

Contents

1 Data Structure

- 1.1 BIT
- 1.2 Segment tree
- 1.3 Trie

2 DP

- 2.1 Josephus
- 2.2 LCS
- 2.3 LIS

3 Graph

- 3.1 SPFA
- 3.2 Dijkstra
- 3.3 Floyd Warshall
- 3.4 Disjoint set Kruskal
- 3.5 KM
- 3.6 Dinic

4 Other

- 4.1 Bubble Sort Expect Value
- 4.2 Crested Ibis vs Monster
- 4.3 dpd Knapsack 1
- 4.4 Fraction Floor Sum
- 4.5 Homer Simpson
- 4.6 Let Me Count The Ways
- 4.7 Luggage
- 4.8 Number of Pairs
- 4.9 ORXOR
- 4.10 Race to 1
- 4.11 SuperSale
- 4.12 Walking on the Safe Side
- 4.13 X drawing

5 Function

- 5.1 strstr
- 5.2 substr
- 5.3 map set
- 5.4 vector
- 5.5 setprecision
- 5.6 GCD LCM
- 5.7 reverse
- 5.8 CHAR
- 5.9 sort
- 5.10 struct
- 5.11 deque

1 Data Structure

1.1 BIT

```

1 #define lowbit(k) (k & -k)
2 void add(vector<int> &tr, int id, int val) {
3     for (; id <= n; id += lowbit(id)) {
4         tr[id] += val;
5     }
6 }
7 int sum(vector<int> &tr, int id) {
8     int ret = 0;
9     for (; id >= 1; id -= lowbit(id)) {
10        ret += tr[id];
11    }
12    return ret;
13 }

```

1.2 Segment tree

```

1 int dfs(int lef, int rig){
2     if(lef + 2 == rig){
3         if(num[lef] > num[rig-1]){
4             return lef;
5         }
6         else{
7             return rig-1;
8         }
9     }
10    int mid = (lef + rig)/2;
11    int p1 = dfs(lef, mid);

```

```

12    int p2 = dfs(mid, rig);
13    if(num[p1] > num[p2]){
14        return p1;
15    }
16    else{
17        return p2;
18    }
19 }

```

1.3 Trie

```

1 const int MAXL = ; // 自己填
2 const int MAXC = ;
3 struct Trie {
4     int nex[MAXL][MAXC];
5     int len[MAXL];
6     int sz;
7     void init() {
8         memset(nex, 0, sizeof(nex));
9         memset(len, 0, sizeof(len));
10        sz = 0;
11    }
12    void insert(const string &str) {
13        int p = 0;
14        for (char c : str) {
15            int id = c - 'a';
16            if (!nex[p][id]) {
17                nex[p][id] = ++sz;
18            }
19            p = nex[p][id];
20        }
21        len[p] = str.length();
22    }
23    vector<int> find(const string &str, int i) {
24        int p = 0;
25        vector<int> ans;
26        for (; i < str.length(); i++) {
27            int id = str[i] - 'a';
28            if (!nex[p][id]) {
29                return ans;
30            }
31            p = nex[p][id];
32            if (len[p]) {
33                ans.pb(len[p]);
34            }
35        }
36        return ans;
37    }
38 };

```

2 DP

2.1 Josephus

```

1 int josephus (int n, int k) {
2     // 有 n 個人圍成一圈，每 k 個一次
3     return n > 1 ? (josephus(n-1, k) + k) % n : 0;
4 }
5 // 回傳最後一人的編號
6 , 0 index

```

2.2 LCS

```

1 int LCS(string s1, string s2) {
2     int n1 = s1.size(), n2 = s2.size();
3     int dp[n1+1][n2+1] = {0};
4     // dp[i][j] = s1的前i個字元和s2的前j個字元
5     for (int i = 1; i <= n1; i++) {
6         for (int j = 1; j <= n2; j++) {
7             if (s1[i - 1] == s2[j - 1]) {

