3 2 5 4 7 2 5 6

3 3 5 5 7 7 7 7

找规律

3 7 5 4 1 2 5 6

4 8 8 8 6 5 6 7

6 10 10 10 10 10 8 9

9 13 13 13 13 13 13 13

DP的常见优化与状态分析

dynamic programming is a method for solving a complex problem by **breaking it down into a collection of simpler subproblems**.

Sublimation

Room 201

msc_sublimation@outlook.com

qq

Outline！

最优化　　//统计(概率)

状态(写搜索+记忆化)
转移(决策,excel大法好，刷表法)
子问题（结构）
边界！！！敲黑板

如何考虑状态？

需要什么加什么

如何化简状态

找出哪些没用

如何优化决策

EX大法好

边界！！！（敲黑板）

最终会被转移到，并且一眼、两眼可以看出来值的状态

Islands and Bridges

Input file: `islands.in`
Time limit: `5 seconds.`

Given a map of islands and bridges that connect these islands, a Hamilton path, as we all know, is a path along the bridges such that it visits each island exactly once. On our map, there is also a positive integer value associated with each island. We call a Hamilton path the best triangular Hamilton path if it maximizes the value described below.

Suppose there are n islands. The value of a Hamilton path $C_1C_2\ldots C_n$ is calculated as the sum of three parts. Let V_i be the value for the island C_i. As the first part, we sum over all the V_i values for each island in the path. For the second part, for each edge $C_i\ C_{i+1}$ in the path, we add the product $V_i * V_{i+1}$. And for the third part, whenever three consecutive islands $C_i\ C_{i+1}\ C_{i+2}$ in the path forms a triangle in the map, i.e. there is a bridge between C_i and C_{i+2}, we add the product $V_i * V_{i+1} * V_{i+2}$.

Most likely but not necessarily, the best triangular Hamilton path you are going to find contains many triangles. It is quite possible that there might be more than one best triangular Hamilton paths; your second task is to find the number of such paths.

Input:

The input file starts with a number q ($q <= 20$) on the first line, which is the number of test cases. Each test case starts with a line with two integers n and m, which are the number of islands and the number of bridges in the map, respectively. The next line contains n positive integers, the i-th number being the V_i value of island i. Each value is no more than **100**. The following m lines are in the form **x y**, which indicates there is a (two way) bridge between island **x** and island **y**. Islands are numbered from **1** to n. You may assume there will be no more than **13** islands.

Output:

For each test case, output a line with two numbers, separated by a space. The first number is the maximum value of a best triangular Hamilton path; the second number should be the number of different best triangular Hamilton paths. If the test case does not contain a Hamilton path, the output must be 0 0.

Note: A path may be written down in the reversed order. We still think it is the same path.

Sample Input:

```
2
3  3
2  2  2
1  2
2  3
3  1
4  6
1  2  3  4
1  2
1  3
1  4
2  3
2  4
3  4
```

Sample Output:

```
22  3
69  1
```

一个机器人，一张图上来回走
每次从一个点等概率随机到达下一个点

问最终到达某个点的概率？
N<=100

上体育课的时候，小蛮的老师经常带着同学们一起做游戏。这次，老师带着同学们一起做传球游戏。

游戏规则是这样的：n个同学站成一个圆圈，其中的一个同学手里拿着一个球，当老师吹哨子时开始传球，每个同学可以把球传给自己左右的两个同学中的一个（左右任意），当老师再次吹哨子时，传球停止，此时，拿着球没传出去的那个同学就是败者，要给大家表演一个节目。

