Generate_matrix

```
def Generate_matrix(x,y):
    import numpy as np
    import random
    return np.ceil(np.array([random.random()*10 for i in
range(x*y)]).reshape(x,y))
```

Max_road

```
def Max_road(A,degree,start):

    import random
    import numpy as np
    import copy

    def change(M,number,start):  #  number 控制变异程度  start 控制变异量
        x , y =  M.shape
        for i in range(start,x):
            Line = zip(range(len(M[i])),M[i])
            index_0 = [t[0] for t in Line if t[1]==0]  # 获取 0  所对应
的下标
            index_1 = [t[0] for t in Line if t[1]==1]  # 获取 1  所对应
的下标
            M[i][random.sample(index_0,number)[0]]=1   # 随机改变序列中
number 个值 0->1
            M[i][random.sample(index_1,number)[0]]=0   # 随机改变序列中
number 个值 1->0
        return M

    x,y = A.shape


    n=x
    generation = y

    #初始化一个有 n 中情况的解决方案矩阵
    init_solve = np.zeros([n,x+y-2])
    init=[1]*(x-1)+[0]*(y-1)
    for i in range(n) :
        random.shuffle(init)
        init_solve[i,:] = init  #  1 表示向下走 0 表示向右走
    solve = copy.copy(init_solve)


    for loop in range(generation):

        Sum = [A[0,0]]*n # 用于记录每一种方案的总流量
```

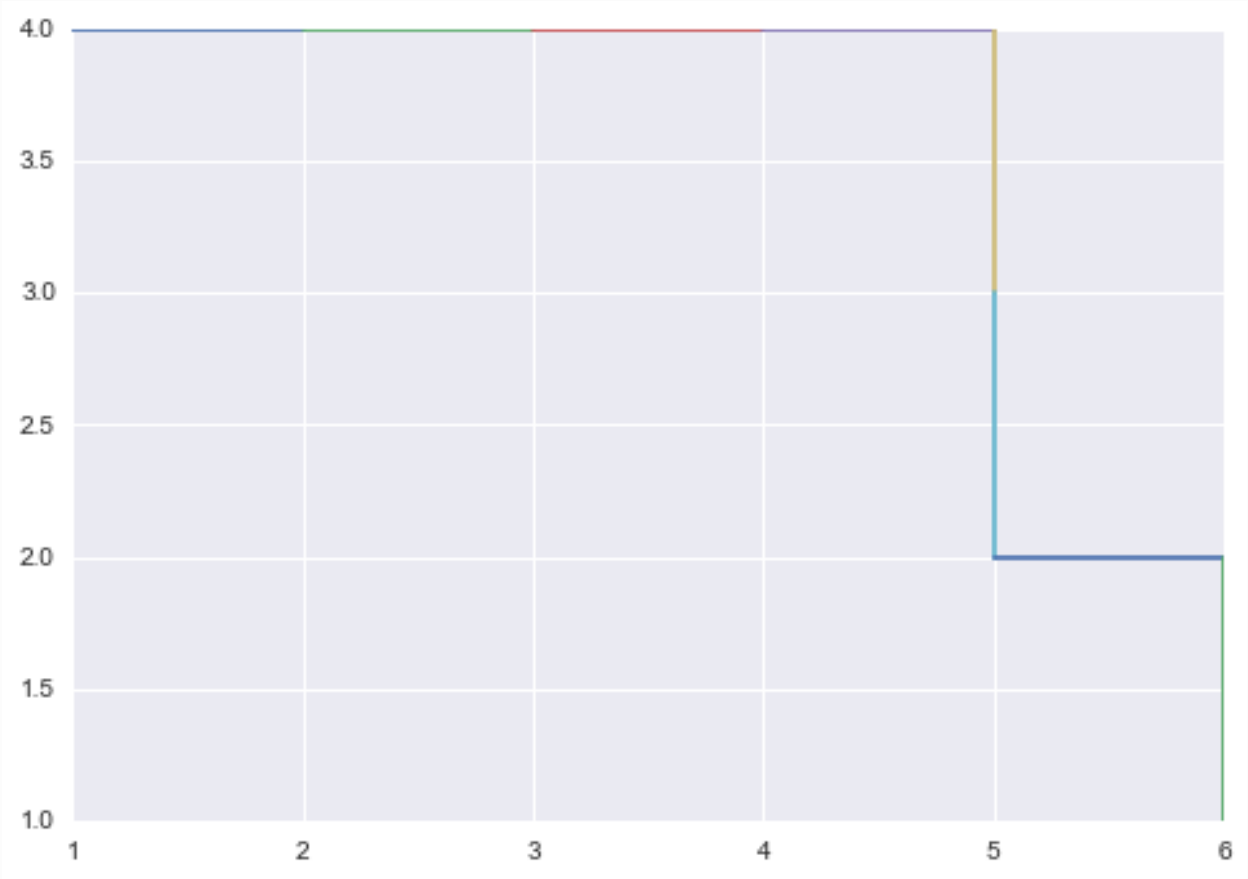
```
        for i in range(n):
            j=0;k=0;
            for m in solve[i,:]:
                if m==1:
                    k=k+1
                else:
                    j=j+1
                Sum[i] = Sum[i] + A[k,j]

        Sum_index = zip(range(len(Sum)),Sum)

        sort_sum_index = sorted(Sum_index,key = lambda d : d[1] ,
reverse =True)  # 将 方案 按照流量总和排序

        Max = sort_sum_index[0][1]  # 最大流量
        #print Max

        solve_index_half = [a[0] for a in sort_sum_index[:n/2]]    #
保留排序后方案的一半

        solve =
np.concatenate([solve[solve_index_half],solve[solve_index_half]])  #
