河南省第十二届大学生程序设计竞赛

（正式赛）

主办：河南省计算机学会

承办：黄淮学院信息工程学院

时间：2018.5.7 9:00--14:00

A. *DNA 序列---复制问题*

Time Limit: 1000MS

核酸与蛋白质是生物体内两大重要的生物大分子，其中核酸是生物遗传信息从上一代传到下一代的的重要载体。核酸的基本组成单元是核苷酸，可将核苷酸分为脱氧核苷酸(DNA)和核糖核苷酸(RNA)。

我们以 DNA 为例，所有的 DNA 核苷酸的磷酸基团和糖基团都是一样的，但其化学组成的碱基基团有四种类型，腺嘌呤（A）、鸟嘌呤（G）、胞嘧啶（C）、胸腺嘧啶（T）。因此，对 DNA 序列的单链研究可以转化为研究由 A、G、C、T 四个字母组成的字符串。

DNA 复制是指以原始的 DNA 分子为模板合成出相同分子的过程。在一些酶的作用下，DNA 复制过程的有四种可能：完全复制、半保留复制、逆复制、逆半保留复制。

给定一个带有遗传信息的模板 *mode*，你能在 DNA 序列 *s* 中找到这样的复制过程最多有多少次？

【标准输入】

第一行： *T* 表示以下有 T 组测试数据 （ $1 \leqslant T \leq 8$ ）

每组数据， 占一行：

mode *s* （|mode |≤ 20， |s| ≤ 300 ， mode 与 s 之间至少一个空格）

【标准输出】

对每组测试数据，输出占一行，

【 样 例 】

标准输入	标准输出
2 ACGA AGACGACGAGCAGCAACGA AAA ACGATTAAAAAGTCTAAAA	5 5

说明：

1 半保留复制是指本次复制可以与前次复制部分重叠。例如：ACGACGA,算 2 次复制。类似逆半保留复制，例如：AGCAGCA,算 2 次复制。

2 若模板是回文串，逆复制过程不再统计。

B. DNA 序列---同源问题 Time Limit: 1000MS

从本质上看，DNA 序列不是一条条孤立的序列。每条序列都是通过进化遗传规律从远古的祖先序列演化而来的。在生物学上，如果两条 DNA 序列是从一个公共祖先序列进化而来的，则称二者具有同源性。

判断两条 DNA 序列是否同源的一个主要依据是探寻它们之间的相似性。序列重排和对齐是比较两条 DNA 序列相似程度的做法。为此，需要对它们各个位点的残基进行对齐，然后考虑从其中一条序列出发经过“变异操作“能否将其演变为另一条序列。其中“变异操作”包括：

（1） 替换：在某个点位从一种残基替换为另一种残基；

（2） 增加：在一条序列中新增加了残基；

（3） 丢失：原始序列中的残基在另一条中消失。

例如：假定两条均包含 7 个核苷酸的 DNA 序列分别为 ***s***=CTGAAGC, ***t***=GGCTAAA。

比对方式 1：

s: C T G A A G C

t: G G C T A A A

比对方式 2：

s: C T G A A G C

t: G G C T A A A

哪种比对更好？还有哪些比对方式？为此，我们需要建立一个比对优劣的量化准则，基于该准则为每种方式赋予一个分值，具有最高分的比对方式作为判断同源问题的依据。

为研究方便，对给定的两个 DNA 序列 *s*，*t*，假设对应位“匹配”得分为 *a*,“替换” 则得分为*-b*，“增加”得分为*-c*，“丢失”得分都为*-d*。将序列 *s* 演变为序列 t 的最高得分 *f* 作为判断同源性的准则。

若 *f* 超过某个阈值时，则称两个 DNA 序列是来自共同祖先的同源序列。

【标准输入】

输入有多组测试数据*（不超过 20 组）*，每组数据格式如下：

第一行： a b c d (*4 个整数* $1 \leqslant a, b, c, d \leqslant 20$)

第二行： s ($|s| \leqslant 300$)

第三行： t ($|t| \leqslant 300$)

【标准输出】

对每组测试数据，输出占一行，将序列 *s* 演变为序列 *t* 的最高得分 *f*.

