Problem A

He asks you to count how many $s_i = s_{i+1}$ in range $[L, R]$, we can use prefix sum to minimize time for each query.

We can use prefix in this way:

$$pref(i) = \begin{cases} arr[i] + pref(i-1), & arr[i] == arr[i-1] \\ pref(i-1), & arr[i]! = arr[i-1] \end{cases}$$

When current index equal previous index we increment the value of prefix, otherwise we use previous value.

0	0	0	1	1	2	3

For each query answer is:(How many $s_i = s_{i+1}$ in range $[0, R]$ - How many $s_i = s_{i+1}$ in range $[0, L-1]$).

```
1  #include <iostream>
2  #include <bits/stdc++.h>
3  using namespace std;
4  int main ()
5  {
6      string s; cin>>s;    int q, l , r,oo=s.size();
7     int arr [oo-1];
8     for (int i = 0; i < oo-1; ++i) {
9        if(s[i]==s[i+1]){arr[i+1]=arr[i]+1;}
10       else
11       {
12          arr[i+1]=arr[i];
13       }
14    }
15     cin>>q;
16    while (q--)
17    {
18        cin>>l>>r;
19       cout<<(arr[r-1]-arr[l-1])<<endl;
20    }
21 }
```

Problem C

We can use prefix sum as problem A, for each number realize the condition we will increment the value of prefix:

$$pref(i) = \begin{cases} pref(i-1)+1, & (n\%10 == 2)\ ||(n\%10 == 3)||(n\%10 == 9) \\ pref(i-1), & otherwise \end{cases}$$

```
1  #include <iostream>
2  #include <bits/stdc++.h>
3  using namespace std;
4  int n;
5  long long arr[N];
6  long long pref[N];
7  int check(int num)
8  {
9        if(num%10==2||num%10==3||num%10==9){return 1;}
10    return 0;
11 }
12 int main ()
13 {
14   cin>>n;
15   for(int i=1;i<N;i++)
16   {
17       pref[i]=pref[i-1]+ check(i);
18   }
19   while (n--)
20   {
21        int l,r;cin>>l>>r;
22        cout<<pref[r]-pref[l-1]<<endl;
23    }
24 }
```

Problem E

In this problem we need to choose x , y optimally. that when we divide $(x + y)$ **the loss is as small as possible**, so we will use smallest values in array first:

Sum	Division	loss
(200 + 300) = 500	250	250
(300 + 500) = 800	400	400
(200 + 500) = 700	350	350

To get first 2 smallest values every time, we will sort.

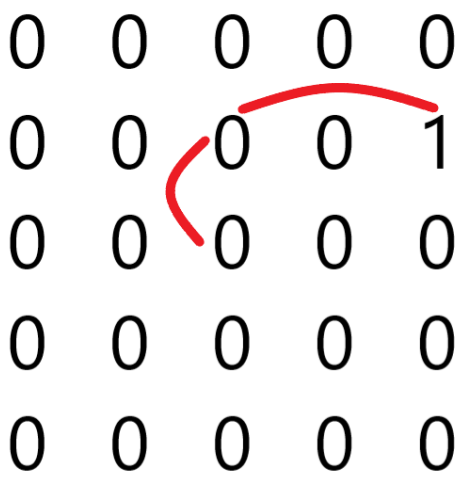
```
1  #include<iostream>
2  #include <algorithm>
3  using namespace std;
4  int main()
5  {
6      int x;
7      cin>>x;
8      float arr[x];
9      for (int i=0;i<x;i++)
10     {
11         cin>>arr[i];
12     }
13     sort (arr,arr+x);
14     for (int i=1;i<x;i++)
15     {
16         arr[i]=(arr[i]+arr[i-1])/2;
17     }
18     cout<<arr[x-1];
19     return 0;}
```

Problem F

we need to move 1 from index [4] [1] to index [2] [2], so we need to move 2 horizontal, and 1 vertical.

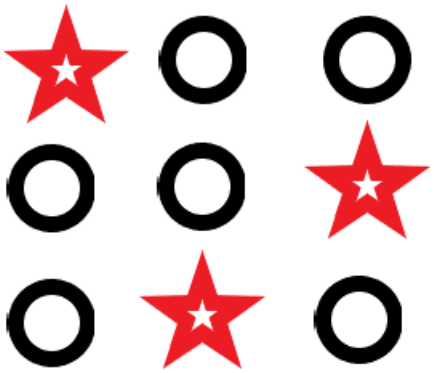
If 1 in index [x] [y] so answer is:

$|x-2| + |y-2|$




```
1  #include <iostream>
2  using namespace std;
3  int butifule_matrix(int arr [5][5])
4  {
5
6     for ( int i =0 ; i< 5 ; i++)
7     {
8        for ( int j =0 ; j<5 ; j++)
9        {
10          if (arr[i][j]==1){    return abs(i-2)+abs(j-2);}
11       }
12    }
13 }
14 int main ()
15 {
16    int arr[5][5];
17    for ( int i =0 ; i< 5 ; i++)
18    {
19       for ( int j =0 ; j<5 ; j++)
20       {
21         cin>>arr[i][j];
22       }
23    }
24    cout<<butifule_matrix(arr);
25 }
```

