

A*

简介&思想

通过估价函数预计搜索到的结点与终点的距离，以估价距离从小到大为顺序搜索终点，得到最短路，减少搜索时间。与dijkstra相似。

例题

八数码难题

来源：洛谷 p1379

概述：3×3的棋盘上有八个棋子和一个空白，空白前后左右的棋子可以填到空白处，给定初始布局和目标布局，求最少移动次数。

答案：统计当前布局每个数字距离目标布局中相同数字的距离作为估价，估计距离则为估价+当前移动次数，按照类似dij的做法，按估价距离的优先级更新结点，同时更新已知结点的最优移动次数并更新其估价距离，直到得到终点。

```
#include<cstdio>
#include<map>
#include<queue>
#include<string>
#include<cstring>
using namespace std;
map<string,int>vist,D,H;
struct unit
{
    string state;
    int d,h,f,p;
    bool operator < (const unit&x) const
    {
        return f>x.f;
    }
};
priority_queue<unit>q;
string End("123804765");
int
targ[9]={4,0,1,2,5,8,7,6,3},dpos[4][9]={{-1,-1,-1,0,1,2,3,4,5},{3,4,5,6,7,8,-1,-1,-1},{-1,0,1,-1,3,4,-1,6,7},{1,2,-1,4,5,-1,7,8,-1}};
int
dis[9][9]={{0,1,2,1,2,3,2,3,4},{1,0,1,2,1,2,3,2,3},{2,1,0,3,2,1,4,3,2},{1,2,3,0,1,2,1,2,3},{2,1,2,1,0,1,2,1,2},{3,2,1,2,1,0,3,2,1},{2,3,4,1,2,3,0,1,2},{3,2,3,2,1,2,1,0,1},{4,3,2,3,2,1,2,1,0}};
void read()
```

```
{
    string s;
    s.resize(9);
    scanf("%s",&s[0]);
    unit zero;
    zero.state=s;
    zero.d=zero.h=0;
    for(int i=0;i<9;i++)
    {
        zero.h+=dis[i][targ[s[i]-48]];
        if(s[i]==48)
            zero.p=i;
    }
    zero.f=zero.h>>1;
    q.push(zero);
    D[s]=0;
    H[s]=zero.h;
}
int main()
{
    read();
    int m=1;
    unit head;
    while(m--)
    {
        head=q.top();
        q.pop();
        if(head.state==End)
        {
            printf("%d",head.d);
            return 0;
        }
        if(vist[head.state]==-1)
            continue;
        vist[head.state]=-1;
        string state_;
        for(int i=0,p_,h_,d_;i<4;i++)
        {
            p_=dpos[i][head.p];
            if(p_>=0)
            {
                state_=head.state;
                state_[head.p]=state_[p_];
                state_[p_]=48;
                if(vist[state_]==-1) continue;
                d_=head.d+1;
                if(!vist[state_])
                {
                    h_=head.h-dis[head.p][targ[0]]-
                    dis[p_][targ[head.state[p_]-48]]+dis[head.p][targ[state_[head.p]-48]]+dis[p_
```

```
    _][targ[0]];
        q.push({state_,d_,h_,d_+(h_>>1),p_});
        m++;
        D[state_]=d_;
        H[state_]=h_;
        vist[state_]=1;
    }
    else if(d_<D[state_])
    {
        q.push({state_,d_,d_+(H[state_]>>1),p_});
        m++;
        D[state_]=d_;
    }
}
}
return 0;
}
```

总结

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Last update: 2020/08/20 19:28