

Contents

1	Section1
1.1	basic
2	Section2 Math
2.1	GCD
2.2	Perfect Squares
3	Section3 String
3.1	string
4	Section4 tools
4.1	permutation
4.2	高斯消元
4.3	最大流
5	Section5 Graph
5.1	kruskal
5.2	floyd
5.3	Dijkstra
5.4	SPFA
6	Java
6.1	java biginteger
7	數學公式
7.1	thm

1 Section1

1.1 basic

```

1 #include <bits/stdc++.h>
2 using namespace std;
3 #define ll long long
4
5 int main() {
6
7     cout<<"for define \n";
8     return 0;
9 }

```

2 Section2 Math

2.1 GCD

```

1 #include<iostream>
2 using namespace std;
3 int GCD(int x,int y){
4     while(y != 0){
5         return GCD(y,x%y);
6     }
7     return x;
8 }
9
10 int main(){
11     int a,b;
12     cin>>a>>b;
13     int gcd = GCD(a,b);
14     int lcm = a*b/gcd;
15
16     cout<<"最大公因數為: "<<gcd<<"\n";
17     cout<<"最小公倍數為: "<<lcm<<"\n";
18     return 0;
19 }

```

2.2 Perfect Squares

```

1 #include<iostream>
2 #include<cmath>
3 using namespace std;
4
5 // 計算是否為完全平方數
6 bool isPerfectSquare(int x) {
7     int y = sqrt(x);
8     return y*y == x;
9 }
10
11 // using Lagrange's four-square theorem
12 bool checkAnswer4(int n) {
13     while (n%4 == 0) {
14         n /= 4;
15     }
16     return n%8 == 7;
17 }
18
19 // 計算數字是否可轉換成
20 // 平方數們的相加
21 // 並取最少個數
22 // e.g.: 13 = 4 + 9
23 int main(){
24     int num;
25     bool isTwo = false;
26     cin >> num;
27     if (isPerfectSquare(num)) {
28         printf("1\n");
29     }
30     else if (checkAnswer4(num)) {
31         printf("4\n");
32     }
33     for (int i=0; i*i<=num ;i++) {
34         int j = num-i*i;
35         if (isPerfectSquare(j)) {
36             printf("2\n");
37             isTwo = true;
38             break;
39         }
40     }
41     if (isTwo == false) {
42         printf("3\n");
43     }
44     return 0;
45 }

```

3 Section3 String

3.1 string

```

1 #include<iostream>
2 #include<string>
3 using namespace std;
4
5 int main(){
6     //初始化字串
7     string s1 = "",s2 = "";
8     long long a;
9     int b;
10
11     //吃整行(含空格)
12     getline(cin,s1);
13
14     //compare,assign,串接
15     s1 == s2;
16     s1 = s2;
17     s1 += s2[i];
18
19     //字串切割,i:起始位置,len:幾個
20     s1 = s1.substr(i,len);
21

```

```

22 //轉成數字或數字轉字串
23     s1 = to_string(a);
24     s2 = to_string(b);
25     a = stoll(s1);
26     b = stoi(s2);
27
28 //判斷數字,字母
29     isdigit(s1[i]);
30     isalpha(s2[i]);
31     return 0;
32 }

```

4 Section4 tools

4.1 permutation

```

1 #include<iostream>
2 #include<algorithm>
3 using namespace std;
4
5 int main(){
6     string a = "abc";
7     string b = "cba";
8     //一定要先排序,才有全部的組合
9     sort(a.begin(),a.end());
10
11 //產生組合的迴圈
12 do{
13     cout<<a<<"\n";
14 }while(next_permutation(a.begin(),a.end()));
15
16 //檢查b字串是否為a字串可排出結果
17 bool isSamePer =
18     is_permutation(a.begin(),a.end(),b.begin());
19
20 //產生上一個排列結果
21 prev_permutation(a.begin(),a.end());
22
23 return 0;
24 }