【 样 例 】

标准输入	标准输出
1 1 2 2 CTA	-1 1

CTGAA 1 1 1 1 CDDAA CAA	

C. *DNA 序列---变异问题* Time Limit: 2000MS

遗传是子代保持亲代特性的现象，变异是指子代与亲代存在不同之处。所谓突变，是指 DNA 序列在复制的过程中出现了可遗传性的改变。突变是某些遗传性疾病的主要原因。比如。染色体重组，基因突变等。其中，基因突变是造成变异的主要原因。

在 DNA 序列中，基因突变可能将一种带有遗传信息的密码子变成另外一种未知信息。我们研究的是，对给定的一条变异的 DNA 序列片段，有多少密码子被改变的。

假设有 n 个不同的密码子 $A_1, A_2, \cdots, A_n$，每个密码子都是由 A,G,C,T 组成的长度≤10 的字符串，并且任意密码子之间相互不为前缀。

给定一个由上述若干个密码子组成的原始 DNA 序列片段 T（长度≤500），和 k 个等长的有变异的 DNA 序列 $S_1, S_2, \cdots, S_k$ 你能否帮助 Dr. Kong 找到每条变异 DNA 片段中发生变异的密码子个数。

【标准输入】

输入有多组测试数据*（不超过 6 组）*，每组数据格式如下：

第一行： n k （ $1 \le n \le 100$ $1 \le k \le 10$）

接下来有 M 行： A_1,

……

A_n

第 M+2 行： T

接下来有 K 行： S_1,

……

S_k

【标准输出】

输出每条变异 DNA 序列中发生变异密码子的个数。

【 样 例 】

标准输入	标准输出
5 2 GCT ACT AGTT AAAAAGGGGG	1 3

CATAAGGAGA AGTTACTACTAAAAAGGGGG AGTTACCACTAAAAAGGGGG GTCAACTGCTAACGAGGGGG	

D. 地铁 1 号线

Time Limit: 1000MS

某市 1 号地铁线， 每天 *6:00* 从始发站发出第一趟地铁，以后每隔 *m* 分钟发出下一趟，直到晚上 *22:00* 发出当日最后一趟地铁。

经过运行 *X* 年的数据分析发现，每趟地铁的车票收入与它的起发时间有一定关联。比如：6:00 发出的地铁，由于坐车人数少，一趟下来车票收入为 4.50 千元；8:00 发出的地铁，由于坐车人多，一趟下来车票收入为 12.00 千元。不同段时间内起发的地铁，车票收入满足不同的线性关系。

车票收入

发车时间

06:00 08:00 15:00 16:20 22:00

给出上述数据分析，地铁运营公司想知道，一天下来，1 号地铁线总的车票收入是多少。

【标准输入】

第一行： *T* 表示以下有 T 组测试数据 （ $1 \le T \le 8$ ）

对每组数据，

第 1 行有两个整数 *m* *n* ，接下来有 *n* 行，每行两个数据，格式为: *hh:mm* *x* 分别表示发车时间和车票收入。

其中： $10 \le m \le 60$ $1 \le n \leqslant 100$ $0.00 \leqslant x \le 100000.00$

【标准输出】

对每组测试数据，输出一个实数，1 号地铁线一天的车票总收入。(*精确到小数点后 2 位*)

【 样 例 】

标准输入	标准输出
1 60 3 06:00 4.50 08:00 12.00 22:00 12.00	192.75

E. 缆车 Time Limit: 3000MS

在远离大陆的太平洋上，有一个风景优美的小岛。传说，小岛上的文明是这样发展起来的。

第一代人沿着岛的坡度选择了 *n* 个定居点，编号为 *1,2,...,n.* 其中编号 *i* 定居点的高度就是 *i* 米。他们在定居点的附近修建了房屋，开辟了农田,种植了植物。

第二代人在 *n* 个定居点之间修建了 *n-1* 条小路，每条小路连接两个定居点，且任意两个定居点之间都可以通过小路相互到达,互通有无。

各个定居点不仅高度不同,而且距离非常远.随着技术的提高,第三代人将盘岛小路改造成可以通缆车的道路。这样不同定居点的人们不费力气就可以借助缆车，自由地到达任何一个定居点。

为了纪念开辟文明的先辈，每年，小岛上都会举行一种特殊的仪式。每年的仪式会选择两个定居点 *x, y*，人们将自己的思念和祝愿写成信件放入缆车，缆车将从定居点 *x* 出发，沿着唯一的路径驶向定居点 *y*。为了体会到翻山越岭的感觉, 岛民们希望缆车行车路线满足如下条件:

缆车依次经过若干定居点 $a_1, a_2, \cdots, a_k$，岛民们认为，如果存在 i,在满足 *1<i<k* 条件下，

$$a_1 < a_2 < \ldots\ldots < ai \quad 且 \quad ai > a_{i+1} \cdots\cdots > a_k$$

a_1 可以作为出发点，a_k 可以作为终止点。

岛民想要知道，存在多少种不同路径的仪式方案？ 所谓两个仪式方案不同，是指在满足约束条件下，如果他们的出发节点不同，或者结束点不同。

【标准输入】

第一行： *T* 表示以下有 *T* 组测试数据 （ $1 \le T \le 5$ ）

对每组数据，第 1 行： 一个整数 *n* 表示定居点个数。 接下来有 *n-1* 行，每行两个整数 *ai aj*，表示定居点 *ai* 到定居点 *aj* 之间有一条缆车路线。$1 \le n \le 2 * 10^5$

