VERSION A

Directions: This is a multiple choice test. Each question is worth 5 points. Please choose the most accurate answer listed.

Here is incorrect incomplete code for a stack. Assume the init function is correct, push never gets called on a full stack, and pop never gets called on an empty stack.

```
typedef struct {
    int items[10];
    int top
} stackT;

void init(stackT* mystack) {
    mystack->top = 0;
}

void push(stackT* mystack, int value) {
    items[top] = value;
    mystack->top += 1;
}

int pop(stackT* mystack) {
    return mystack->items[mystack->top];
}
```

1) Which of the following should be the first line of the push function?

```
a) mystack->items[top] = value;
b) items[mystack->top] = value;
c) mystack->items[mystack->top] = value;
d) mystack->items[mystack->top] = mystack->value;
e) items[top] = value;
```

2) The pop function can be fixed by inserting one line of code before its return statement. What line needs to be inserted before the return statement to fix the pop function?

```
a) mystack->top = 1;
b) mystack->top -= 1;
c) mystack->top++;
d) mystack->top *= 2;
e) mystack->top += 10;
```

3) What is the value of the postfix expression shown below?

```
10   5    /    6    3    +    7    -    4    *    +
```

a) 8   b) 10   c) 20   d) 29   e) None of the Above
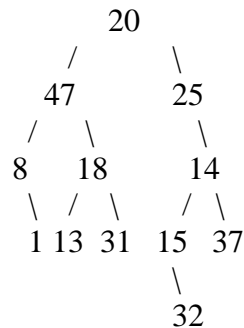

4) Consider implementing a queue with a linked list, with only a pointer to the front of the queue. Which of the functions, in this implementation, would still have an O(1) run time? (Answer with a name that is appropriate based on the convention for queue functions.)

a) enqueue   b) dequeue   c) recurse   d) printAll   e) None of the Above

5) In which of our class assignments was a queue used?

a) Normalized Form   b) AVL Tree Heist   c) Duck Duck Boot
          d) Passwords   e) None of the Above

6) Which of the following is the preorder traversal of the following binary tree?

```
                    20
                   /    \
                 47       25
                / \        \
               8   18       14
                \ / \      / \
               1 13 31   15  37
                          \
                          32
```

a) 8, 1, 37, 13, 18, 31, 20, 25, 15, 32, 14, 37
b) 20, 47, 8, 1, 18, 13, 31, 25, 14, 32, 15, 37
c) 20, 47, 8, 1, 18, 13, 31, 25, 14, 15, 32, 37
d) 1, 8, 13, 31, 18, 47, 32, 15, 37, 14, 25, 20
e) None of the Above

7) Which line of code should replace /*** insert code ***/ in the function shown below, if the goal of the function is to return the number of nodes in the binary tree pointed to by root? Note: the node that root directly points to should be counted as well as all the ones "underneath" that one.

```
struct treeNode {
    int data;
    treeNode* left;
    treeNode* right;
};

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

int countNodes(struct treeNode* root) {
    if (root == NULL) return 0;
    /*** insert code ***/
}
```

a) return countNodes(root->left) + countNodes(root->right) + 1;
b) return countNodes(root->left) + countNodes(root->right);
c) return max(countNodes(root->left),countNodes(root->right))+1;
d) return max(countNodes(root->left),countNodes(root->right));
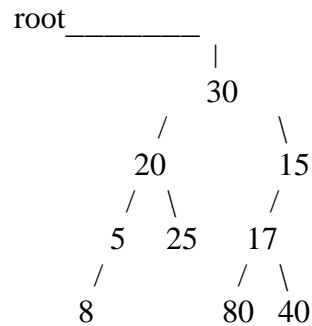e) None of the Above

8) For a tree with n nodes, what is the average case run-time of the completed function shown in the previous question?

a) O(1)   b) O(lg n)   c) O(n)   d) O(nlg n)   e) None of the Above

9) What is the output of the function call f(root) where f is the function shown below and root is a pointer to the root of the tree shown below? (Note: use the struct defintion from the two previous questions.)
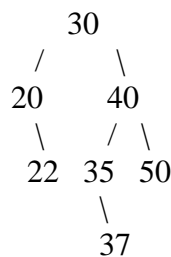
```c
void f(struct treeNode* root) {

    if (root == NULL) return 0;
    if (root->left == NULL && root->right == NULL)
        return root->data;

    int left = f(root->left);
    int right = f(root->right);
    return left + right;
}
```

```
             root_____
                         |
                        30
                       /     \
                     20       15
                    /  \      /
                   5   25    17
                  /         /  \
                 8        80  40
```

a) 0   b) 150   c) 153   d) 230   e) None of the Above

10) Inserting which of the values shown into the AVL tree shown below would cause a rebalancing operation?

```
                      30
                     /    \
                   20      40
                     \    /  \
                     22  35  50
                          \
                          37
```

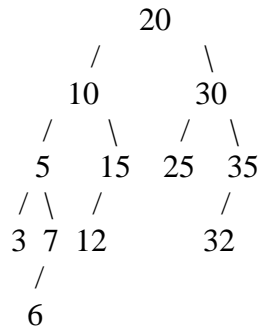a) 8   b) 19   c) 32   d) 55   e) None of the Above

11) What is the minimum number of nodes an AVL tree with height 5?

a) 10   b) 12   c) 20   d) 33   e) None of the Above

12) Deleting which node from the AVL tree shown below would cause rebalancing operations on two separate nodes of the tree ?

```
                    20
                  /     \
                10       30
              /    \    /  \
             5    15  25   35
            / \   /        /
           3 7 12         32
            /
           6
```

a) 5   b) 6   c) 15   d) 32   e) None of the Above

13) How many possible min heaps are there that store the values 1, 2, 3 and 4? (Two min heaps are different if there is at least one corresponding location in the two heaps that contain different values.)

a) 1   b) 2   c) 3   d) 4   e) None of the Above

14) Consider inserting the value 13 into the minimum heap shown below in its array representation. What is the resulting heap's array representation?

index	1	2	3	4	5	6	7	8
value	5	18	10	19	22	44	12	27

a) 5, 18, 10, 19, 22, 44, 12, 27, 13
b) 5, 10, 12, 13, 18, 19, 22, 27, 44
c) 5, 18, 10, 19, 22, 13, 12, 27, 44
d) 5, 13, 10, 18, 22, 44, 12, 27, 19
e) None of the Above

15) Which of the following replacement techniques for collisions in a hash table utilizes linked lists?

a) Separate Chaining Hashing   b) Linear Probing   c) Quadratic Probing
            d) Least Recently Used   e) None of the Above

16) Consider inserting the item 14 into the hash table shown below of size 11, using the hash function $f(x) = (2x^2 + 3x + 1) \% 11$, and the quadratic probing strategy. In which index would 14 be placed?

index	0	1	2	3	4	5	6	7	8	9	10
value					2		1	3			7

a) 0   b) 3   c) 8   d) 9   e) None of the Above

17) Which of the following is the binary equivalent to the hexadecimal value B9?

a) 10101000   b) 10101001   c) 10111000   d) 10111010   e) None of the Above

18) Which of the following is the binary equivalent to the decimal value 286?

a) 100011110   b) 100011111   c) 0110000110   d) 100100000   e) None of the Above

19) Which of the following is the decimal equivalent to the binary value 11010111?

a) 192   b) 208   c) 215   d) 217   e) None of the Above

20) Upon how many large companies is the S & P 500 stock index based?

a) 500   b) 1000   c) 50,000   d) 5 billion   e) 5 trillion