```
from __future__ import print_function
import numpy as np
import copy
import Queue
from pylab import *
import time
from PIL import Image
from scipy.misc import imread, imresize, imsave

# a = [[[[] for i in range(6)] for j in range(6)] for k in range(6)]
INF = 100000000.0
eps = 0.000001
dx = [1, 0, -1, 0, 1, 1, -1, -1]
dy = [0, 1, 0, -1, -1, 1, 1, -1]
edge = [1.0, 1.0, 1.0, 1.0, np.sqrt(2.0), np.sqrt(2.0), np.sqrt(2.0), np.sqrt(2.0)]

unit = 10
limit = 1 * unit
def dcmp(x):
    if np.fabs(x) < eps:
        return 0
    if x > 0:
        return 1
    return -1

class spfa():
    def __init__(self, _mp, _n, _m, _s_x, _s_y, _e_x, _e_y):
        self.mp = _mp
        self.n = _n
        self.m = _m
        self.checkmp = np.zeros((self.n, self.m))
        self.s_x = int(_s_x * unit)
        self.s_y = int(_s_y * unit)
        self.e_x = int(_e_x * unit)
        self.e_y = int(_e_y * unit)
        self.dist = np.zeros((self.n, self.m))
        self.inq = np.zeros((self.n, self.m), dtype=int32)
        self.fax = np.zeros((self.n, self.m), dtype=int32)
        self.fay = np.zeros((self.n, self.m), dtype=int32)
        self.q = Queue.Queue(maxsize = self.n * self.m)
        self.ans = []
        for i in range(self.n):
            for j in range(self.m):
                if self.mp[i][j] == 1:
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                        for kx in range(int(-0.3*unit), int(0.3*unit)):
                            for ky in range(int(-0.3*unit), int(0.3*unit)):
                                if i+kx >= 0 and i+kx < self.n and j+ky >= 0 and j + ky <
self.m:
                                    self.checkmp[i + kx][j + ky] = 1

        # x = np.random.random((self.n, self.m, 3))
        # for i in range(self.n):
        #         for j in range(self.m):
        #             if self.mp[i][j] == 1:
        #                 print('111111')
        #                 x[i][j][0] = 1.0
        #             else:
        #                 x[i][j][0] = 0.0
        # plt.imshow(x)
        # plt.show()
        # self.showmp(self.mp)


        # time.sleep(10000000)
        for i in range(self.n):
            for j in range(self.m):
                self.dist[i][j] = INF
                if i == self.s_x and j == self.s_y:
                    self.dist[i][j] = 0
                    self.inq[i][j] = 1
                    self.q.put([i, j])
    def showmp(self, a):
        tmp = np.zeros((self.n, self.m))

        for i in range(self.n):
            for j in range(self.m):
                tmp[i][j] = a[self.n - 1 - i][j]
        plt.imshow(tmp)
        plt.show()
    def check(self, x, y):
        if x >= 0 and x < self.n and y >= 0 and y < self.m:
            if self.mp[x][y] == 0 and self.checkmp[x][y] == 0:
                return True
            return False
        else:
            return False
    def run(self):
        print('start')
```

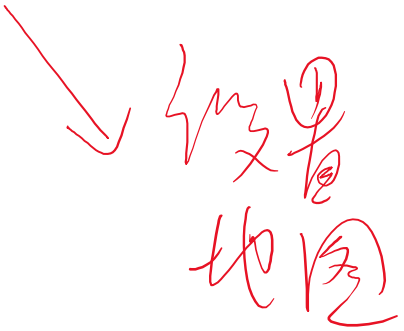

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        tim = 0
        while(self.q.empty() == False):
            tim += 1
            # print('now', str(tim))
            t = self.q.get()
            x = t[0]
            y = t[1]
            # print("??", x, y)
            self.inq[x][y] = 0
            for k in range(8):
                nx = x + dx[k]
                ny = y + dy[k]
                # print('????', x, y, nx, ny)
                # time.sleep(0.5)
                d = edge[k]
                if self.check(nx, ny) == False:
                    continue
                if dcmp(self.dist[x][y] + d - self.dist[nx][ny]) < 0:
                    self.dist[nx][ny] = self.dist[x][y] + d
                    # print('1111', type(x), x, y, nx, ny, self.fax[nx][ny], self.fay[nx][ny])
                    self.fax[nx][ny] = x
                    self.fay[nx][ny] = y
                    # print('fffuck', type(x), x, y, nx, ny, self.fax[nx][ny], self.fay[nx][ny])
                    # time.sleep(1)
                    # if y < 0:
                        # print('?????????')
                    if self.inq[nx][ny] == 0:
                        self.inq[nx][ny] = 1
                        self.q.put([nx, ny])
        t_x = self.e_x
        t_y = self.e_y