【标准输出】

对每组测试数据，输出一个正整数，表示有多少种不同的仪式方案。

【 样 例 】

标准输入	标准输出

1 4 1 4 2 4 3 4	6

F. Information Transmission-1

Time Limit: 1000MS

Information resources are information producers, information and information technology organisms. The fundamental purpose of information management is to control the flow of information and realize the utility and value of information. The broad meaning of information transmission is the transfer of information between media. Strictly speaking, all information processing is the transfer of information within the organization, that is, the movement of information in its physical location.

Information transmission methods include one-way transmission, two-way transmission, half-two-way transmission (only one direction per transmission), multi-channel transmission (one channel through multiple signals), etc.

Now, a university has a urgent notice, hoping all teachers can see the content at the first time. The physical location of all teachers is known , Once a teacher (*xi,yi*) receives information, he or she immediately passes it to another teacher in the adjacent position (*xi+1,yi*) or (*xi-1,yi*) or (*xi,yi+1*) or (*xi,yi* -1).

You can tell the authority , at first which teachers should be notified at least to ensure that everyone can see the notice content at the first time.

Input

The first line of the input contains one integer *T*, which is the number of test cases (*1<=T<=8)*. Each test case specify:

* *Line 1:* *m n* ($1 \le m \le 200, 1 \le n \le 500$)
* *Line 2~m+1:* Each row has *n* numbers, '1' indicates that there is a teacher in this position.

Output

For each test case generate a single line: minimum number of teachers to be notified first.

Sample Input	**Sample Output**
2 1 10 1110111111 7 9	5 17

000110000 110010001 010011011 000000000 111111100 010100100 111111100	

G. *Information Transmission-2*

Time Limit: 2000MS

Information plays a very important role in people's social life. For example, scientific research must not only obtain the results of others 'research in time, but also publish and inform others of the results of their own research in time. Only through this exchange of information can we continue to develop. Network communication is based on computer communication network for information transmission, exchange and utilization.

There are *n* base points and there is a certain transfer relationship between them., the information can be transmitted from point A to point B, and point B to point C, and so on. Now there is a massage to be broadcasted , at least which base points to be sent the message first, so that all the base points can be received?

Input

The first line of the input contains one integer *T*, which is the number of test cases (*1<=T<=8*). Each test case specify:

** Line 1: n (2 ≤ n ≤ 100)*

**Line 2~n+1: each line contains a 01 string of length n .*

ie:if the sixth column in the third row is 1, it means that the third base point can pass the message to the sixth base point.

Output

For each test case generate a single line: minimum number of base that the massage must be sent first, so that all the basis points can be received.

Sample Input	Sample Output

2 3 010 001 000 6 010000 001001 000100 010000 001000 000000	1 2

H. Information Transmission-3 Time Limit: 2000MS There is n bases in a certain area, numbered $1, 2, \ldots, n$, the location of base i is represented by coordinates (x_i, y_i). Dr. Kong is at point (x_1, y_1), he must send an information to point (x_n, y_n). Because of the insecurity of the network, he decided to drive the information in person. When he is ready to leave, he find that there is something wrong with the steering wheel of his car. The steering wheel can only turn right and can not turn left.

All roads in the area are known . If there is a road from base i to base j, the path length of the road is calculated from the coordinates $sqrt((x_i-x_j)^2+(y_i-y_j)^2)$, assuming that all roads are two-way. At first, Dr. Kong may choose any road to set off from base 1. Once he leaves, he can only go straight or turn right at a given coordinate point. For faster transmission of information , Can you help Dr. Kong design a shortest path from Base 1 to Base n without turning left on the steering wheel?

Input

The first line of the input contains one integer *T*, which is the number of test cases (*1<=T<=5*). Each test case specifity:

* Line 1: n m *n* bases, *m* roads ($1 \le n \le 100, 1 \le m \le 200$)
* Line *2~n+1:* x_i y_i the location of base *i* (*2 integers,* $0 \le x_i, y_i \le 1000$)
* Line *n+2~n+m+1:* i_k j_k there is a road from base i_k to base j_k

Output

For each test case generate a single line: a real number, the shortest path from Base *1* to Base *n* without turning left on the steering wheel. accurate to 2 decimal places.

