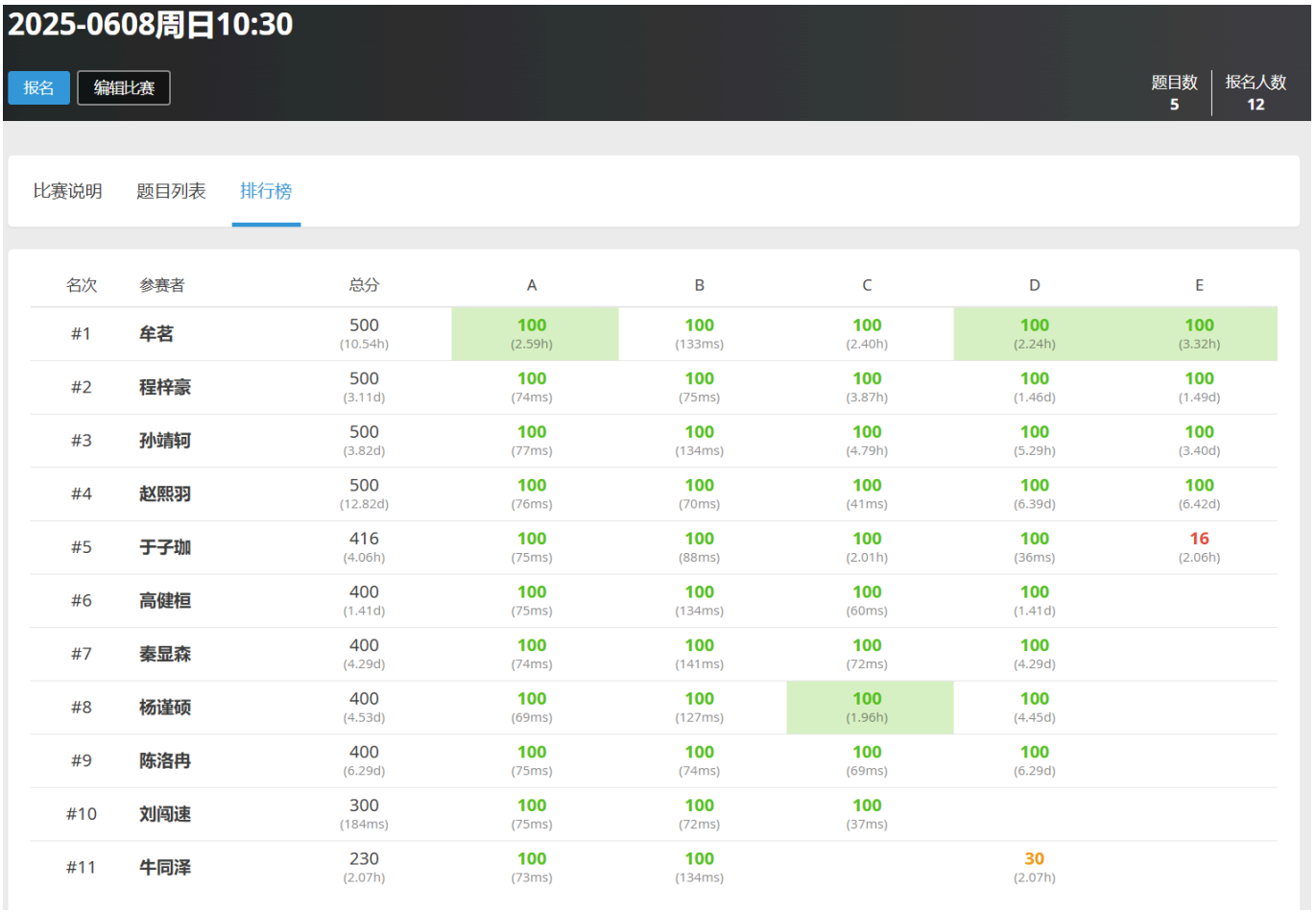
双指针

人员

秦显森、刘闯速、赵熙羽、牛同泽、高健桓、程梓豪、孙靖轲、杨瑾硕、隋钰涵 到课

上周作业检查

https://www.luogu.com.cn/contest/251033



2025-0608周日10:30

报名 编辑比赛

题目数 5 | 报名人数 12

比赛说明 题目列表 排行榜

名次	参赛者	总分	A	B	C	D	E
#1	牟茗	500 (10.54h)	100 (2.59h)	100 (133ms)	100 (2.40h)	100 (2.24h)	100 (3.32h)
#2	程梓豪	500 (3.11d)	100 (74ms)	100 (75ms)	100 (3.87h)	100 (1.46d)	100 (1.49d)
#3	孙靖轲	500 (3.82d)	100 (77ms)	100 (134ms)	100 (4.79h)	100 (5.29h)	100 (3.40d)
#4	赵熙羽	500 (12.82d)	100 (76ms)	100 (70ms)	100 (41ms)	100 (6.39d)	100 (6.42d)
#5	于子珈	416 (4.06h)	100 (75ms)	100 (88ms)	100 (2.01h)	100 (36ms)	16 (2.06h)
#6	高健桓	400 (1.41d)	100 (75ms)	100 (134ms)	100 (60ms)	100 (1.41d)	
#7	秦显森	400 (4.29d)	100 (74ms)	100 (141ms)	100 (72ms)	100 (4.29d)	
#8	杨谨硕	400 (4.53d)	100 (69ms)	100 (127ms)	100 (1.96h)	100 (4.45d)	
#9	陈洛冉	400 (6.29d)	100 (75ms)	100 (74ms)	100 (69ms)	100 (6.29d)	
#10	刘闯速	300 (184ms)	100 (75ms)	100 (72ms)	100 (37ms)		
#11	牛同泽	230 (2.07h)	100 (73ms)	100 (134ms)		30 (2.07h)	

作业

https://www.luogu.com.cn/contest/252011 (课上讲了 A ~ C 题, 课后作业是 D 题)

课堂表现

今天讲了 双指针 的内容, 双指针 思路很好理解, 但是代码很容易出现 +1 -1 的边界问题, 同学们课下要多写几遍 双指针 这几道题。

课堂内容

P2040 打开所有的灯