        print("over")
        print('start', self.dist[self.e_x][self.e_y], self.e_x, self.e_y, self.s_x, self.s_y,
self.fax[t_x][t_y], self.fay[t_x][t_y])
        print('????')
        while((t_x == self.s_x and t_y == self.s_y) == False):
            # print(t_x, t_y, self.dist[t_x][t_y])
            # time.sleep(1)
            self.ans.append([t_x, t_y])
            n_x = self.fax[t_x][t_y]
            n_y = self.fay[t_x][t_y]
            t_x = n_x
            t_y = n_y
```

```
            print('another over')

        def getKey(self):
            if self.checkmp[self.s_x][self.s_y] == 1 or self.checkmp[self.e_x][self.e_y] == 1:
                return 1.0 * ((self.s_x - self.e_x) * (self.s_x - self.e_x) + (self.s_y - self.e_y) * (self.s_y
- self.e_y)) / unit, 1.0 * self.e_x / unit, 1.0 * self.e_y / unit

            self.run()
            # self.showPath()
            g_x = 1.0 * self.e_x / unit
            g_y = 1.0 * self.e_y / unit
            for i, var in enumerate(self.ans):
                t_x = var[0]
                t_y = var[1]
                if self.dist[t_x][t_y] <= limit:
                    g_x = 1.0 * t_x / unit
                    g_y = 1.0 * t_y / unit
                    break
            return 1.0 * self.dist[self.e_x][self.e_y] / unit, g_x, g_y
        def drawBigPoint(self, data, x, y, num):
            for k in range(8):
                nx = x + dx[k]
                ny = y + dy[k]
                if nx >= 0 and nx < self.n and ny >= 0 and ny < self.m:
                    data[nx][ny] = num
        def showPath(self):
            print('draw')
            data = np.zeros((self.n, self.m))
            for i in range(self.n):
                for j in range(self.m):
                    data[i][j] = self.mp[i][j]
            self.drawBigPoint(data, self.s_x, self.s_y, 3)
            for i, var in enumerate(self.ans):
                t_x = var[0]
                t_y = var[1]
                self.drawBigPoint(data, t_x, t_y, 2)
            self.showmp(data)
            # plt.imshow(data)
            # plt.show()


if __name__ == '__main__':
    N = int(6.6 * unit + 10)
    M = int(9.9 * unit + 10)
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```
mp = np.zeros((int(6.6 * unit + 10), int(9.9 * unit + 10)))
for i in range(int(4.5*unit),int( 6.60*unit + 1)):
    for j in range(int(0*unit),int( 1.90*unit + 1)):
        mp[i][j] = 1
for i in range(int(6.00*unit),int( 6.60*unit + 1)):
    for j in range(int(2.80*unit),int( 5.00*unit + 1)):
        mp[i][j] = 1
for i in range(int(2.30*unit),int( 3.70*unit + 1)):
    for j in range(int(3.15*unit),int( 3.45*unit + 1)):
        mp[i][j] = 1
for i in range(int(3.70*unit),int( 4.10*unit + 1)):
    for j in range(int(9.10*unit),int( 9.90*unit + 1)):
        mp[i][j] = 1
for i in range(int(1.60*unit),int( 3.40*unit + 1)):
    for j in range(int(8.50*unit),int( 9.90*unit + 1)):
        mp[i][j] = 1
for i in range(int(0*unit),int( 1.00*unit + 1)):
    for j in range(int(0*unit),int( 3.30*unit + 1)):
        mp[i][j] = 1
for i in range(int(0*unit),int( 1.00*unit + 1)):
    for j in range(int(4.40*unit),int( 5.80*unit + 1)):
        mp[i][j] = 1
for i in range(int(0*unit),int( 1.40*unit + 1)):
    for j in range(int(6.10*unit),int( 7.90*unit + 1)):
        mp[i][j] = 1
myspfa = spfa(mp, N, M, 3, 1.5, 3, 7)
myspfa.run()
myspfa.showPath()
```