COP 3502H
Computer Science I Honors
Practice Final Exam

1) a) For the code segment shown below,

(a) (4 pts) Find the Big-Oh order of this code segment in terms of n. Provide justification.

(b) (6 pts) Determine a summation representing the final value of x. Solve for the closed form solution in terms of n.

```
int x = 0;
for (i = 1; i <= (2*n); i++) {
   for (j = 1; j <= n; j++)  {
      if ( j < i)
         x = x + 1;
   }
}
```

c) An algorithm runs in $O(\sqrt{n})$ time. When the algorithm is run with an input size of 14900, it takes 7 seconds to complete. How long will it take to complete on an input size of 59600?

d) Let T(n) represent the best case run-time of a Quick Sort of n elements. Write down a recurrence relation that T(n) satisfies that is based on the standard recursive implementation of the sort.

2) Consider a binary search in the array below for the value 28, which values are checked in the array before it is found? (Please list these in the order in which they are checked.)

index	0	1	2	3	4	5	6	7	8	9	10	11	12
value	2	3	7	10	11	15	18	20	22	26	27	28	30

____ , ____ , ____ , ____ , ____ , ____ , ____ , ____

Note: More blanks than necessary are provided. Fill them in from the left. The last blank you fill in should have a 28 in it.

3) The permutation function is defined as follows: P(n, k) = n(n-1)(n-2)…(n-k+1), for positive integers n and k, with $1 \leq k \leq n$. Note that P(n, 1) = n. Write a recursive function that takes in integer parameters n and k and returns P(n, k) below.

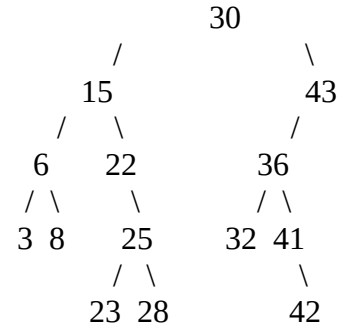
```
int perm(int n, int k) {




}
```

4) Convert 137_8 to base 5. (Remember you need to use a two step process.)

5) Write a **recursive function** that deletes every other node in a linked list pointed to by the pointer front, which is passed in as a parameter. In particular, make sure you delete the first, third, fifth, etc. nodes and return a pointer to the new list. If the list has zero or one item in it, NULL should be returned.

```
struct ll* {
    int data;
    struct ll* next;
};

struct ll* delEveryOther(struct ll* front) {









}
```

6) Write a recursive function that pushes all even values into a Stack and enqueue's all odd values into a Queue. Assume S and Q are initialized.



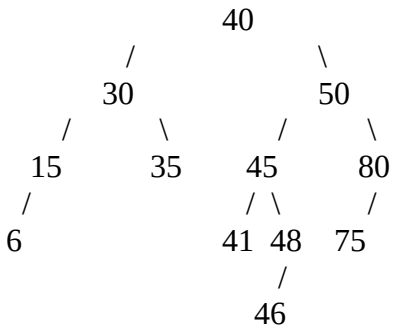

```
struct tree_node {
    int data;
    struct tree_node* left;
    struct tree_node* right;
};

int question6(struct tree_node *root, Stack *S, Queue *Q) {

}
```

After the function call question6(root, S, Q), where root points to tree_node 30, and s and Q are originally empty. What are the contents of S and Q?

S:_____

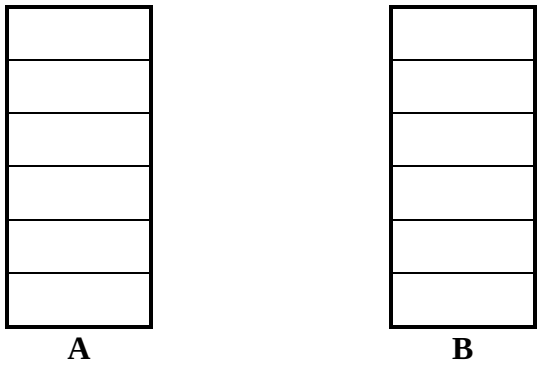
Q:_____

7) Show the result of deleting 35 from the AVL Tree below:



8) Evaluate the following postfix expression showing the contents of the stack in each of the positions (A and B) indicated.

						A						B		
6	8	2	+	*	7	3	–	/	10	+	3	–		



A **B**

Value of Postfix expression: _____

9) Solve the following three recurrences using the Master Theorem:

a) $T(n) = 8T(n/3) + O(n^2)$ _____

b) $T(n) = 8T(n/2) + O(n^2)$ _____

c) $T(n) = 25T(n/5) + O(n^2)$ _____

10) Show the contents of the following array after each pass of an insertion sort.

Index	0	1	2	3	4	5	6
Start	7	2	6	1	5	3	4
End	1	2	3	4	5	6	7

11) Consider running the partition function on the array below (using index 0 as the partition element) in the manner shown in class. Show the final result of partitioning this array.

Index	0	1	2	3	4	5	6	7	8
Original	6	3	9	5	1	12	2	4	15
Answer									

12) Consider a hash table that uses the quadratic probing technique with the following hash function f(x) = (3x+4)%12. (The hash table is of size 12.) If we insert the values 5, 8, 3, 2 and 6, in that order, show where these values would end up in the table?

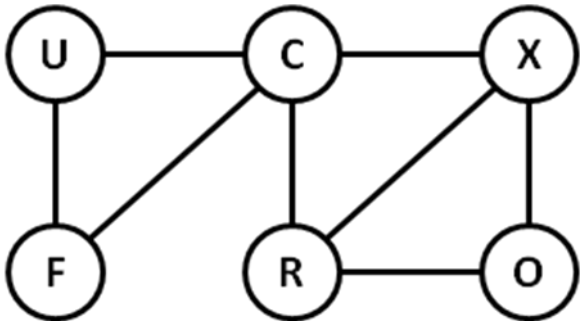
Index	0	1	2	3	4	5	6	7	8	9	10	11
Value												

13) Draw the heap corresponding to the following array:

Index	1	2	3	4	5	6	7	8	9
Value	3	8	6	15	9	7	12	22	16

14) Show the result of inserting the value 4 into the heap from the previous question.

15)



a) Give the adjacency matrix of the graph above:

b) Give the Depth First Search traversal of the graph above, starting with U and if there is a choice between vertices choose in alphabetical order.

DFS:_____ , _____ , _____ , _____ , _____ , _____

c) Give the Breadth First Search traversal of the graph above, starting with U and if there is a choice between vertices choose in alphabetical order.

BFS:_____ , _____ , _____ , _____ , _____ , _____