```

```

8     dp[i][j] = dp[i - 1][j - 1] + 1;
9     } else {
10        dp[i][j] = max(dp[i - 1][j], dp[i][j - 1]);
11    }
12 }
13 }
14 return dp[n1][n2];
15 }

```

2.3 LIS

```

1 int LIS(vector<int> &a) { // Longest Increasing
    Subsequence
2     vector<int> s;
3     for (int i = 0; i < a.size(); i++) {
4         if (s.empty() || s.back() < a[i]) {
5             s.push_back(a[i]);
6         } else {
7             *lower_bound(s.begin(), s.end(), a[i],
8                 [](int x, int y) {return x < y;}) = a[i];
9         }
10    }
11    return s.size();
12 }

```

3 Graph

3.1 SPFA

```

1 bool SPFA(int s){
2     // 記得初始化這些陣列
3     int cnt[1000+5], dis[1000+5];
4     bool inqueue[1000+5];
5     queue<int> q;
6
7     q.push(s);
8     dis[s] = 0;
9     inqueue[s] = true;
10    cnt[s] = 1;
11    while(!q.empty()){
12        int now = q.front();
13        q.pop();
14        inqueue[now] = false;
15
16        for(auto &e : G[now]){
17            if(dis[e.t] > dis[now] + e.w){
18                dis[e.t] = dis[now] + e.w;
19                if(!inqueue[e.t]){
20                    cnt[e.t]++;
21                    if(cnt[e.t] > m){
22                        return false;
23                    }
24                    inqueue[e.t] = true;
25                    q.push(e.t);
26                }
27            }
28        }
29    }
30    return true;
31 }

```

3.2 Dijkstra

```

1 struct Item{
2     int u, dis;
3     // 取路徑最短
4     bool operator < (const Item &other) const{
5         return dis > other.dis;
6     }
7 };

```

```

8 int dis[maxn];
9 vector<Edge> G[maxn];
10 void dijkstra(int s){
11     for(int i = 0; i <= n; i++){
12         dis[i] = inf;
13     }
14     dis[s] = 0;
15     priority_queue<Item> pq;
16     pq.push({s, 0});
17     while(!pq.empty()){
18         // 取路徑最短的點
19         Item now = pq.top();
20         pq.pop();
21         if(now.dis > dis[now.u]){
22             continue;
23         }
24         // 鬆弛更新，把與 now.u 相連的點都跑一遍
25         for(Edge e : G[now.u]){
26             if(dis[e.v] > now.dis + e.w){
27                 dis[e.v] = now.dis + e.w;
28                 pq.push({e.v, dis[e.v]});
29             }
30         }
31     }
32 }

```

3.3 Floyd Warshall

```

1 void floyd_warshall(){
2     for(int i = 0; i < n; i++){
3         for(int j = 0; j < n; j++){
4             G[i][j] = INF;
5         }
6         G[i][i] = 0;
7     }
8     for (int k = 0; k < n; k++){ //
9         // 嘗試每一個中繼點
10        for (int i = 0; i < n; i++){ //
11            // 計算每一個 i 點與每一個 j 點
12            for (int j = 0; j < n; j++){
13                G[i][j] = min(G[i][j], G[i][k] + G[k][j]);
14            }
15        }
16    }
17 }

```

3.4 Disjoint set Kruskal

```

1 struct Edge{
2     int u, v, w;
3     // 用權重排序 由大到小
4     bool operator < (const Edge &other) const{
5         return w > other.w;
6     }
7 }edge[maxn];
8 // disjoint set
9 int find(int x){
10    if(parent[x] < 0){
11        return x;
12    }
13    else{
14        return parent[x] = find(parent[x]);
15    }
16 }
17 void unite(int a, int b){
18     a = find(a);
19     b = find(b);
20
21     if(a != b){
22         if(parent[a] < parent[b]){
23             parent[a] += parent[b];
24             parent[b] = a;
25         }
26     }
27 }