每个灯如果重复两次的话, 等于没操作

所有每个灯只有 动一次 或者 没动 两种情况, 因此可以 2^n 枚举所有可能即可。

```
#include <bits/stdc++.h>

using namespace std;

const int maxn = 5 + 5;
int w[maxn][maxn], a[maxn][maxn];
bool st[maxn][maxn];
int dx[] = {-1, 1, 0, 0}, dy[] = {0, 0, -1, 1};

bool check() {
  for (int i = 0; i < 3; ++i) {
    for (int j = 0; j < 3; ++j) a[i][j] = w[i][j];
  }

  for (int i = 0; i < 3; ++i) {
    for (int j = 0; j < 3; ++j) {
      if (st[i][j]) {
        a[i][j] = 1 - a[i][j];
        for (int k = 0; k < 4; ++k) {
          int ni = i+dx[k], nj = j+dy[k];
          if (ni>=0 && ni<3 && nj>=0 && nj<3) a[ni][nj] = 1 - a[ni][nj];
        }
      }
    }
  }

  for (int i = 0; i < 3; ++i) {
    for (int j = 0; j < 3; ++j) {
      if (!a[i][j]) return false;
    }
  }
  return true;
}

int main()
{
  for (int i = 0; i < 3; ++i) {
    for (int j = 0; j < 3; ++j) cin >> w[i][j];
  }

  int res = 10000000;
  for (int i = 0; i < (1<<9); ++i) {
    int cnt = 0;
    for (int j = 0; j < 9; ++j) {
      int x = j/3, y = j%3; st[x][y] = (i>>j)%2;
      if ((i>>j)%2 == 1) ++cnt;
    }
    if (check()) res = min(res, cnt);
  }
  cout << res << endl;
```

```
  return 0;
}
```

