CMPSC 24 Winter 2018 Final Exam Answer Sheet
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Name: Solutions Seat no. _____ Perm no. :_____

Student to your left:_____ Student to your right _____

Part 1

Q1 [5pts]

i. _____O(N)__ ii. ____O(logN)_____iii. _____O(1)_____ iv. ____O(logN)__ v. ___O(1)_____

Q2 [5pts]

i. ____A_____ ii. ____C_____iii. _____C_____ iv. ___B_____ v. ____B_____

Q3 [20 pts]

i. _____Yes_____ ii. _____Yes_____iii. _____Yes_____ iv. ___No____ v. __D_____

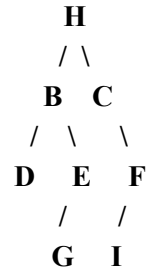
vi. _____F_____ vii. _____G_____viii. _____A_____

ix. a. D B G E H A C I F

b. A B D E G H C F I

x.

OR



Q4 i.

5	20	15	25	50	40	30	55	80
0	1	2	3	4	5	6	7	8

ii. a._____50_____ b._____(50 or 25)_____ c.__(20, 5)____ d._____(15, 30)_____

iii.

15	20	30	25	50	40	80	55
0	1	2	3	4	5	6	7

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Q5 [10 pts] i. (3 pts) a. _____true_____ b._____true_____ c._____false_____

ii. (3 pts)

```
if (input[i] == '(') {
    st.push(input[i]);
} else if(input[i] == ')' && !st.empty(){
    st.pop();
} else if(input[i] == ')' && st.empty(){
    return false;
}

//Other equivalent solutions are acceptable
```

iii. (2 pts) _____O(N)_____ iv. (2 pts) C, D_____

Q6 i. (3pts)

Variable/ expression in `foo()`	Instance of `stack`? **(Yes/No)**	Where is it located in memory? **(Heap/Stack)**	Is the deconstructor of `stack` invoked on this object when `foo()` returns? **(Yes/No)**
`a`	`Yes`	`Stack`	`yes`
`p`	`No`	`Stack`	`no`
`*p`	`Yes`	`Heap`	`no`

ii (3 pts)

```
30 20 10
30 20 10
```

iii. (2 pts) _____B_____ iv (2pts) _____AB_____

Q7 [5 pts] i._____O(1)_____ ii_____N(N-1)/2 OR 1 +2 + 3…..+ (N-1)

iii _____O(N^2)_____ iv_____Stays the same_____

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Q8 [5 pts]

```
Input: unsorted array a[N]
Insert all the elements of the array in a minHeap or a balanced BST
// O(N log N)
for 1:N
   a[i] = min element of Heap or BST    O(1) for heap, O(logN) for BST
   Delete min element of heap or BST    O(logN) for heap, O(logN) for BST

Overall O(NlogN) better than O(N^2)
//Other solutions are acceptable
```

Part 2 Q1 [10 pts]

```
bool BST::search(const int value) const{

       return searchHelper(root, value);
}

bool BST::searchHelper(Node* n , const int value) const{

      if(!n)      //Do a null check
             return false;
      if(n->data == value)  // Check for match
             return true;
      else if(value < n->data)
             return searchHelper(n->left, value);
      else
             return searchHelper(n->right, value);


}
```

1. Run solution on empty tree
2. Run the solution on some small examples

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Part 2 Q2 [15 pts]

```
void BST::deleteTreeRecursively(Node* n){
      if(!n) return;
      deleteTreeRecursively(n->left);
      deleteTreeRecursively(n->right);
      delete n;
}
```

OR

```
Node* BST::successor(Node* n) const {
     if(!n) return 0;
     //Case 1: node has a right child
     if(n->right){
         n=n->right;
         while(n->left!= 0) {
              n=n->left;
         }
         return n;
     }
     //Case 2: // node has no right child
     while(n->parent && n->parent->data < n->data)
           n = n->parent;
     return n;

}
```