聪明的小蛮提出一个有趣的问题：有多少种不同的传球方法可以使得从小蛮手里开始传的球，传了m次以后，又回到小蛮手里。两种传球的方法被视作不同的方法，当且仅当这两种方法中，接到球的同学按接球顺序组成的序列是不同的。比如有3个同学1号、2号、3号，并假设小蛮为1号，球传了3次回到小蛮手里的方式有1->2->3->1和1->3->2->1，共2种。

n，m（3<=n<=30，1<=m<=30）。

输入

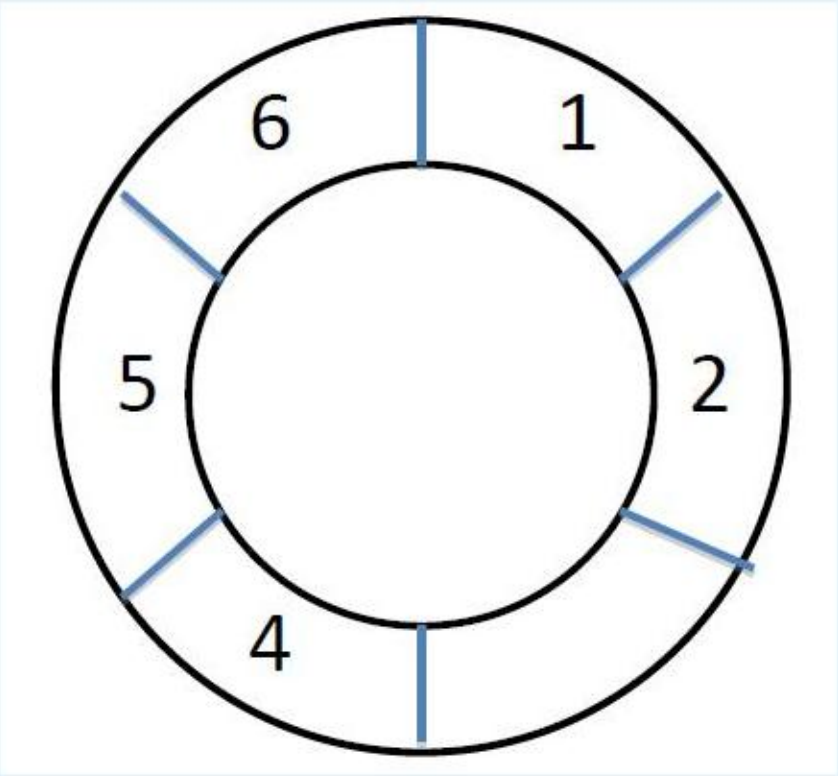
```
3 3
```

输出

```
2
```

Hdu 4576

Michael has a telecontrol robot. One day he put the robot on a loop with n cells. The cells are numbered from 1 to n clockwise.



At first the robot is in cell 1. Then Michael uses a remote control to send m commands to the robot. A command will make the robot walk some distance. Unfortunately the direction part on the remote control is broken, so for every command the robot will chose a direction(clockwise or anticlockwise) randomly with equal possibility, and then walk w cells forward.
Michael wants to know the possibility of the robot stopping in the cell that cell number >= l and <= r after m commands.

Input

There are multiple test cases.
Each test case contains several lines.
The first line contains four integers: above mentioned n($1 \le n \le 200$) ,m($0 \le m \le 1,000,000$),l,r($1 \le l \le r \le n$).
Then m lines follow, each representing a command. A command is a integer w($1 \le w \le 100$) representing the cell length the robot will walk for this command.
The input end with n=0,m=0,l=0,r=0. You should not process this test case.

Output

For each test case in the input, you should output a line with the expected possibility. Output should be round to 4 digits after decimal points.

Sample Input

```
3 1 1 2
1
5 2 4 4
1
2
0 0 0 0
```

Sample Output

```
0.5000
0.2500
```

Source

2013ACM-ICPC杭州赛区全国邀请赛

FFT 优化dp

阿申准备报名参加GT考试，准考证号为N位数X1X2....Xn(0<=Xi<=9),他不希望准考证号上出现不吉利的数字。
他的不吉利数学A1A2...Am(0<=Ai<=9)有M位，不出现是指X1X2...Xn中没有恰好一段等于A1A2...Am. A1和X1可以为
0

nput

第一行输入N,M,K.接下来一行输入M位的数。 N<=10^9,M<=20,K<=1000

Output

阿申想知道不出现不吉利数字的号码有多少种，输出模K取余的结果.

