Programming 3-6: 单元最短路

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2018.11.15

1   Problem 3-6-A: 布袋跳

1.1   代码样例

```
//OJ6-A DFS_Recording
#include<stdio.h>
using namespace std;
int V,E;         //出发点外的顶点数，边数
int end;         //终点
int global_min; //DFS 使用，已知最小
int weight[55]; //每个点的人
int Edge[55][55];//每两个边的距离
int son[55];
int vis[55];     //已经访问过的点。

//first is the one to be switched.
//If value is greater than global_min,halt.
//DFS 的轨迹记录。
//如果 DFS 成功，start 节点会在 son 中记录下它的下一个节点。
int DFS(int start,int first,int second,int time)
{
    if(time > global\_min)
        return 0;
    if(start == end)
    {
        global\_min = time;
        return 1;
    }
    int find = 0;
    for(int i=0;i<V+1;i++)
    {
        if(vis[i])
            continue;
        //Connected
        if(Edge[start][i]>=0)
        {
            //Find a shorter path
            vis[i] = 1;
            if(DFS(i,second,weight[i],time + Edge[start][i]*(first+second)))
            {
                find = 1;
                son[start] = i;
```

```
39                }
40                vis[i] = 0;
41            }
42        }
43        if(find)
44            return 1;
45        else
46            return 0;
47  }
48
49  int main()
50  {
51      int first ,second;
52      scanf("%d%d%d%d",&V,&E,&first,&second);
53      global\_min = 1<<28;
54      for(int i=0;i<55;i++)
55      {
56          for(int j=0;j<55;j++)
57          {
58              Edge[i][j] = -1;
59          }
60      }
61      for(int i=0;i<55;i++)
62          vis[i] = 0;
63      for(int i=1;i<=V;i++)
64      {
65          scanf("%d",&weight[i]);
66      }
67      for(int i=0;i<E;i++)
68      {
69          int u,v,w;
70          scanf("%d%d%d",&u,&v,&w);
71          Edge[u][v] = w;
72      }
73      scanf("%d",&end);
74      son[end] = end;
75      vis[0] = 1; //出发点不可到达。
76      if( first >second)
77          DFS(0,first,second,0);
78      else
79          DFS(0,second,first,0);
80      int cur = 0;
81      while(true)
82      {
83          if(cur == son[cur])
84          {
85              printf("%d",son[cur]);
86              return 0;
87          }
88          printf("%d ",cur);
89          cur = son[cur];
90      }
91  }
92  /********************************************************
93      Problem: 1555
94      User: 171860639
95      Language: C++
```

```
96      Result: 正确
97      Time:0 ms
98      Memory:972 kb
99  *****************************************************************/
```

Listing 1: A by 171860639

2   Problem 3-6-B: 营救小猪佩奇

2.1   代码样例

```
1   #include <bits/stdc++.h>
2   using namespace std;
3
4   const int maxn=22;
5   const double inf=100000000.0;
6   double x[maxn],y[4][maxn];
7   int n;
8   void readin()
9   {
10      scanf("%d",&n);
11      for(int i=0;i<n;i++)
12      {
13          scanf("%lf",&x[i]);
14          scanf("%lf%lf%lf%lf",&y[0][i],&y[1][i],&y[2][i],&y[3][i]);
15      }
16  }
17  double dp[maxn][4];
18  double s(double a)
19  {
20      return a*a;
21  }
22  double dis(double x1,double y1,double x2,double y2)
23  {
24      return sqrt(s(x2-x1)+s(y2-y1));
25  }
26  int flag=0;
27  bool judge(double x1,double y1,double x2,double y2)
28  {
29      for(int i=0;i<n;i++)
30      {
31          if(x[i]<=x1||x[i]>=x2)
32              continue;
33          double buf=(y2-y1)/(x2-x1)*(x[i]-x1)+y1;
34          if((buf>=y[0][i]&&buf<=y[1][i])||(buf>=y[2][i]&&buf<=y[3][i]))
35              continue;
36          return false;
37      }
38      return true;
39  }
40  void solve()
41  {
42      for(int i=0;i<n;i++)
43          for(int j=0;j<4;j++)
44          {
45              if(judge(0,5,x[i],y[j][i]))
46                  dp[i][j]=dis(0,5,x[i],y[j][i]);
47              else
48                  dp[i][j]=inf;
49              for(int k=0;k<i;k++)
50                  for(int l=0;l<4;l++)
51                      if(judge(x[k],y[l][k],x[i],y[j][i]))
```

```
52                    dp[i][j]=min(dp[i][j],dp[k][l]+dis(x[k],y[l][k],x[i],y[j][i]));
53              }
54        double ans;
55            flag=1;
56        if(judge(0,5,10,5))
57        {
58            flag=0;
59            ans=dis(0,5,10,5);
60            printf("yes\n");
61        }
62        else
63            ans=inf;
64        for(int k=0;k<n;k++)
65            for(int l=0;l<4;l++)
66                if(judge(x[k],y[l][k],10,5))
67                    ans=min(ans,dp[k][l]+dis(x[k],y[l][k],10,5));
68        printf("%.2f\n",ans);
69 }
70 int main()
71 {
72     readin();
73     solve();
74     return 0;
75 }
76
77
78 /************************************************************
79     Problem: 1556
80     User: 171250623
81     Language: C++
82     Result: 正确
83     Time:0 ms
84     Memory:1564 kb
85 ************************************************************/
```