```

4.2 高斯消元

```

1 #define maxn 500+5
2 int A[maxn][maxn];
3 int gaussian_elimination(int m, int n){
4     int r,i,j,k,u;
5     i=j=0;
6     while(i<m && j<n){
7         r=i;
8         for(k=i; k<m; k++){//找為1的值
9             if(A[k][j]){
10                 r=k;
11                 break;
12             }
13         }
14         if(A[r][j]){
15             if(r!=i){//換到first row
16                 for(k=0; k<n; k++){
17                     swap(A[r][k],A[i][k]);
18                 }
19             }
20             //需要減時,該row才減第一個row
21             if(A[u][j]){
22                 for(k=0; k<n; k++){
23                     A[u][k]^=A[i][k];
24                 }
25             }
26             i++;
27         }
28         j++;
29     }
30 }

```

```

29 }
30 return n-i;// free variable數量
31 }

```

4.3 最大流

```

1 #define N 105
2 int path[N],adj[N][N];
3
4 memset(adj,0,sizeof(adj));
5 //建雙向邊
6 for(int i=0,u,v,w; i<c; i++){
7     scanf("%d %d %d",&u,&v,&w);
8     adj[u][v] += w;
9     adj[v][u] += w;
10 }
11
12 int flow = 0;
13 while(true){
14     memset(path,0,sizeof(path));
15     queue<int> Q;
16
17     path[s] = s;
18     Q.push(s);
19     //BFS找路徑
20     while(!Q.empty() && !path[t]){
21         int now = Q.front();
22         Q.pop();
23         for(int i=1; i<=n; i++){
24             if(!path[i] && adj[now][i]>0){
25                 Q.push(i);
26                 path[i] = now;
27             }
28         }
29     }
30     //完全沒有路到t就break
31     if(!path[t]) break;
32     int min_flow = 1e9;
33     //找最窄的路
34     for(int from=path[t],to=t; from!=to;
35         from=path[to=from]){
36         min_flow = min(min_flow,adj[from][to]);
37     }
38     //更新該路徑所有邊的額度
39     for(int from=path[t],to=t; from!=to;
40         from=path[to=from]){
41         adj[from][to] -= min_flow;
42         adj[to][from] += min_flow;
43     }
44     flow += min_flow;
45 }

```

5 Section5 Graph

5.1 kruskal

```

1 #define maxn 200005
2 #define MP make_pair
3 int N,M;
4 int par[maxn],Rank[maxn];
5 vector<pair<int,int>> G[maxn*2];//雙向邊,所以x2
6
7 struct edge{
8     int x,y,w;
9     bool operator<(const edge& rhs) const{
10         return w<rhs.w;
11     }
12 }e[maxn*2];//雙向邊,所以x2
13
14 int Find(int a){

```

```

15     return par[a]==a?a:(par[a] = Find(par[a]));
16 }
17
18 bool Union(int a, int b){
19     a = Find(a);
20     b = Find(b);
21     if(a==b) return false;
22     int tmp = Rank[a] + Rank[b];
23     if(Rank[a]>=Rank[b]){
24         Rank[a] = tmp;
25         par[b] = a;
26     }
27     else{
28         par[a] = b;
29         Rank[b] = tmp;
30     }
31     return true;
32 }
33
34 int kruskal(){
35     for(int i=0; i<N; i++){
36         G[i].clear();
37         par[i] = i;
38         Rank[i] = 1;
39     }
40     int m = 0, tot = 0;
41     for(int i=0, u, v, w; i<M; i++){
42         scanf("%d %d %d", &u, &v, &w);
43         e[m++] = edge{u, v, w};
44         e[m++] = edge{v, u, w};
45         tot += w;
46     }
47     sort(e, e+m);
48
49     int mst = 0, cost = 0;
50     for(int i=0, u, v, w; i<m; i++){
51         u = e[i].x;
52         v = e[i].y;
53         w = e[i].w;
54         if(Union(u, v)){
55             cost += w;
56             mst++;
57             G[u].push_back(MP(v, w));
58             G[v].push_back(MP(u, w));
59         }
60         if(mst==N-1)
61             break;
62     }
63     return cost;
64 }

