

Question 1

```
#include<iostream>
#include<vector>
using namespace std;
int binary_to_decimal(vector<int> &a)
{
    int n=0;
    for(int i=0;i<a.size();i++)
    {
        n=n*2+(a[i]);
    }
    return n;
    //cout<<"decimal : "<<n<<"\n";
}
int octal_to_decimal(vector<int> &a)
{
    int n=0;
    for(int i=0;i<a.size();i++)
    {
        n=n*8+(a[i]);
    }

    //cout<<"decimal : "<<n<<"\n";
    return n;
}
int hexa_to_decimal(vector<char> &a)
{
    int n=0;
    for(int i=0;i<a.size();i++)
    {
        if(a[i]<='9'&& a[i]>='0')
            n=n*16+(a[i]-'0');
        else
        {
            n=n*16+(a[i]-'A'+10);
        }
    }
}

//cout<<"decimal : "<<n<<"\n";
return n;

}
```

```

vector<int> decimal_to_binary( int n)
{
    vector<int> a;

    while(n)
    {
        a.push_back(n%2);
        n=n/2;
    }

    for(int i=0;i<a.size()/2;i++)
    {
        int temp=a[i];
        a[i]=a[a.size()-1-i];
        a[a.size()-1-i]=temp;
    }
    return a;
}

```

```

vector<int> decimal_to_octal(int n)
{
    vector<int> a;
    while(n)
    {
        a.push_back(n%8);
        n=n/8;
    }

    for(int i=0;i<a.size()/2;i++)
    {
        int temp=a[i];
        a[i]=a[a.size()-1-i];
        a[a.size()-1-i]=temp;
    }
    return a;
}

```

```

vector<char> decimal_to_hexadecimal(int n)
{
    vector<char> a;
    while(n)
    {
        int temp=n%16;

```

```

        if(temp<10)
        {
            a.push_back('0'+temp);
        }
        else
        {
            a.push_back('A'+(temp-10));
        }
        n=n/16;
    }

```

```

    for(int i=0;i<a.size()/2;i++)
    {
        int temp=a[i];
        a[i]=a[a.size()-1-i];
        a[a.size()-1-i]=temp;
    }
    return a;
}

```

```

template<typename t>
void print(vector<t> a)
{
    for(int i=0;i<a.size();i++)
    {
        cout<<a[i];
    }
    cout<<"\n";

}

```

```

void binary_to_hexadecimal()
{
    vector<int> a;
    int n;
    cout<<"ENTER -1 TO STOP";
    cin>>n;
    while(n!=-1)
    {
        a.push_back(n);
        cin>>n;
    }
    cout<<"\n BINARY :";
}

```

```
    print(a);  
    int d=binary_to_decimal(a);  
    vector<char> b;  
    b=decimal_to_hexadecimal(d);  
    cout<<"\n HEXADECIAML : ";  
    print(b);
```

```
}  
void hexadecimal_to_binary()  
{  
    vector<char> a;  
    char n;  
    cout<<"ENTER S TO STOP";  
    cin>>n;  
    while(n!='S')  
    {  
        a.push_back(n);  
        cin>>n;  
    }  
    cout<<"\n HEXADECIMAL :";  
    print(a);  
    int d=hexa_to_decimal(a);  
    vector<int> b;  
    b=decimal_to_binary(d);  
    cout<<"\n BINARY : ";  
    print(b);
```

```
}  
void binary_to_octal()  
{  
    vector<int> a;  
    int n;  
    cout<<"ENTER -1 TO STOP";  
    cin>>n;  
    while(n!=-1)  
    {  
        a.push_back(n);  
        cin>>n;  
    }  
    cout<<"\n BINARY :";  
    print(a);  
    int d=binary_to_decimal(a);  
    vector<int> b;
```

```

        b=decimal_to_octal(d);
        cout<<"\n OCTAL : ";
        print(b);

    }
    void octal_to_binary()
    {
        vector<int> a;
        int n;
        cout<<"ENTER -1 TO STOP";
        cin>>n;
        while(n!=-1)
        {
            a.push_back(n);
            cin>>n;
        }
        cout<<"\n OCTAL : ";
        print(a);
        int d=octal_to_decimal(a);
        vector<int> b;
        b=decimal_to_binary(d);
        cout<<"\n BINARY : ";
        print(b);

    }
    void octal_to_hexadecimal()
    {
        vector<int> a;
        int n;
        cout<<"ENTER -1 TO STOP";
        cin>>n;
        while(n!=-1)
        {
            a.push_back(n);
            cin>>n;
        }
        cout<<"\n OCTAL : ";
        print(a);
        int d=octal_to_decimal(a);
        vector<char> b;
        b=decimal_to_hexadecimal(d);
        cout<<"\n HEXADECIAML : ";
        print(b);
    }