Listing 2: B by 171250623

3   Problem 3-6-C: 奢侈的旅行

3.1   代码样例

```cpp
#include <cstring>
#include <cstdio>
#include <queue>
#define isNum(c) ('0' <= (c) && (c) <= '9')
char buff[15000000], *pb = buff;
char mvpb() {
    char ret = *(pb++);
    if (pb == buff + sizeof(buff)) {
        fread(buff, sizeof(char), sizeof(buff), stdin);
        pb = buff;
    }
    return ret;
}
int ReadInt() {
    int ret = 0;
    while (!isNum(*pb)) {
        mvpb();
    }
    while (isNum(*pb)) ret = (ret << 1) + (ret << 3) + (mvpb()) - '0';
    return ret;
}

typedef std::pair<long long, int> P;
const int N = 50005;
const long long inf = (long long) (2e9) * N;
int T, n, m, head[N];
long long ans, dis[N];
std::priority_queue<P, std::vector<P>, std::greater<P> > q;
struct Edge {
    int v, a, b, next;
} e[N << 1];
long long Dijkstra() {
    q.push(std::make_pair(1, 1));
    while (!q.empty()) {
        int u = q.top().second;
        long long level = q.top().first;
        q.pop();
        if (dis[u] < level) continue;
        dis[u] = level;
        for (int i = head[u]; i; i = e[i].next) {
            int v = e[i].v, a = e[i].a, b = e[i].b;
            if (1 + a / level >= 1ll << b && level + a < dis[v])
                q.push(std::make_pair(dis[v] = level + a, v));
        }
    }
    return dis[n];
}
int Log(long long x) {
    int t = 0;
    for (; x > 1; x >>= 1, ++t);
    return t;
```

```
52 }
53 int main() {
54     fread(buff, sizeof(char), sizeof(buff), stdin);
55     for (T = ReadInt(); T; −−T) {
56         memset(head, 0, sizeof(head));
57         memset(dis, 0x7f, sizeof(dis));
58         n = ReadInt();
59         m = ReadInt();
60         for (int i = 1; i <= m; ++i) {
61             int u = ReadInt(), v = ReadInt(), a = ReadInt(), b = ReadInt();
62             e[i] = (Edge) {v, a, b, head[u]};
63             head[u] = i;
64         }
65         ans = Dijkstra();
66         if (ans > inf) printf("-1\n");
67         else printf("%d\n", Log(ans));
68     }
69 }
70 /************************************************************
71     Problem: 1557
72     User: 171860020
73     Language: C++
74     Result: 正确
75     Time:588 ms
76     Memory:18068 kb
77 ************************************************************/
```

Listing 3: C by 171860020

4   Problem 3-6-D: strawgoH

4.1   代码样例

```cpp
#include <cstdio>
#include <utility>
#include <queue>
const int N = 1005, inf = 1e9;
int n, m, S, T, ans, head[N], dis[N];
struct node {
    int to, cost, next;
} E[N * N];
std::priority_queue<std::pair<int, int> > q;
int Dijkstra() {
    for (int i = 1; i <= n; ++i) dis[i] = inf;
    q.push(std::make_pair(0, S));
    while (!q.empty()) {
        std::pair<int, int> x = q.top();
        q.pop();
        if (dis[x.second] < -x.first) continue;
        dis[x.second] = -x.first;
        for (int e = head[x.second]; e; e = E[e].next) {
            int y = E[e].to;
            int c = - x.first + E[e].cost;
            if (c < dis[y])
                dis[y] = c, q.push(std::make_pair(-c, y));
        }
    }
    return dis[T];
}
int main() {
    scanf("%d%d", &n, &m);
    for (int i = 1, x, y, z; i <= m; ++i) {
        scanf("%d%d%d", &y, &x, &z);
        E[i] = (node){y, z, head[x]};
        head[x] = i;
    }
    scanf("%d%d", &T, &S);
    ans = Dijkstra();
    if (ans == inf) {
        printf("-1\n");
    } else {
        printf("%d\n", ans);
        for (int i = 1; i <= n; ++i, printf("\n"))
            for (int j = 1; j <= n; ++j)
                printf("%d ", dis[i] - dis[j]);
    }
}
/************************************************************
    Problem: 1558
    User: 171860020
    Language: C++
    Result: 正确
    Time:504 ms
    Memory:12916 kb
************************************************************/
```

Listing 4: D by 171860020