```

```

25     }
26     else{
27         parent[b] += parent[a];
28         parent[a] = b;
29     }
30 }
31 }
32 void kruskal(){
33     memset(parent, -1, sizeof(parent));
34     sort(edge, edge + m);
35     int i, j;
36     for(i = 0, j = 0; i < n - 1 && j < m; i++){
37         // 如果 u 和 v 的祖先相同, 則 j++
38         // (祖先相同代表會產生環 所以不要)
39         while(find(edge[j].u) == find(edge[j].v)) j++;
40         // 若都會產生環 則讓兩點之間產生橋
41         // (連接兩顆子生成樹)
42         unite(edge[j].u, edge[j].v);
43         j++;
44     }
45 }

```

3.5 KM

```

1  const int X = 50; // x的點數, 等於y的點數
2  const int Y = 50; // y的點數
3  int adj[X][Y]; // 精簡過的adjacency matrix
4  int lx[X], ly[Y]; // vertex labeling
5  int mx[X], my[Y]; //
6  // x各點的配對對象、y各點的配對對象
7  int q[X], *qf, *qb; // BFS queue
8  int p[X]; // BFS
9  // parent, 交錯樹之偶點, 指向上一個偶點
10 bool vx[X], vy[Y]; // 記錄是否在交錯樹上
11 int dy[Y], pdy[Y]; // 表格
12
13 void relax(int x){ // relaxation
14     for (int y=0; y<Y; ++y)
15         if (adj[x][y] != 1e9)
16             if (lx[x] + ly[y] - adj[x][y] < dy[y]){
17                 dy[y] = lx[x] + ly[y] - adj[x][y];
18                 pdy[y] = x; //
19                 // 記錄好是從哪個樹葉連出去的
20             }
21 }
22
23 void reweight(){ // 調整權重、調整表格
24     int d = 1e9;
25     for (int y=0; y<Y; ++y) if (!vy[y]) d = min(d, dy[y]);
26     for (int x=0; x<X; ++x) if (vx[x]) lx[x] -= d;
27     for (int y=0; y<Y; ++y) if (vy[y]) ly[y] += d;
28     for (int y=0; y<Y; ++y) if (!vy[y]) dy[y] -= d;
29 }
30
31 void augment(int x, int y){ // 擴充路徑
32     for (int ty; x != -1; x = p[x], y = ty){
33         ty = mx[x]; my[y] = x; mx[x] = y;
34     }
35 }
36
37 bool branch1(){ // 延展交錯樹: 使用既有的等邊
38     while (qf < qb)
39         for (int x=*qf++, y=0; y<Y; ++y)
40             if (!vy[y] && lx[x] + ly[y] == adj[x][y]){
41                 vy[y] = true;
42                 if (my[y] == -1){
43                     augment(x, y);
44                     return true;
45                 }
46                 int z = my[y];
47                 *qb++ = z; p[z] = x; vx[z] = true;
48                 relax(z);
49             }
50     return false;
51 }
52
53 bool branch2(){ // 延展交錯樹: 使用新添的等邊

```

```

46     for (int y=0; y<Y; ++y){
47         if (!vy[y] && dy[y] == 0){
48             vy[y] = true;
49             if (my[y] == -1){
50                 augment(pdy[y], y);
51                 return true;
52             }
53             int z = my[y];
54             *qb++ = z; p[z] = pdy[y]; vx[z] = true;
55             relax(z);
56         }
57     }
58     return false;
59 }
60 int Hungarian(){
61     // 初始化vertex labeling
62     // memset(lx, 0, sizeof(lx)); // 任意值皆可
63     memset(ly, 0, sizeof(ly));
64     for (int x=0; x<X; ++x)
65         for (int y=0; y<Y; ++y)
66             lx[x] = max(lx[x], adj[x][y]);
67
68     // x側每一個點, 分別建立等邊交錯樹。
69     memset(mx, -1, sizeof(mx));
70     memset(my, -1, sizeof(my));
71     for (int x=0; x<X; ++x){
72         memset(vx, false, sizeof(vx));
73         memset(vy, false, sizeof(vy));
74         memset(dy, 0x7f, sizeof(dy));
75         qf = qb = q;
76         *qb++ = x; p[x] = -1; vx[x] = true; relax(x);
77         while (true){
78             if (branch1()) break;
79             reweight();
80             if (branch2()) break;
81         }
82     }
83     // 計算最大權完美匹配的權重
84     int weight = 0;
85     for (int x=0; x<X; ++x)
86         weight += adj[x][mx[x]];
87     return weight;
88 }

