ESO207 Theoretical Assignment - 1

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Q4)

A. *Pseuso Code:*

```
1  Query(n)        Returns the value of n^th card from the top
2  First ← Query(1)
3  Find(left,right){
4  if(left ≤ right){
5        mid ← (left+right)/2
6        if(query(mid) = 1) return mid
7        else if(query(mid) > First) return Find(mid+1,right)
8        else return Find(left, mid-1)
9  }
10 return -1
11 }
```

B. *Time complexity:*

$$T(n) \leq c+T(n/2)$$

Let $n = 2^m$

$$\begin{gathered} T(2^m) \leq c+T(2^{m-1}) \\ T(2^{m-1}) \leq c+T(2^{m-2}) \\ T(2^{m-2}) \leq c+T(2^{m-3}) \\ \vdots \quad \text{m times} \\ T(2) \leq c+T(1) \end{gathered}$$

As T(1) is a constant it can be included into c.

$$\begin{gathered} T(2^m) \leq c * m \\ T(n) \leq c*\log(n) \end{gathered}$$

Hence the time complexity of the program is O(log n).

Q5)

A

```
1  ispalindrome(i,j)       checks if the given substring is palindrome
2  expandcenter(i,j,left,right){
3       if(i=left or j=right) return ( j - i )/2
4       else if(i=left+1 or j=right-1) {
5            if(ispalindrome(i-1,j+1)) return (j - i +2)/2
6            else return (j-i)/2
7       }
8       max ← maximum element of i-1,n-j
9       mid ← max/2
10      if(ispalindrome(i-mid, j+mid))
11           return expandcenter(i - mid , j + mid ,left, right)
12      else
13           return expandcenter(i,j, left-mid+1, right+mid-1)
14 }
15 countpalindrome(){
16      count ← 0
17      For(i=1 to n-2)
18           if(ispalindrome(i,i+2))
19                count+=expandpalindrome(i,i+2,1,n)
20           if(ispalindrome(i,i+1))
21                count+=expandpalindrome(i,i+1,i,n)
22             if(ispalindrome(n-1,n)) count++
23      return count
24 }
```