10, 20, 30, 40, 50, 60, 70, 200, 190, 180, 170, 160, 150, 140

7. (10 points) Delete the following values (10, 30, 180, 50, 60, 70, 160, 190, 180, 20) in the order given from the tree you obtained in problem 6. Use the technique discussed in class of only deleting from the leaf unless a combine forces you to toss out an internal node value.

OTHER PROBLEMS FOR ADDITIONAL PRACTICE:

G. (8 points total, 4 points each subpart) Use the Radix Search Trie pictured below to answer this question. **Be sure to use the ORIGINAL TREE TO ANSWER EACH SUBPART.** Draw the resultant tree after the delete operation.



Here are the codes that built this tree –

- B 011111
- X 110011
- D 011101
- E 110110
- V 001101
- M 000110

a) Delete V

b) Delete B

H. (20 points) Build a Patricia Tree by inserting the following values into an initially empty Patricia Tree.

Note: Here are the codes for the elements of this tree –

bit 543210

B 000010

X 010011

D 000111

E 011011

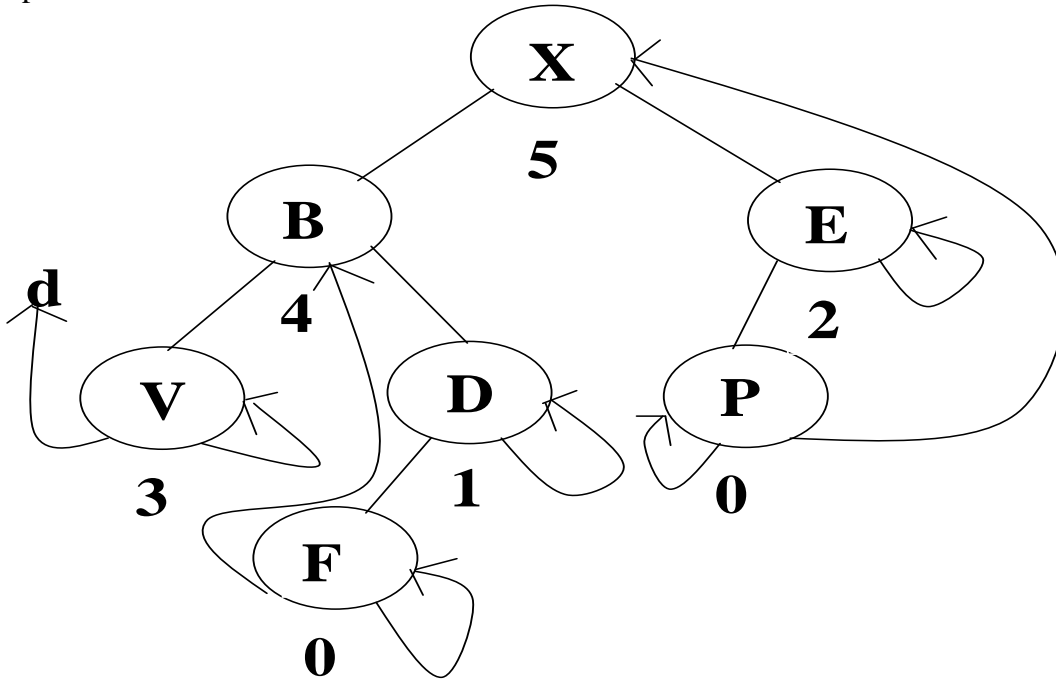
V 011001

M 001001

F 101001

D 000111

I.(10 points total, 5 points each subpart) Use the Patricia Tree pictured below to answer this question. **Be sure to use the ORIGINAL TREE TO ANSWER EACH SUBPART.** Draw the resultant tree after the delete operation.



d stands for dummy

Here are the codes used to build this tree:

bit 543210
 B 011100
 X 110011
 D 011111
 E 110110
 V 001101
 F 011101
 P 110010

b) Delete D (5 points)

c) Delete X (5 points)