```

3.6 Dinic

```

1  // Maximum Flow
2  const int V = 100, E = 1000;
3  int adj[V]; // adjacency lists, 初始化為-1。
4  struct Element {int b, r, next;} e[E*2];
5  int en = 0;
6  void addedge(int a, int b, int c){
7      e[en] = (Element){b, c, adj[a]}; adj[a] = en++;
8      e[en] = (Element){a, 0, adj[b]}; adj[b] = en++;
9  }
10 int d[V]; // 最短距離
11 bool visit[V]; // BFS/DFS visit record
12 int q[V]; // queue
13 int BFS(int s, int t){ // 計算最短路徑, 求出容許圖
14     memset(d, 0x7f, sizeof(d));
15     memset(visit, false, sizeof(visit));
16     int qn = 0;
17     d[s] = 0;
18     visit[s] = true;
19     q[qn++] = s;
20
21     for (int qf=0; qf<qn; ++qf){
22         int a = q[qf];
23         for (int i = adj[a]; i != -1; i = e[i].next){
24             int b = e[i].b;
25             if (e[i].r > 0 && !visit[b]){
26                 d[b] = d[a] + 1;
27                 visit[b] = true;
28                 q[qn++] = b;
29                 if (b == t) return d[t];

```

```

30     }
31 }
32 }
33 return V;
34 }
35 int DFS(int a, int df, int s, int t){ //
    求出一條最短擴充路徑，並擴充流量
36 if (a == t) return df;
37 if (visit[a]) return 0;
38 visit[a] = true;
39 for (int i = adj[a]; i != -1; i = e[i].next){
40     int b = e[i].b;
41     if (e[i].r > 0 && d[a] + 1 == d[b]){
42         int f = DFS(b, min(df, e[i].r), s, t);
43         if (f){
44             e[i].r -= f;
45             e[i^1].r += f;
46             return f;
47         }
48     }
49 }
50 return 0;
51 }
52 int dinitz(int s, int t){
53     int flow = 0;
54     while (BFS(s, t) < V)
55         while (true){
56             memset(visit, false, sizeof(visit));
57             int f = DFS(s, 1e9, s, t);
58             if (!f) break;
59             flow += f;
60         }
61     return flow;
62 }

```

4 Other

4.1 Bubble Sort Expect Value

```

1 /* 期望值算法:
2 擲一枚公平的六面骰子，其每次「點數」的期望值是 3.5
3  $E(x) = 1 * 1/6 + 2 * 1/6 + 3 * 1/6 + 4 * 1/6 + 5 * 1/6 + 6 * 1/6$ 
4  $= (1 + 2 + 3 + 4 + 5 + 6)/6 = 3.5$ 
5 bubble sort 每兩兩之間交換機率是 1/2
6 總共會做  $C(n, 2)$  次
7  $E(x) = C(n, 2) * 1/2 = (n * (n - 1))/2 * 1/2$  */
8 int t, ca = 1;
9 cin >> t;
10 while(t--){
11     long long int n;
12     cin >> n;
13     cout << "Case " << ca++ << ": ";
14     // 如果  $(n * (n - 1))$  可以被 4 整除
15     // 代表最後答案會是整數，否則會是分數
16     if((n * (n - 1)) % 4){
17         cout << ( (n * (n - 1)) / 2 ) << " / 2" << endl;
18     }
19     else{
20         cout << ( (n * (n - 1)) / 2 ) / 2 << endl;
21     }
22 }