B4006 [GESP202406 四级] 宝箱

```
// O(n^2) 暴力做法
#include <bits/stdc++.h>

using namespace std;

const int maxn = 1000 + 5;
int w[maxn], p[maxn];

int get_sum(int l, int r) { return p[r] - p[l-1]; }

int main()
{
  int n, k; cin >> n >> k;
  for (int i = 1; i <= n; ++i) cin >> w[i];
  sort(w+1, w+n+1);
  for (int i = 1; i <= n; ++i) p[i] = p[i-1] + w[i];

  int res = 0;
  for (int i = 1; i <= n; ++i) {
    for (int j = i; j <= n; ++j) {
      if (w[j] - w[i] <= k) res = max(res, get_sum(i, j));
    }
  }
  cout << res << endl;
  return 0;
}
```

```
// O(nlogn) 二分查找做法
#include <bits/stdc++.h>

using namespace std;

const int maxn = 1000 + 5;
int w[maxn], p[maxn];

int get_sum(int l, int r) { return p[r] - p[l-1]; }

int main()
{
  int n, k; cin >> n >> k;
  for (int i = 1; i <= n; ++i) cin >> w[i];
  sort(w+1, w+n+1);
  for (int i = 1; i <= n; ++i) p[i] = p[i-1] + w[i];
```

```
  int res = 0;
  for (int i = 1; i <= n; ++i) {
    int j = upper_bound(w+1, w+n+1, w[i]+k) - w - 1;
    res = max(res, get_sum(i,j));
  }
  cout << res << endl;
  return 0;
}
```

```
// O(n) 双指针做法
#include <bits/stdc++.h>

using namespace std;

const int maxn = 1000 + 5;
int w[maxn], p[maxn];

int get_sum(int l, int r) { return p[r] - p[l-1]; }

int main()
{
  int n, k; cin >> n >> k;
  for (int i = 1; i <= n; ++i) cin >> w[i];
  sort(w+1, w+n+1);
  for (int i = 1; i <= n; ++i) p[i] = p[i-1] + w[i];

  int res = 0;
  for (int l = 1, r = 0; l <= n; ++l) {
    r = max(r, l-1);
    while (r+1<=n && w[r+1]-w[l]<=k) ++r;
    res = max(res, get_sum(l,r));
  }
  cout << res << endl;
  return 0;
}
```

双指针模板

双指针题目并不固定, 具体题目需要具体分析, 没有一个固定使用的模板, 同学们可以参考这个模板来帮助自己理解

```
int res = 0;
for (int l = 1, r = 0; l <= n; ++l) {
  r = max(r, l-1);
  while (r+1<=n && check(l,r+1)) r++;
  res = max(res, r-l+1);
}
```

P1638 逛画展

经典双指针问题, 参考双指针模板做这个题正好

cnt 变量代表 l~r 区间中出现过多少种不同类型的数

```cpp
#include <bits/stdc++.h>

using namespace std;

const int N = 1e6 + 5, M = 2e3 + 5;
int w[N], f[M];

int main()
{
  int n, m; cin >> n >> m;
  for (int i = 1; i <= n; ++i) cin >> w[i];

  int res = 1e9+10, resl = -1, resr = -1;
  for (int l = 1, r = 0, cnt = 0; l <= n; ++l) {
    r = max(l-1, r);
    while (r+1<=n && cnt<m) {
      ++r;
      f[w[r]]++;
      if (f[w[r]] == 1) cnt++;
    }
    if (cnt < m) break;
    if (r-l+1 < res) {
      res = r-l+1, resl = l, resr = r;
    }
    f[w[l]]--;
    if (f[w[l]] == 0) cnt--;
  }
  cout << resl << " " << resr << endl;
  return 0;
}
```