```

```

}
void hexadecimal_to_octal()
{
    vector<char> a;
    char n;
    cout<<"ENTER S TO STOP";
    cin>>n;
    while(n!='S')
    {
        a.push_back(n);
        cin>>n;
    }
    cout<<"\n HEXADECIMAL :";
    print(a);
    int d=hexa_to_decimal(a);
    vector<int> b;
    b=decimal_to_octal(d);
    cout<<"\n OCTAL : ";
    print(b);
}

```

```

int main()
{
    int t=1;
    while(t)
    {
        cout<<"ENTER 1 TO CONVERT DECIMAL TO BINARY TO DECIMAL \nENTER 2 TO
CONVERT DECIMAL TO OCTAL TO DECIMAL\nENTER 3 TO CONVERT DECIMAL TO
HEXADECIMAL TO DECIMAL\nENTER 4 TO CONVERT BINARY TO HEXA\nENTER 5 TO
CONVERT BINARY TO OCTAL\nENTER 6 TO CONVERT OCTAL TO BINARY\nENTER 7 TO
CONVERT OCTAL TO HEXA\nENTER 8 TO CONVERT HEXA TO OCTAL\nENTER 9 TO
CONVERT HEXA TO BINARY\nENTER 0 TO EXIT\nENTER YOUT CHOISE : ";
        cin>>t;

        int n;
        vector<int> a;
        vector<char> b;

        switch(t)
        {

```

```
case 1:
    cout<<"enter the integer : ";
    cin>>n;
    a=decimal_to_binary(n);
    cout<<"BINARY : ";
    print(a);
    n=binary_to_decimal(a);
    cout<<"DECIMAL : "<<n<<"\n";
    break;
case 2:
    cout<<"enter the integer : ";
    cin>>n;
    a=decimal_to_octal(n);
    cout<<"OCTAL : ";
    print(a);
    n=octal_to_decimal(a);
    cout<<"DECIMAL : "<<n<<"\n";
    break;
case 3:
    cout<<"enter the integer : ";
    cin>>n;
    b=decimal_to_hexadecimal(n);
    cout<<"HEXA : ";
    print(b);
    n=hexa_to_decimal(b);
    cout<<"DECIMAL : "<<n<<"\n";
    break;
case 4:
    binary_to_hexadecimal();
    break;
case 5:
    binary_to_octal();
    break;
case 6:
    octal_to_binary();
    break;
case 7:
    octal_to_hexadecimal();
    break;
case 8:
    hexadecimal_to_octal();
    break;
case 9:
    hexadecimal_to_binary();
```

```
        break;
    }
}
```

```
}
```

Question 2

```
#include <iostream>
#include <vector>
using namespace std;
class student
{
public:
    string name;
    long long unsigned int enroll;
    int marks[5];
    void input()
    {
        string n;
        cout << "enter name : ";
        fflush(stdin);
        getline(cin, n);
        fflush(stdin);
        name = n;
        cout << "enter enrollment number : ";
        cin >> enroll;
        cout << "enter the marks of 5 subs : ";
        for (int i = 0; i < 5; i++)
        {
            cin >> marks[i];
        }
    }
    void detail()
    {
        cout << "NAME : " << name << "\n";
        cout << "ENROLLMENT NO : " << enroll << "\n";

        cout << " MARKS : ";
        for (int i = 0; i < 5; i++)
```



```

    {
        cout << marks[i] << " ";
    }
    cout << "\n";
}
};

```

```

void change ( string s)
{
    cout<<s<<" : ";
    char a=s[0];

    for(int i=0;i<s.length()-1;i++)
    {
        s[i]=s[i+1];
    }
    s[s.length()-1]=a;
    s+="ay";

    s[0]='A'+(s[0]-'a');

    cout<<s<<"\n";

```

```

}
int main()
{
    int n;
    cout << "enter n : ";
    cin >> n;
    student s[n];

    int t = 1;
    while (t)
    {
        cout << "enter 0 to exit\n";
        cout << "enter 1 to input\n";
        cout << "enter 2 to sort by name \n";
        cout << "enter 3 to sort by enrollment number \n";
        cout << "enter 4 to sort by subject marks \n";
        cout << "enter your choice : ";
        cin >> t;

```

```

switch (t)
{
case 1:
    for (int i = 0; i < n; i++)
    {
        s[i].input();
    }
    break;
case 2:
    cout << "\n\nsorted by name \n";
    for (int i = 0; i < n - 1; i++)
    {
        for (int j = 0; j < n - i - 1; j++)
        {
            if (s[j].name > s[j + 1].name)
            {
                swap(s[j], s[j + 1]);
            }
        }
    }
}

```

```

    for (int i = 0; i < n; i++)
    {
        s[i].detail();
    }
    break;

```

```

case 3:
    cout << "\n\nsorted by enrollment \n";
    for (int i = 0; i < n - 1; i++)
    {
        for (int j = 0; j < n - i - 1; j++)
        {
            if (s[j].enroll > s[j + 1].enroll)
            {
                swap(s[j], s[j + 1]);
            }
        }
    }
    for (int i = 0; i < n; i++)
    {
        s[i].detail();
    }
    break;