Problem H



In this example we have two cases:

- Two neighbors O: we have two options
  - Take separately so cost will be $2 * X$
  - Take both O so cost will be Y
- Only one O:
  - Take this one with cost X

So, we will take minimum when we have two neighbors.

```
1  #include <iostream>
2  using namespace std;
3  int main(){
4     int tc ; cin>>tc;
5     while (tc--)
6     {
7        int  n , m  , x , y ;
8        cin>>n>>m>>x>>y;
9        char arr[n][m];
10       for (int i = 0; i < n; ++i) {
11          for (int j = 0; j <m ; ++j) {
12             cin>>arr[i][j];
13          }
14       }
15       int ans = 0 ;
16       for (int i = 0; i < n; ++i) {
17          for (int j = 0; j < m ; ++j) {
18             if(j+1 <m &&arr[i][j]=='.' && arr[i][j+1]=='.' )
19             {
20                ans += min(2*x , y) ;
21                j++;
22             }
23             else if(arr[i][j]=='.')
24             {
25                ans+= x;
26             }
27          }
28       }
29       cout<<ans<<endl;
30    }
31 }
```

Problem I

We will use prefix sum to answer each query in $O(1)$, so we need to know the index of character in alphabet.

We can do this using this formula:

$$pref[i+1] = pref[i] + (s[i] - 'a' + 1)$$

Because $int('a') = 49$, and $int('b') = 50$

'a' – 'a'	0
'b' – 'a'	1
'c' – 'a'	2

```
1  #include <iostream>
2  using namespace std;
3  int main(){
4      int n , q ;
5      cin>>n>>q ;
6      int pref[n+1];
7      string s ; cin>>s;
8      pref[0] =  0;
9      for (int i = 0; i < s.size(); ++i) {
10         pref[i+1]  = pref[i] + (s[i] - 'a'+1) ;
11     }
12     while (q--)
13     {
14         int l , r ;
15         cin>>l>>r ;
16         cout<<pref[r] - pref[l-1]<<endl;
17     }
18 }
```

Problem J

We search for <u>continuous</u> K element in array their sum as small as possible.

I can use prefix sum to get sum of $\sum_{i}^{i-k} Arr[i]$.

1 2 6 1 1 7 1

I will minimize value $pref[i] - pref[i-k-1]$.

```
1  #include <iostream>
2  using namespace std;
3  int val(int l , int r , int arr [])
4  {
5     if(l==0){return arr[r];}
6     else{return arr[r]-arr[l-1];}
7  }
8  int main(){
9  int n , k ,ind=0;cin>>n>>k;
10    int arr[n];
11    cin>>arr[0];
12    int minn= 1000000000;
13    for(int i = 1 ; i< n ;i++)
14    {
15       int x; cin>>x;
16       arr[i]=x+arr[i-1];
17    }
18    for(int i = 0 ; i< n-k+1 ; i++)
19    {
20       if(val(i,i+k-1,arr) <minn)
21       {
22          minn=val(i,i+k-1,arr);
23          ind=i;
24       }
25    }
26   cout<<ind+1;
27 }
```

Problem K

In this problem we need to minimize the cost of string, first let's define cost.

If we take any index I and any index L so the cost increase when:

$$S[I] = S[L] \quad and \quad S[I+1] = S[L+1]$$

So if we have A B in string try to not have another A B.

By use this sequence:

A AB AC AD B BC BD C CD ….

```
1  #include <iostream>
2  using namespace std;
3  int main(){
4  int n , k;
5    cin>>n>>k;
6      while (n>0) {
7          for (int j = 0; j < k and n>0; ++j)
8          {
9             cout<<(char)(j + 'a'); n--;
10            for (int l = j+1; l < k and n>0; ++l)
11            {
12               cout<<(char)(j + 'a'); n--;
13               if(n>0)
14               {
15                  cout<<(char)(l + 'a'); n--;
16               }
17            }
18         }
19     }
```

Problem L

At first:

$$a^2 - b = c$$

$$a^2 + b^2 = c^2$$

Subtract two equations:

$$b^2 + b = c^2 - c$$

$$b(b+1) = c(c-1)$$

B never equal C because if $b = c$, $(b+1) \neq (b-1)$.

So:

$$b = c - 1$$

$$c = b + 1$$

Now in first equation:

$$a^2 - b = b + 1$$

$$a^2 = 2b + 1$$

So a^2 always will be odd so a is Odd.

$$a \leq b \leq c \leq N$$

if C = N (max value)

$$a^2 = 2c - 1$$

So a will be any odd value between $[3, \sqrt{2c-1}]$.

Count odd values in this range in $O(1)$ by using $\frac{\sqrt{2n-1}]}{2} - 1$.

Or iterate loop on odd values in $O(\frac{N}{2})$.