```

4.2 Crested Ibis vs Monster

```

1 /* dp 背包 - 重量/價值/可重複使用
2 因為這題可以重複使用同一條魔法
3 所以可以這樣 dp */
4 int h, n;
5 cin >> h >> n;
6 for(int i = 1; i <= n; i++){

```

```

7     cin >> a[i] >> b[i];
8 }
9 memset(dp, 0x3f3f3f3f, sizeof(dp));
10 dp[0][0] = 0;
11 for(int i = 1; i <= n; i++){
12     for(int j = 0; j <= h; j++){
13         dp[i][j] = min(dp[i-1][j], dp[i][max(0, j - a[i])] + b[i]);
14     }
15 }
16 cout << dp[n][h] << endl;

```

4.3 dp Knapsack 1

```

1 // dp 背包 - 時間/數量/價值 - 第幾分鐘符合
2 int N, W;
3 cin >> N >> W;
4 int w[100000+5];
5 int v[100000+5];
6 for(int i = 0; i < N; i++){
7     cin >> w[i] >> v[i];
8 }
9 long long int dp[100000+5];
10 memset(dp, 0, sizeof(dp));
11 for(int i = 0; i < N; i++){
12     for(int j = W; j >= w[i]; j--){
13         dp[j] = max(dp[j], dp[j - w[i]] + v[i]);
14     }
15 }
16 cout << dp[W] << endl;

```

4.4 Fraction Floor Sum

```

1 /*  $[N/i] == M$ 
2  $\rightarrow M \leq N/i < M + 1$ 
3  $\rightarrow N/(M+1) < i \leq N/M$  */
4 long long int N;
5 cin >> N;
6 long long int ans = 0;
7 for(long long int i = 1; i <= N; i++){
8     long long int M = N / i;
9     long long int n = N / M;
10     // 總共會有  $n - i$  個的  $[N/i]$  值都是  $M$ 
11     ans += (n - i + 1) * M;
12     // 更新跳過 以免重複計算
13     i = n;
14 }
15 cout << ans << endl;

```

4.5 Homer Simpson

```

1 // dp 背包 - 時間/數量 - 漢堡
2 int m, n, t;
3 while(cin >> m >> n >> t){
4     int dp[10000+5];
5     memset(dp, -1, sizeof(dp));
6     dp[0] = 0;
7     for(int i = m; i <= t; i++){
8         if(dp[i - m] != -1){
9             dp[i] = max(dp[i], dp[i - m] + 1);
10        }
11    }
12    for(int i = n; i <= t; i++){
13        if(dp[i - n] != -1){
14            dp[i] = max(dp[i], dp[i - n] + 1);
15        }
16    }
17    if(dp[t] == -1){ // 時間無法剛好吃滿的時候
18        for(int i = t; i >= 0; i--){
19            if(dp[i] != -1){
20                cout << dp[i] << " " << t - i << endl;

```

```

21         break;
22     }
23 }
24 }
25 else{
26     cout << dp[t] << endl;
27 }
28 }

```

4.6 Let Me Count The Ways

```

1 // dp - 時間/數量 - 硬幣排序
2 long long int n, dp[30000+5];
3 int coin[] = {1, 5, 10, 25, 50};
4 memset(dp, 0, sizeof(dp));
5 dp[0] = 1;
6 for(int i = 0; i < 5; i++){
7     for(int j = coin[i]; j < 30000+5; j++){
8         if(dp[j - coin[i]] != -1){
9             dp[j] += dp[j - coin[i]];
10        }
11    }
12 }
13 while(cin >> n){
14     if(dp[n] == 1){
15         cout << "There is only " << dp[n] << " way to
16             produce " << n << " cents change." <<
17             endl;
18     }
19     else{
20         cout << "There are " << dp[n] << " ways to
21             produce " << n << " cents change." <<
22             endl;
23     }
24 }

