2016 Spring COP 3502 Exam #2 - Linked Lists (30 pts)

Date: 4/7/2016

Name: _____

Consider using a linked list to store a string. Each node in the list would store a character and a pointer to the node storing the next character. The pointer for the node storing the last character in the string would point to NULL. Each of the following questions will be based on this premise using the struct shown below:

```
typdef struct letnode {
    char letter;
    struct letnode* next;
} letnode;
```

1) (10 pts) A "strictly sorted string" is one where the Ascii values of each of the characters in the string are in strictly increasing order. For example, "Back" is a strictly sorted string since 'B' < 'a' < 'c' < 'k'. Write a function that takes in a pointer to the first letnode in a string and returns 1 if the string is strictly sorted, and 0 otherwise. (Note that we can compare the Ascii values of two character variables by simply using the usual relational operators, > , < , >=, <=, == and !=.)

```
int strictlySorted(letnode* word) {









}
```

2) (5 pts) Write a **recursive** function that takes in a pointer to the first charnode in a string and returns the length of that string. Please fill in the function prototype shown below:

```
int stringlen(letnode* word) {









}
```

3) (15 pts) Write a **recursive** function that takes pointers to two letnodes, first and second, returns a negative integer if the string pointed to by first comes before the string pointed to by second, lexicographically, 0 if the two strings are equal, or positive integer if the string pointed to by first comes after the string pointed to by second, lexicographically. (Essentially, implement the strcmp function.)

```
int stringcmpRec(letnode* first, letnode* second) {









}
```

2016 Spring COP 3502 Exam #2 - Stacks and Queues (30 pts)

Date: 4/7/2016

Name: _____

4) (10 pts) Evaluate the following postfix expression, showing the state of the operand stack at the three points A, B and C indicated below:

				A					B					C		
12	6	2	-	/	5	42	7	/	4	-	*	+				

A B C

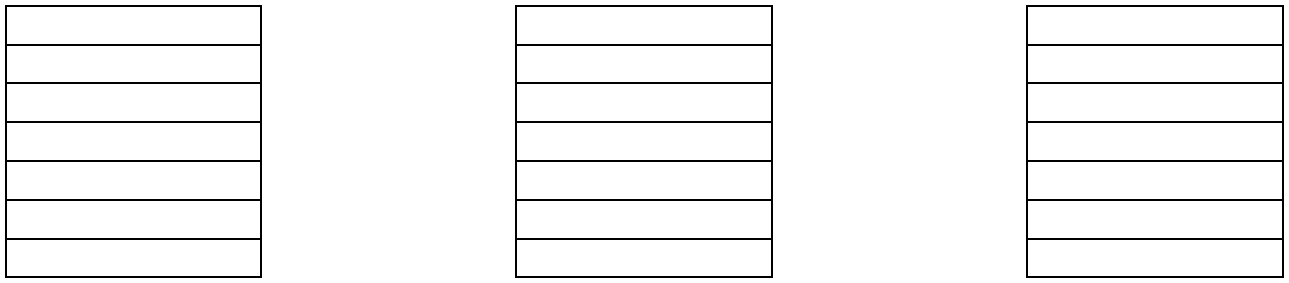
Value of the Expression: _____

5) (10 pts) Circle either True or False about each of the following assertions about queues.

a) A queue is a Last In, First Out (LIFO) abstract data structure.	True	False
b) If a queue is implemented with a regular linked list, with a pointer to the front of the queue only, the enqueue operation would take Θ(n) time for a list with n elements. (Θ indicates proportional to n.)	True	False
c) If a queue is implemented with a regular linked list, with a pointer to the front of the queue only, the dequeue operation would take Θ(n) time for a list with n elements.	True	False
d) A queue must be implemented with a linked list.	True	False
e) A queue allows for access to any of its elements in O(1) time.	True	False

6) (10 pts) Convert the following infix expression to postfix, showing the state of the operator stack at the three points A, B and C indicated below:

```
                    A                 B                 C
( ( 42 - 9 ) / ( 2 + 5 - 2 * 2 ) - 2 * 3 ) * ( 3 + 4 )
```



A B C

Equivalent Postfix Expression:

_____

2016 Spring COP 3502 Exam #2 - Binary Trees (25 pts)

Date: 4/7/2016

Name: _____

Consider implementing a binary search tree where at each node, in addition to storing a string and pointers to both the left and right child, the height of the node is stored, as well as the total number of nodes in the subtree rooted at the node. The struct defintion for a node in the tree is provided below.

```
#include <string.h>
#define MAX 20

typedef struct bintreenode {
    char word[MAX];
    int height;
    int numNodes;
    struct bintreenode* left;
    struct bintreenode* right;
} bintreenode;
```

7) (10 pts) Write a **recursive** search function that takes in a word and a pointer to the root of a binary search tree, and returns the height of the first node encountered that stores the word. If no such node exists, your function should return -1.

```
int search(bintreenode* root, char myword[]) {




}
```

8) (15 pts) Implement a **recursive** insert function for this tree. If the word being inserted is less than **or equal** to a word in a node in the tree, it should be inserted in the left subtree of that node. Otherwise, it should be inserted in the right subtree. Use the partially filled out function provided below. (Note: assume stdlib.h and string.h are included.)

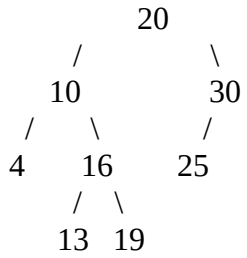
```
int max(int a, int b);

bintreenode* insert(bintreenode* root, char newword[]) {

    if (root == NULL) {
        bintreenode* tmp = malloc(sizeof(bintreenode));

        ____________________________________ ;

        tmp->height = ____ ;

        tmp->numNodes = ____ ;
        tmp->left = NULL;
        tmp->right = NULL;
        return tmp;
    }

    if (strcmp(newword, _________________ ) <= 0)

        ____________________________________________________________ ;
    else

        ____________________________________________________________ ;

    root->numNodes = _____________________________ ;
    int leftH = root->left == NULL ? -1 : root->left->height;
    int rightH = root->right == NULL ? -1 : root->right->height;

    root->height = _____________________________________ ;
}

int max(int a, int b) {
    return a > b ? a : b;
}

/*** Partial List of String Functions

strlen(s) - returns the length of string s
strcpy(s,t) - copies the contents of string t into string s.
strcmp(s,t) - returns a negative integer if s comes before t,
              lexicographically, 0 if s equals t, and a positive
              integer if s comes after t lexicographically.
***/
```

2016 Spring COP 3502 Exam #2 - AVL Trees (15 pts)

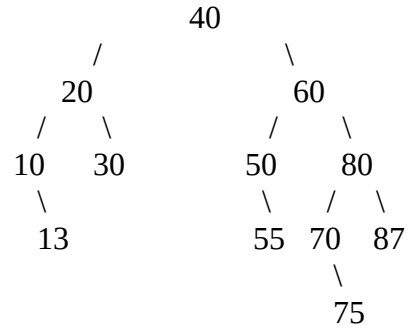
Date: 4/7/2016

Name: _____

9) (6 pts) Show the final result of inserting the value 18 into the AVL tree shown below. Draw a box around your final answer.



10) (8 pts) Show the final result of deleting the value 30 from the AVL tree shown below. Draw a box around the intermediate answer after the first rebalance and a separate box around your final answer (after the second rebalance). Label both boxes clearly.



11) (1 pt) The John C. Hitt Library is named after what UCF President? _____