Sample Input

```
4 3 100
111
```

矩阵优化

- 1、背包模型
  包括0-1背包、无限背包、有限背包、有价值背包等！
  2、最长非降子序列模型
  渡河问题、合唱队型等
  3、最大子段和模型
  K大子段和、最佳游览，最大子矩阵和等。
  4、LCS模型
  回文字串、多串的LCS等
  5、括号序列模型
  cf,（母函数、默慈金数等
  6、递推模型

  7、线段覆盖问题
  snoi 2012！

  8、连续段划分模型
  即要求把数列划分成k个连续段，使每段和的最大值最小。
  9、游戏模型
  这类题的阶段（一般是时间）和决策（一般就是游戏目标）很清楚，因此比较容易想到。改版：免费馅饼（NOI98）

- LCS
- LIS (取第k项)

- F[i][j]?

Input
7 2 1 5 11 5 9 11
Output
9

Input
5 5 4 3 2 1
Output
12

Note

In the first sample, the array is going to look as follows:

2 3 5 6 7 9 11

$|2-2|+|1-3|+|5-5|+|11-6|+|5-7|+|9-9|+|11-11|=9$

背包

变种多！

- 变体积
- 转换维度
- 大体积
- 多重复（数学）

- 01背包
- 完全背包
- **多重背包**
- 混合三种背包
- 二维费用背包
- 分组背包
- 有依赖的背包

CCPC2015

有n个木条，放在桌子长L上，

每个木条有一个长度和价值，求不超长度最大价值

但只要木条重心在桌子上就好

N<=1000,L,l[i]<=10000

UVA 12260

n(<=1000)个物品，一个味道指数，一个是金钱指数，艾老师和数老师玩游戏，两人轮流取，每次一个。因为A老师非常憨厚，每次取味道最好的（相等时让对方收益最高），S老师很机智，取**最终**能让自己收益最高的（相等时让对方美味度最低）

sweet<=1e9,value<=1e9

合并后回文，最小代价？

Sample Input

```
5
6 2 8 7 1
0 5 2 10 20
0
```

Sample Output

```
10
```

Hint

In the sample, there is two ways to achieve Xiaoji's goal.
[6 2 8 7 1] -> [8 8 7 1] -> [8 8 8] will cost 5 + 5 = 10.
[6 2 8 7 1] -> [24] will cost 20.

1171: Furu

时间限制: 1

提交

[提交][状态][

题目描述

Furude_Rika decided to paint a wall.The wall consists of n*m tiles,that are arranged in an n*m table, and each tile is a 1*1 square.At the beginning all the tiles are not painted.
Furude_Rika wants to paint the wall that in each row and in each column the number of printed tile is 0,1 or 2.She wants to know how many different ways she can paint her wall.
As the answer will be too big,mod it by 14020130063.

输入

Only two intergers n,m(n<=100,m<=100).

输出

Output an interger,the answer to the problem.

样例输入

```
1 3
```

样例输出

```
7
```

提示

For every tile you can choose whether to paint it or not,the total way of sample is 2*2*2=8.

but if we paint all the tiles,the number of painted tiles in the 1 row is 3.

so the final answer is 8-1=7.

L - La Vie en rose HDU - 5745

Professor Zhang would like to solve the multiple pattern matching problem, but he only has only one pattern string $p = p_1 p_2 \ldots p_m$. So, he wants to generate as many as possible pattern strings from p using the following method:

1. select some indices $i_1, i_2, \ldots, i_k$ such that $1 \le i_1 < i_2 < \ldots < i_k < |p|$ and $|i_j - i_{j+1}| > 1$ for all $1 \le j < k$.
2. swap p_{i_j} and p_{i_j+1} for all $1 \le j \le k$.