Sample Input	Sample Output
1 5 6 10 10 10 5 30 5 12 30 15 0 1 2 2 5 3 5 1 3 1 4 4 5	36.43

I. Destroy Base

Time Limit: 16 seconds

A base is developing chemicals of mass destruction. In order to prevent attack, there are several invisible protective panels above the base.

Now a army code *TT01* receive a mission to destroy the base as soon as possible. At present, *TT-1* is the most powerful weapon in the army. However, after many attacks, a difficult problem was found when *TT-1* fires vertically at the base from above, it does not penetrate layers of protective panels, but slides down panels to the end point. If the end point is within the range of the base, it can be destroyed, otherwise the base cannot be destroyed.

Good news, enhanced version of weapon *TT-2* has been developed. It is based on *TT-1* plus materials that can penetrate protective panels. Through the activation mechanism, *TT-2* can choose to penetrate one layer, go on slide down panel, *TT-2* can still choose to penetrate one layer..... It is a pity that every time TT2 breaks through a protective shield, the energy decreases. the energy decay formula is $y=e^{-ax}$

For convenience, we transform this problem into two-dimensional space. The base is an interval *[l, r]* on the x-axis, invisible protective panels are modeled as line segments(*x1,y1, x2,y2*) above the x-axis. The panels are slanted, that is, not parallel to the x- or y-axes. *TT-2* fires vertically from above. When any *TT-2* fires on a panel, it can flows toward the panel's lower end and falls off from there. But the penetration mechanism is activated, it can also penetrate one layer instead. After *TT-2* falls off a pannel, it continues to fall vertically. This repeats until *TT-2* hits the base. Finally, maximum destructive power of *TT2* to the base as follows:

$$Z=t/w*e^{-ax}$$

t is the initial energy of TT2, *w* is base length , *x* is number of *TT2* penetrate the panels, *a* is given parameter. due to the rarity of penetrating materials, we need to know how many penetration mechanisms can be activated at least to hit the base point , how much damage can be achieved.

Input

The first line of input contains five integers *t, a, l, r* and *n*, where *[l, r]* is the Left and right boundary of the base and *n* is the number of panels. Each of the following *n* lines describes a panel and contains four integers *x1, y1, x2, y2.*

Where *t is a integer , a* is a real number *, l, r, x, y* are integers. and *x1* and *x2* for all panels are all distinct. The pannels described in the input will not intersect, and no endpoint of a panel will lie on another panel.

($10^2 \leqslant t \leqslant 10^9$, $0.00<a<1$, $0 \leq l< r \leq 10^9$,
$0 \leq n \leq 5 \cdot 10^5$, $0 \leq x1, x2, y1, y2 \leqslant 10^9$ $x1 \neq x2$, $y1 \neq y2$,).

Output

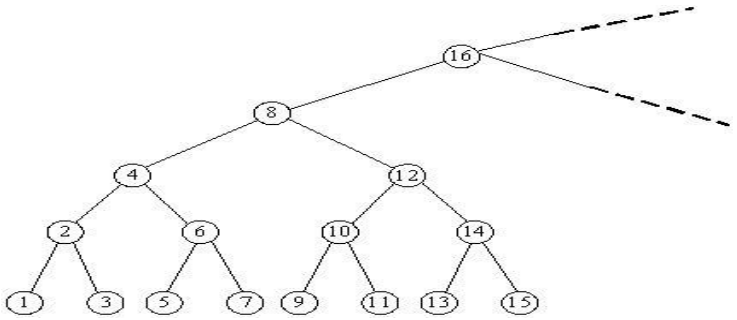
The maximum destructive power of *TT2* to the base, accurate to 3 decimal places

Sample Input	**Sample Output**
800 0.192540 10 20 2 5 2 15 15 2 80 25 70	82.592

J. Special Formation

Time Limit: 1000ms

A large number of new microbes have been found in an uninhabited island. Strangely, these microbes, how ever active during the day, end up resting at night in the following pattern. It's very much like an infinite full binary search tree .



.

You might as well number these microbes as 1,2,3.. .... In a subtree whose root node is *ith*, we can get the

minimum number in this subtree by repeating going down the left node until the last level, and we can also find the maximum number by going down the right node. Now you are given some queries as "What are the minimum and maximum numbers in the subtree whose root node is *ith*?" Please try to find answers for there queries.

Input

The first line contains an integer *N*, which represents the number of queries *(1⩽N⩽20)*. In the next *N* lines, each contains a number representing a subtree with root number *xi* *(2⩽xi⩽2^{31} - 1)*.

Output

There are *N* lines in total, the *i-th* of which contains the answer for the *i-th* query.

Sample Input	**Sample Output**
3 3 8 20	3 3 1 15 17 23