1. Write down all the steps of Bubble Sort on the Following Array.

Index	0	1	2	3	4	5
Value	7	2	13	2	11	4

For example:
1st iteration:
  1st step: **7 2** 13 2 11 4 -> 2 7 13 2 11 4
  2nd step: 2 **7 13** 2 11 4 -> 2 7 13 2 11 4
  3rd step: 2 7 **13 2** 11 4 -> 2 7 2 13 11 4
  ……..

2. Write down two differences between array and vector in C++.

3. Write down the time complexity with proper explanation of the following code segment.

```
for(int i=1;i<=n;i++)
{
        if(builtin_popcount(i) == 2)
        {
                for(int j=1;j<=n;j++)
                        cout<<i<<j<<endl;
        }
}

Note: builtin_popcount(i) returns the number of set bits in 'i'.
For example builtin_popcount(5) = 2. Because, 5 = (101)₂. So there are 2 set
bits in 5.
```

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4. Look at the following code which calculates the number of distinct elements. Are there any flaws in this code? If yes, write down the flaws with proper explanation.

```
#include<bits/stdc++.h>
using namespace std;
int main(){
        int n;
        cin>>n;
        vector<int>a(n);
        for(int i=0;i<n;i++)
                cin>>a[i];
        sort(a.begin(),a.end());
```

```
        int ans = 0;
        for(int i=0 ; i<=n ; i++)
                if(a[i]!=a[i-1])
                        ans++;
        cout<<ans;
        return 0;
}
```

5. Write down the time and space complexity with proper explanation of the following code segment.

```
vector<int>d[n+1];
for(int i=1 ; i<=n ; i++)
        for(int j=i ; j<=n ; j = j+i )
                d[j].push_back(i);
```

6. Fill up the following table with 'YES' or 'NO' in each cell in the context of public, private and protected access modifiers in C++ Class. First cell is already filled up for your convenience.

Name	Accessibility from own class	Accessibility from derived class	Accessibility from world
Public	YES		
Private			
Protected			

7. What is 'new' and 'delete' in C++.

8. Alice wrote a new algorithm which works in $O(n^3)$ where n can be atmost 10^6. Bob told Alice that it will take years to finish in the worst case. Do you agree with Bob? If yes, then approximately how many years will it take to finish? Assume Alice's computer can run 10^9 instructions in 1 second.

9. Write down two differences between binary search and linear search.

10. Suppose you wrote a code for a server which contains the following function.

```
void func()
{
    int* p = new int;
```

```
    return;
}
```

Are there any flaws in the function? If yes, then explain the flaw and modify the function so that there is no flaw in the function. You cannot delete any lines of code from the function. You are only allowed to write your own code to overcome the flaw.