```

4.7 Luggage

```

1 // dp 背包 - 重量/是否成立
2 int t;
3 cin >> t;
4 cin.ignore();
5 while(t--){
6     string str;
7     getline(cin, str);
8     vector<int> v;
9     stringstream ss;
10    int num, cnt = 0, sum = 0;
11    bool dp[4000+5];
12    memset(dp, false, sizeof(dp));
13    ss << str;
14    while(ss >> num){
15        cnt++;
16        sum += num;
17        v.emplace_back(num);
18    }
19    if(sum & 1){
20        cout << "NO" << endl;
21        continue;
22    }
23    dp[0] = true;
24    for(int i = 0; i < v.size(); i++){
25        for(int j = sum; j >= v[i]; j--){
26            if(dp[j - v[i]]){
27                dp[j] = true;
28            }
29        }
30    }
31    cout << (dp[sum/2] ? "YES" : "NO") << endl;
32 }

```

4.8 Number of Pairs

```

1 /* upper_bound ex:
2 10 20 30 30 40 50
3 upper_bound for element 30 is at index 4
4 lower_bound ex:
5 10 20 30 40 50
6 lower_bound for element 30 at index 2 */
7 int t;
8 cin >> t;
9 while(t--){
10     int n, l, r;
11     vector<int> v;
12     cin >> n >> l >> r;
13     int num;
14     for(int i = 0; i < n; i++){
15         cin >> num;
16         v.emplace_back(num);
17     }
18     sort(v.begin(), v.end());
19     long long int ans = 0;
20     for(int i = 0; i < n; i++){
21         ans += (upper_bound(v.begin() + i + 1,
22             v.end(), r - v[i]) -
23             lower_bound(v.begin() + i + 1, v.end(), l
24             - v[i]));
25     }
26     cout << ans << endl;
27 }

```

4.9 ORXOR

```

1 /* 如何切區段，之所以要1<<n是為了可以跑000~111
2 i = 0, binary i = 000
3 0 : 1 5 7
4 i = 1, binary i = 001
5 1 : 1 5 7
6 i = 2, binary i = 010, 看得出來切了一刀
7 2 : 1 | 5 7
8 i = 3, binary i = 011
9 3 : 1 | 5 7
10 i = 4, binary i = 100, 為了要切在index=2, 所以才要1<<j
11 4 : 1 5 | 7
12 i = 5, binary i = 101
13 5 : 1 5 | 7
14 i = 6, binary i = 110
15 6 : 1 | 5 | 7
16 i = 7, binary i = 111
17 7 : 1 | 5 | 7
18 可以觀察出來，前兩位 bit 是 1 時代表的意義是切在哪裡*/
19 int n;
20 int num[20+7];
21 memset(num, 0, sizeof(num));
22 cin >> n;
23 for(int i = 1; i <= n; i++){
24     cin >> num[i];
25 }
26 int mini = 2147483647; // 不知道為什麼只有 2147483647
27     給過
28 // 1 << n = n * 2
29 for(int i = 0; i < (1 << n); i++){
30     int XOR = 0, OR = 0;
31     for(int j = 1; j <= n; j++){
32         OR |= num[j];
33         if((i & (1 << j))){
34             XOR ^= OR;
35             OR = 0;
36         }
37     }
38     XOR ^= OR;
39     mini = min(mini, XOR);
40 }
41 cout << mini << endl;

