CSCE 221 Cover Page
Homework Assignment #3
Due November 30 to CSNet

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Please list all sources in the table below including web pages which you used to solve or implement the current homework. If you fail to cite sources you can get a lower number of points or even zero, read more Aggie Honor System Office http://aggiehonor.tamu.edu/

Type of sources			
People			
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I certify that I have listed all the sources that I used to develop the solutions/codes to the submitted work.

"On my honor as an Aggie, I have neither given nor received any unauthorized help on this academic work."

Your Name Kevin Chou Date 11/30/15

Homework 3

due November 30

1. (10 points) R-10.17 p. 493
   For the following statements about red-black trees, provide a justification for each true statement and a counterexample for each false one.

   (a) A subtree of a red-black tree is itself a red-black tree.

   False, if a subtree is rooted at a node that is red, then it does not follow the rule that a red black tree must have a black root.

   (b) The sibling of an external node is either external or it is red.

   False, if its sibling node is black and has 2 red node children, then it is not a external node.

   (c) There is a unique (2,4) tree associated with a given red-black tree.

   False, there are different red black trees that can be represented in the same (2,4) tree.

   (d) There is a unique red-black tree associated with a given (2,4) tree.

   True, there

2. (10 points) R-10.19 p. 493
   Consider a tree T storing 100,000 entries. What is the worst-case height of T in the following cases?

   (a) T is an AVL tree.

   1.44log100,000

   (b) T is a (2,4) tree.

   log100,000

   (c) T is a red-black tree.

   2log100,000

   (d) T is a binary search tree.

   100,000

3. (10 points) R-9.16 p. 418

   Draw an example skip list that results from performing the following series of operations on the skip list shown in Figure 9.12: `erase(38)`, `insert(48,x)`, `insert(24,y)`, `erase(55)`. Record your coin flips, as well.

4. (10 points) R-9.7 p. 417

   Draw the 11-entry hash table that results from using the has function, $h(k) = (3k + 5) \bmod 11$, to hash the keys 12, 44, 13, 88, 23, 94, 11, 39, 20, 16, and 5, assuming collisions are handled by chaining.

5. (10 points) R-9.8 p. 417

   What is the result of the previous exercise, assuming collisions are handled by linear probing?

6. (10 points) R-9.10 p. 417

   What is the result of Exercise R-9.7, when collisions are handled by double hashing using the secondary hash function $h_s(k) = 7 - (k \bmod 7)$?

7. (10 points) R-8.2 p. 361

   How long would it take to remove $\lceil log\, n \rceil$ smallest elements from a heap that contains n entries using the `removeMin()` operation?

8. (10 points) R-8.7 p. 361

   An airport is developing a computer simulation of air-traffic control that handles events such as landings and takeoffs. Each event has a *time-stamp* that denotes the time when the event occurs. The simulation program needs to efficiently perform the following two fundamental operations:

   - Insert an event with a given time-stamp (that is, add a future event)
   - Extract the event with smallest time-stamp (that is, determine the next event to process)

   Which data structure should be used for the above operations? Why?

9. (10 points) R-13-3 and R-13-4, p. 654
10. (10 points) R-13.8, p. 655
11. (10 points) R-13.16, p. 656
12. (10 points) R-13.17, p. 656
13. (10 points) You want to help CS/CSE freshman students to prepare their course schedules for the first two years in the lower level division. By building a directed graph suggest order in which they should schedule their courses taking into account their corresponding prerequisites. A set of vertices represents courses and a set of edges represents a dependence of a given course on a course prerequisite.
14. (10 points) R-13.31, p. 656
15. (10 points) Write what the running time, and provide its justification, of the Dijkstra's algorithm is for a sparse and dense graph and the priority queue implemented based on

    (a) a binary heap

    (b) an unsorted list

    (c) a sorted list
16. (10 points) C-13.10, p. 658
17. (10 points) C-13.15, p. 659
18. (10 points) C-13.18, p. 659