将保留的一半方案 进行复制 , 复制部分用于变异

        change(solve,int((x+y-2)*degree)+1 ,start)  #  变异

    return solve[0] , Max
```

```
Draw_road
```

```
def Draw_road(road,A):

    import pylab as plt
    import seaborn
    seaborn.set()

    x , y =A.shape

    # 将下移和右移映射到绘图坐标上
    Road = [(1,x)]  #  初始坐标
    j=1;k=x;
    for m in road:
        if m==1:
            k=k-1
        else:
            j=j+1
        Road.append((j,k))

    # print Road

    for i in range(len(road)):
        plt.plot([Road[i][0],Road[i+1][0]],[Road[i][1],Road[i+1][1]])
```

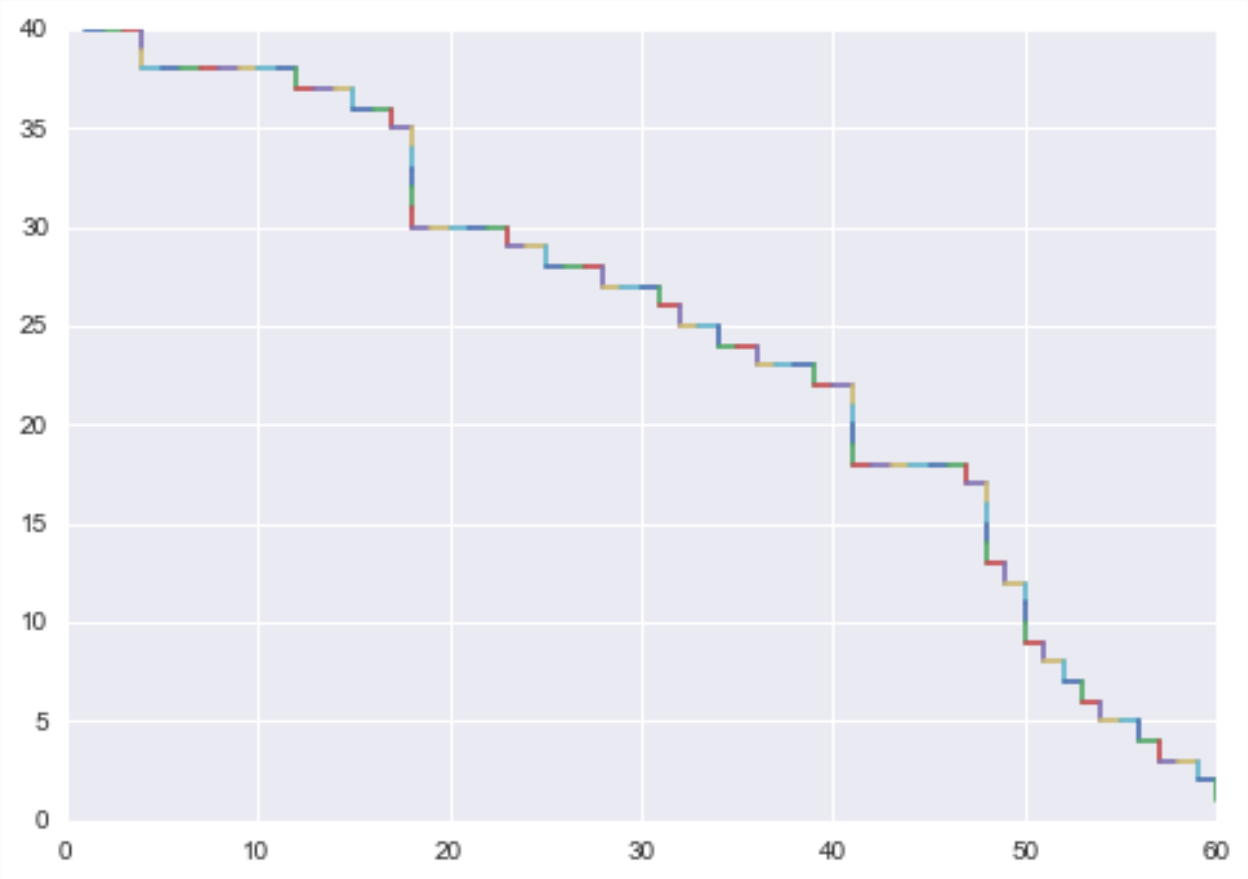
实际运行的例子

```
In [119]: A = Generate_matrix(4,6)

In [120]: A
Out[120]:
array([[ 10.,   1.,   7.,  10.,   8.,   8.],
       [  4.,   8.,   8.,   4.,   8.,   2.],
       [  9.,   8.,   8.,   3.,   9.,   8.],
       [  7.,   2.,   5.,   9.,   3.,   8.]])

In [121]: road , M=Max_road(A,0.1,2)

In [122]: Draw_road(road,A)