```

4.10 Race to 1

```

1 const int N = 1000000;
2 bool sieve[N+5];
3 vector<int> pri;
4 double dp[N+5];
5 void Linear_Sieve(){ // 線性篩
6     for (int i = 2; i < N; i++){
7         if (!sieve[i])
8             pri.push_back(i);
9         for (int p: pri){
10             if (i * p >= N){
11                 break;
12             }
13             sieve[i * p] = true;
14             if (i % p == 0){
15                 break;
16             }
17         }
18     }
19 }
20 double dfs(int n){
21     if(dp[n] != -1) return dp[n];
22     dp[n] = 0;
23     if(n == 1) return dp[n];
24     int total = 0, prime = 0;
25     for(int i = 0; i < pri.size() && pri[i] <= n;
26         i++){
27         total++;
28         if(n % pri[i]) continue;
29         prime++;
30         dp[n] += dfs(n/pri[i]);
31     }
32     dp[n] = (dp[n] + total)/prime; // 算期望值
33     return dp[n];
34 }
35 int main(){
36     int t;
37     int num;
38     int ca = 1;
39     for(int i = 0; i <= N; i++){
40         dp[i] = -1;
41     }
42     Linear_Sieve();
43     cin >> t;
44     while(t--){
45         cin >> num;
46         cout << "Case " << ca++ << ": " << fixed <<
47             setprecision(10) << dfs(num) << endl;
48     }
49 }

```

4.11 SuperSale

```

1 // dp 背包 - 重量/價值/不可重複使用 - 舉重
2 int t;
3 cin >> t;
4 while(t--){
5     int n;
6     cin >> n;
7     for(int i = 0; i < n; i++){
8         cin >> edge[i].p >> edge[i].w;
9     }
10    int g, total = 0;
11    cin >> g;
12    for(int i = 0; i < g; i++){
13        int pw, dp[30+5];
14        cin >> pw;
15        memset(dp, 0, sizeof(dp));
16        for(int j = 0; j < n; j++){
17            for(int k = pw; k >= edge[j].w; k--){
18                dp[k] = max(dp[k], dp[k - edge[j].w]
19                    + edge[j].p);
20            }
21        }
22    }
23 }

```

```

20     }
21     total += dp[pw];
22 }
23 cout << total << endl;
24 }

```

4.12 Walking on the Safe Side

```

1 // dp - 地圖更新
2 int t;
3 bool space = false;
4 cin >> t;
5 while(t--){
6     if(space){
7         cout << endl;
8     }
9     else{
10        space = true;
11    }
12    int r, c;
13    cin >> r >> c;
14    cin.ignore();
15    memset(mp, false, sizeof(mp));
16    memset(dp, 0, sizeof(dp));
17    string str;
18    for(int i = 0; i < r; i++){
19        getline(cin, str);
20        int n, num;
21        stringstream ss(str);
22        ss >> n;
23        while(ss >> num){
24            mp[n][num] = true;
25        }
26    }
27    dp[1][1] = 1;
28    for(int i = 1; i <= r; i++){
29        for(int j = 1; j <= c; j++){
30            if(mp[i][j]){
31                continue;
32            }
33            if(i > 1){
34                dp[i][j] += dp[i-1][j];
35            }
36            if(j > 1){
37                dp[i][j] += dp[i][j-1];
38            }
39        }
40    }
41    cout << dp[r][c] << endl;
42 }

```

4.13 X drawing

```

1 long long int n, a, b, p, q, r, s;
2 cin >> n >> a >> b;
3 cin >> p >> q >> r >> s;
4 for(long long int i = p; i <= q; i++){
5     for(long long int j = r; j <= s; j++){
6         if(abs(i - a) == abs(j - b)){
7             cout << '#';
8         }
9         else{
10            cout << '.';
11        }
12    }
13    cout << endl;
14 }

```

5 Function

5.1 strstr

```

1 #include <stdio.h>
2 #include <string.h>
3
4 int main(){
5     char * c;
6     char str1[1005], str2[1005];
7     scanf("%s %s", str1, str2);
8     c = strstr(str1, str2);
9     if (c != NULL){
10         printf("Yes\n");
11     }
12     else printf("No\n");
13 }
14 // Input : Hello eLl
15 // Output : No