```

5.2 floyd

```

1 //N為點的個數，G為記錄路徑長的二維振烈
2 for(int k=0; k<N; k++){
3     for(int i=0; i<N; i++){
4         for(int j=0; j<N; j++){
5             G[i][j]=min(G[i][j], G[i][k]+G[k][j]);
6         }
7     }
8 }

```

5.3 Dijkstra

```

1 struct Data{
2     int u, w;
3     bool operator<(const Data&rhs) const
4     {
5         return w>rhs.w;
6     }
7 };
8
9 void sol(int s){

```

```

10     memset(d, 0x3f, sizeof(d));
11     memset(vis, 0, sizeof(vis));
12     d[s] = 0;
13     priority_queue<Data> pq;
14     pq.push(Data{s, 0});
15
16     while(!pq.empty()){
17         Data k = pq.top();
18         pq.pop();
19         int u = k.u;
20         if(vis[u]) continue;
21         vis[u] = 1;
22
23         for(int i=0; i<G[u].size(); i++){
24             int v = G[u][i].first, w = G[u][i].second;
25             if(d[v]>d[u]+w){
26                 d[v] = d[u] + w;
27                 pq.push(Data{v, d[v]});
28             }
29         }
30     }
31 }

```

5.4 SPFA

```

1 #define N 1005
2 #define MP make_pair
3 typedef pair<int, int> PII;
4
5 int n, m;
6 int dis[N], cnt[N];
7 vector<PII> G[N];
8 bool inq[N];
9
10 bool SPFA(){
11     memset(dis, 0x3f, sizeof(dis));
12     memset(inq, false, sizeof(inq));
13     memset(cnt, 0, sizeof(cnt));
14
15     queue<int> Q;
16     dis[0] = 0;
17     Q.push(0);
18     inq[0] = true;
19     while(!Q.empty()){
20         int u = Q.front();
21         Q.pop();
22         inq[u] = false;
23         for(int i=0; i<G[u].size(); i++){
24             int v = G[u][i].first, w = G[u][i].second;
25             if(dis[v]>dis[u]+w){
26                 dis[v] = dis[u] + w;
27                 if(!inq[v]){
28                     //如果鬆弛超過n次，代表有負環
29                     if(++cnt[v]>=n)
30                         return true;
31                     inq[v] = true;
32                     Q.push(v);
33                 }
34             }
35         }
36     }
37     return false;
38 }

```

6 Java

6.1 java biginterger

```

1 import java.io.*;
2 import java.util.*;
3 import java.math.BigInteger;
4

```

```

5 public class z {
6     public static void main(String args[]) {
7         Scanner cin = new Scanner(System.in);
8         //Java大數資料型態: BigInteger
9
10        BigInteger num = BigInteger.valueOf(1);
11        BigInteger btwo = new BigInteger("2");
12        while (cin.hasNext()){
13            BigInteger a = BigInteger.valueOf(0);
14            BigInteger b = BigInteger.valueOf(0);
15
16            //讀入一整行字串
17            String str = cin.next();
18
19            //-1停止輸入
20            if (str.equals("-1")) break;
21
22            num = new BigInteger(str);
23            //a += num
24            a = a.add(num);
25
26            //b -= num
27            b = b.subtract(num);
28
29            System.out.print("a+num is " + a + "\n");
30            System.out.print("b-num is " + b + "\n");
31        //乘2
32        System.out.printf("%s*2 = %s\n", num,
33            num.multiply(btwo));
34        //除2
35        System.out.printf("%s/2 = %s\n\n", num,
36            num.divide(btwo));
37        }
38        //2的100次方
39        System.out.printf("2^100 = %s\n",
40            btwo.pow(100));
41    }
42 }

```

7 數學公式

7.1 thm

· 中文測試

$$\cdot \sum_{i=1}^n i^2 = \frac{n(n+1)(2n+1)}{6}$$