```

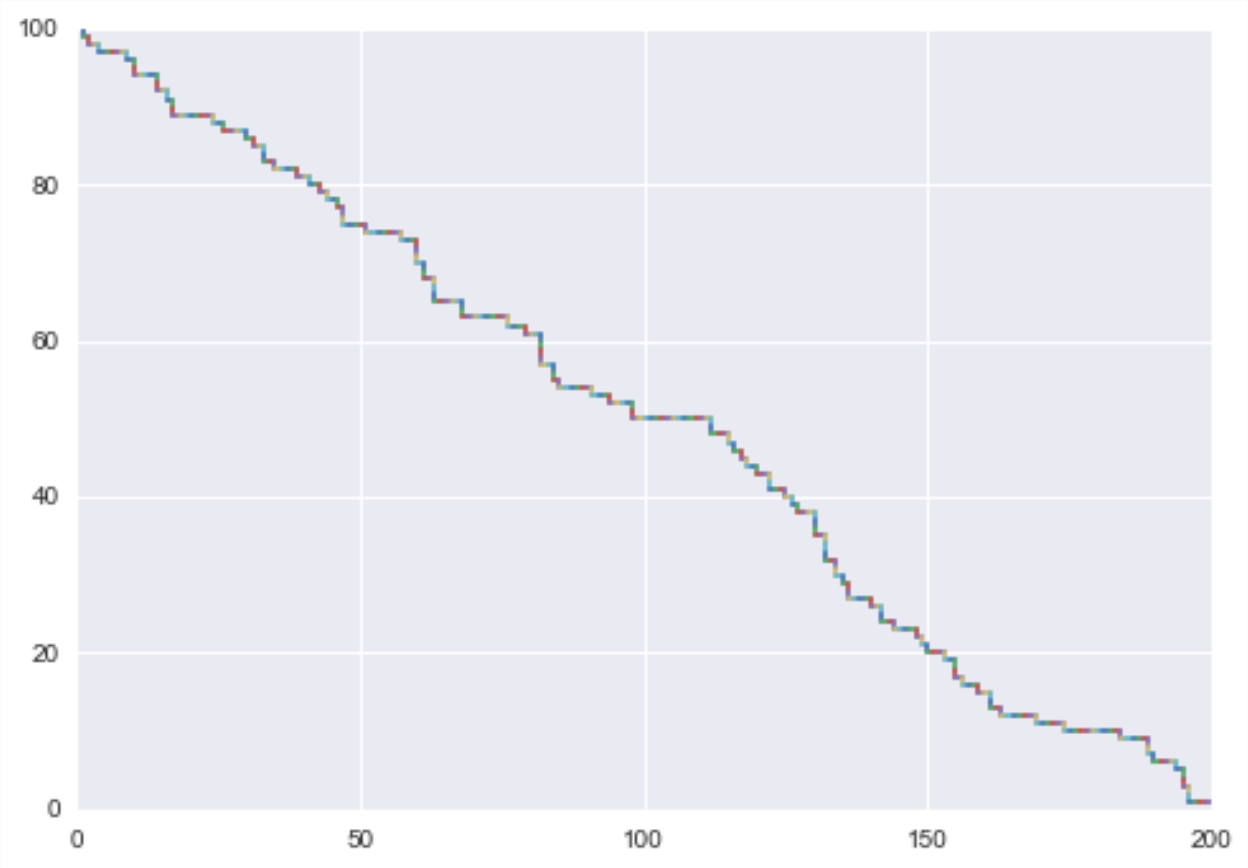


较大规模的情况

```
In [105]: A = Generate_matrix(40,60)

In [106]: road , M=Max_road(A,0.1,4)

In [107]: road
Out[107]:
array([ 0.,  0.,  0.,  1.,  1.,  0.,  0.,  0.,  0.,  0.,  0.,  0.,
0.,
        1.,  0.,  0.,  0.,  1.,  0.,  0.,  1.,  0.,  1.,  1.,  1.,
1.,
        1.,  0.,  0.,  0.,  0.,  0.,  1.,  0.,  0.,  1.,  0.,  0.,
0.,
        1.,  0.,  0.,  0.,  1.,  0.,  1.,  0.,  0.,  1.,  0.,  0.,
1.,
        0.,  0.,  0.,  1.,  0.,  0.,  1.,  1.,  1.,  1.,  0.,  0.,
0.,
        0.,  0.,  0.,  1.,  0.,  1.,  1.,  1.,  1.,  0.,  1.,  0.,
1.,
        1.,  1.,  0.,  1.,  0.,  1.,  0.,  1.,  0.,  1.,  0.,  0.,
1.,
        0.,  1.,  0.,  0.,  1.,  0.,  1.])

In [108]: Draw_road(road,A)
```




```
In [109]: A = generate_Matrix(100,200)

In [110]: road , M=Max_road(A,0.1,10)

In [111]: draw_road(road,A)
```


100
80
60
40
20
0
0
50
100
150
200