```

5.2 substr

```

1 int main(){
2     string str; //abcdef
3     cin >> str;
4     string tmp;
5     tmp = str.substr(0, 2); //ab
6     str = str.substr(2); //cdef
7     cout << tmp << " " << str;
8     return 0;
9 }

```

5.3 map set

```

1 .begin( ) // Return iterator to beginning
2 .end( ) // Return iterator to end
3 .empty( ) // 檢查是否為空
4 .size( ) // 回傳大小
5 mp.insert(pair<char,int>('a',100))
6 st.insert(100) // 插入key、value
7 .erase( ) // 刪掉指定key和他的value
8 .clear( ) // 清空整個 map
9 m.find( )
10 cout << "a => " << mymap.find('a')->second << endl;
11 // 找出 map 裡 key
12 // 有沒有在裡面，如果有的話會回傳元素所在的 iterator
13 s.count() // 返回某個值元素在set的個數
14 while( !mymap.empty()){
15     cout << mymap.begin()->first << " => " <<
16         mymap.begin()->second << endl;
17     mymap.erase(mymap.begin());
18 }
19 for (auto it = mymap.begin(); it != mymap.end(); ++it)
20     cout << it->first << " => " << it->second << endl;

```

5.4 vector

```

1 v.erase(v.begin() + 5) //拿掉第六個數
2 v.erase (v.begin(), v.begin() + 3); //拿掉前三個數

```

5.5 setprecision

```

1 // 將數字的小數部分設定為固定長度
2 cnt = 3.5555;
3 cout << fixed << setprecision(3) << cnt ;
4 // output : 3.555

```

5.6 GCD LCM

```

1 int gcd(int a, int b){
2     return (b == 0 ? a : gcd(b, a % b));
3 }
4 int lcm(int a, int b){
5     return a * b / gcd(a, b);
6 }
7
8 /* 輾轉相除法 - 求兩數是否互質
9 如果兩數互質 最終結果其中一方為0時 另一方必為1
10 若兩數有公因數 最終結果其中一方為0時 另一方必不為1 */
11 while ( ( num1 % num2 ) != 0 && ( num2 % num1 ) != 0 );

```

5.7 reverse

```

1 int a[10] = {0, 1, 2, 3, 4, 5, 6, 7, 8, 9};
2 reverse(a, a+5) // 轉換0~5
3
4 vector<int> v;
5 reverse(v.begin(), v.end());
6
7 string str = "123";
8 reverse(str.begin(), str.end());
9 cout << str << endl; //321

```

5.8 CHAR

```

1 isdigit()
2 isalnum() //判斷字母 // 數字
3 isalpha()
4 islower()
5 isupper()
6 isblank() //判斷是否為空格，或者 tab 健制表符，即
7     space 和 \t
8 toupper()
9 tolower()

```

5.9 sort

```

1 priority_queue<int, vector<int>, less<int>> //大到小
2 priority_queue<int, vector<int>, greater<int>> //小到大
3
4 int arr[] = {4, 5, 8, 3, 7, 1, 2, 6, 10, 9};
5 sort(arr, arr+10);
6
7 vector<int> v;
8 sort(v.begin(), v.end()); //小到大
9
10 int cmp(int a, int b){
11     return a > b;
12 }
13 sort(v.begin(), v.end(), cmp); //大到小

```

5.10 struct

```

1 struct area{
2     int a, b;
3     bool operator<(const area rhs) const{
4         return a > rhs.a || ( a == a && b > rhs.b);
5     }
6     bool operator!=(const area rhs) const{
7         return a != rhs.a || b != rhs.b;
8     }
9 };

```

5.11 deque

```
1 deque <int> que;  
2 que.push_back(10);  
3 que.push_front(20);  
4 que.front()  
5 que.back()  
6 que.pop_front()  
7 que.pop_back()  
8 cout << "Element at position 2 : " << que.at(2) <<  
    endl;
```