```

case 4:

```
cout << "\n\nsorted by marks of subject 1 \n";
```

```
for (int i = 0; i < n - 1; i++)
```

```
{
```

```
    for (int j = 0; j < n - i - 1; j++)
```

```
    {
```

```
        if (s[j].marks[0] > s[j + 1].marks[0])
```

```
        {
```

```
            swap(s[j], s[j + 1]);
```

```
        }
```

```
    }
```

```
}
```

```
for (int i = 0; i < n; i++)
```

```
{
```

```
    s[n - 1 - i].detail();
```

```
}
```

```
cout << "\n\nsorted by marks of subject 2 \n";
```

```
for (int i = 0; i < n - 1; i++)
```

```
{
```

```
    for (int j = 0; j < n - i - 1; j++)
```

```
    {
```

```
        if (s[j].marks[1] > s[j + 1].marks[1])
```

```
        {
```

```
            swap(s[j], s[j + 1]);
```

```
        }
```

```
    }
```

```
}
```

```
for (int i = 0; i < n; i++)
```

```
{
```

```
    s[n - 1 - i].detail();
```

```
}
```

```
cout << "\n\nsorted by marks of subject 3 \n";
```

```
for (int i = 0; i < n - 1; i++)
```

```
{
```

```
    for (int j = 0; j < n - i - 1; j++)
```

```
    {
```

```
        if (s[j].marks[2] > s[j + 1].marks[2])
```

```
        {
```

```
            swap(s[j], s[j + 1]);
```

```
        }
```

```
}
```

```

    }
}

    for (int i = 0; i < n; i++)
    {
        s[n - 1 - i].detail();
    }

    cout << "\n\nsorted by marks of subject 4 \n";
    for (int i = 0; i < n - 1; i++)
    {
        for (int j = 0; j < n - i - 1; j++)
        {
            if (s[j].marks[3] > s[j + 1].marks[3])
            {
                swap(s[j], s[j + 1]);
            }
        }
    }

    for (int i = 0; i < n; i++)
    {
        s[n - 1 - i].detail();
    }

    cout << "\n\nsorted by marks of subject 5 \n";
    for (int i = 0; i < n - 1; i++)
    {
        for (int j = 0; j < n - i - 1; j++)
        {
            if (s[j].marks[4] > s[j + 1].marks[4])
            {
                swap(s[j], s[j + 1]);
            }
        }
    }

    for (int i = 0; i < n; i++)
    {
        s[n - 1 - i].detail();
    }
    break;
}
}

```

```
cout<<"PIGLATIN : \n";
```

```
for(int i=0;i<n;i++)  
{  
    change(s[i].name);  
}  
}
```

Question 3

$T(N)=O(N/2)+O(1)= \text{THETA}(N)$

$SC= O(1)$

```
#include<iostream>  
using namespace std;
```

```
int main()  
{  
    int n;  
    cout<<"enter the number of elements of array :";  
    cin>>n;
```

```
    int a[n];
```

```
    for(int i=0;i<n;i++)  
    {  
        cout<<"enter the "<<i+1<<"th element : ";  
        cin>>a[i];
```

```
    }
```

```
    //sort
```

```
    for(int i=0;i<n;i+=2)  
    {  
        if(a[i-1]>=a[i] && i-1>=0)  
        {  
            swap(a[i-1],a[i]);  
        }  
        if(a[i+1]>=a[i] && i+1<=n-1)
```

```

    {
        swap(a[i+1],a[i]);

    }
}

cout<<" wave array : ";

for(int i=0;i<n;i++)
{
    cout<<a[i]<< " ";

}
}

```

Question 4

Algo:

Step 1: create a array "lower" which contains the product of elements before the ith element.//O(N)

Step 2: create a array "upper" which contains the product of all elements after the ith element. //O(N)

Step 3: $b[i] = \text{lower}[i] * \text{upper}[i]$ // O(N)

$T(N) = \Theta(N)$

$SC = 3 * O(N) = O(N)$

```

#include<iostream>
using namespace std;

```

```

int main()
{
    int n;
    cout<<"enter the number of elements of array :";
    cin>>n;

    int a[n];

```

```

    for(int i=0;i<n;i++)
    {
        cout<<"enter the "<<i+1<<"th element : ";
        cin>>a[i];
    }
    int i=0;
    int j,lp=1,up=1;

    int lower[n],upper[n],b[n];

    for(i=0;i<n;i++)
    {
        Low
er[i]=lp;
        lp*=a[i];

        j=n-1-i;

        upper[j]=up;
        up*=a[j];

    }

    while(i--)
    {
        b[i]=lower[i]*upper[i];
    }

    cout<<" b : ";
    for(int i=0;i<n;i++)
    {
        cout<<b[i]<<" ";
    }

}

```