Now, for a given a string $s = s_1 s_2 \ldots s_n$, Professor Zhang wants to find all occurrences of all the generated patterns in s.

nput

There are multiple test cases. The first line of input contains an integer T, indicating the number of test cases. For each test case:

The first line contains two integers n and m $(1 \le n \le 10^5, 1 \le m \le \min\{5000, n\})$ -- the length of s and p.

The second line contains the string s and the third line contains the string p. Both the strings consist of only lowercase English letters.

Sample Input

```
3
4 1
abac
a
4 2
aaaa
aa
9 3
abcbacacb
abc
```

Sample Output

```
1010
1110
100100100
```

1171: Furu

时间限制: 1

提交

[提交][状态][

题目描述

Furude_Rika decided to paint a wall.The wall consists of n*m tiles,that are arranged in an n*m table, and each tile is a 1*1 square.At the beginning all the tiles are not painted.
Furude_Rika wants to paint the wall that in each row and in each column the number of printed tile is 0,1 or 2.She wants to know how many different ways she can paint her wall.
As the answer will be too big,mod it by 14020130063.

输入

Only two intergers n,m(n<=100,m<=100).

输出

Output an interger,the answer to the problem.

样例输入

```
1 3
```

样例输出

```
7
```

提示

For every tile you can choose whether to paint it or not,the total way of sample is 2*2*2=8.

but if we paint all the tiles,the number of painted tiles in the 1 row is 3.

so the final answer is 8-1=7.

- 多次背包问题：给定**n** 种物品和一个背包。第**i**种物品 的价值是W_i，其体积为V_i，数量是K_i件，背包的容量为**C**。可以任意选择装入背包中的物品，求装入背包中物品的最大总价值。

二进制

从n个可变体积的弹簧中取一些，第i个弹簧的长度满足l[i]~r[i]，获得的价值是基础价值a[i]加额外(p-l[i])*b[i]，p为第i个弹簧最终所取得的长度。

求价值最大！

n,l<=1k,a,b<=1e9

有 n 个产品，编号为 1~n。要在 m 个机器人的手中生产完成。其中，第 i 个产品在第 j 个机器人手中的生产时间给出 。要求每个机器人只能生产连续的一段区间.求生 产完所有产品的最短时间是多少。其中 n<=5*10^5， m<=5。

NOIP2005过河（青蛙过河）

题目描述　　在河上有一座独木桥，一只青蛙想沿着独木桥从河的一侧跳到另一侧。在桥上有一些石子，青蛙很讨厌踩在这些石子上。由于桥的长度和青蛙一次跳过的距离都是正整数，我们可以把独木桥上青蛙可能到达的点看成数轴上的一串整点：0，1，……，L（其中L是桥的长度）。坐标为0的点表示桥的起点，坐标为L的点表示桥的终点。青蛙从桥的起点开始，不停的向终点方向跳跃。一次跳跃的距离是S到T之间的任意正整数（包括S,T）。当青蛙跳到或跳过坐标为L的点时，就算青蛙已经跳出了独木桥。

题目给出独木桥的长度L，青蛙跳跃的距离范围S,T，桥上石子的位置。你的任务是确定青蛙要想过河，最少需要踩到的石子数。

对于30%的数据，L <= 10000；

对于全部的数据，L <= 10^9。

输入格式　　输入的第一行有一个正整数L（1 <= L <= 10^9），表示独木桥的长度。第二行有三个正整数S，T，M，分别表示青蛙一次跳跃的最小距离，最大距离，及桥上石子的个数，其中1 <= S <= T <= 10，1 <= M <= 100。第三行有M个不同的正整数分别表示这M个石子在数轴上的位置（数据保证桥的起点和终点处没有石子）。所有相邻的整数之间用一个空格隔开。

17年ecfinal简化版

一维线性的桌子上有N（n<=1000）只蚂蚁，所有蚂蚁速度一样初始每一只有一个朝向（左右），撞墙则回头，两只相遇后会打架，双方获胜概率各0.5。

问最终第n只存活的概率？