CSCE 221 Cover Page
Homework Assignment #2
Due March 27 at 23:59 pm to eCampus

First Name Joseph Last Name   Martinsen   UIN 323006691

User Name   josephmart   E-mail address   josephmart@tamu.edu

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			
Web pages (provide URL)			
Printed material			
Other Sources			

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   Date

due March 27 at 11:59 pm to eCampus.

1. (15 points) Write a recursive function that counts the number of nodes in a singly linked list. Write a recurrence relation that represents your algorithm. Solve the relation and obtain the running time of the algorithm in Big-O.

   (a)
   ```
   int nodeCounter(Node* n)
   {
       if(temp == nullptr) { return 0; }

       return nodeCounter(n->next()) + 1;
   }
   ```

   (b) nodeCounter(0) = 0
       nodeCounter(n) = nodeCounter($n-1$) + 1

   (c) Solving the relation: nodeCounter(n) = 0
       The Big-$O : O(n)$

2. (15 points) Write a recursive function that finds the maximum value in an array of int values without using any loops. Write a recurrence relation that represents your algorithm. Solve the relation and obtain the running time of the algorithm in Big-O.

3. (10 points) What data structure is most suitable to determine if a string s is a palindrome, that is, it is equal to its reverse. For example, "racecar" and "gohan gasalamiimalasagnahog" are palindromes. Justify your answer. Use Big-O notation to represent the efficiency of your algorithm.

4. (10 points) Describe how to implement the stack ADT using two queues. What is the running time of the push and pop functions in this case?

5. (10 points) What is the best, worst and average running time of quick sort algorithm? Provide arrangement of the input and the selection of the pivot point at every case. Provide a recursive relation and solution for each case.

6. (10 points) What is the best, worst and average running time of merge sort algorithm? Use two methods for solving a recurrence relation for the average case to justify your answer.

7. (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.

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

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

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

8. (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.

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

   (c) T is a red-black tree.

   (d) T is a binary search tree.

9. (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.