牛客网暑期ACM多校训练营（第三场）

一. 编程题

1. Eddy was a contestant participating in ACM ICPC contests. ACM is short for Algorithm, Coding, Math. Since in the ACM contest, the most important knowledge is about algorithm, followed by coding(implementation ability), then math. However, in the ACM ICPC World Finals 2018, Eddy failed to solve a physics equation, which pushed him away from a potential medal.

Since then on, Eddy found that physics is actually the most important thing in the contest. Thus, he wants to form a team to guide the following contestants to conquer the PACM contests(PACM is short for Physics, Algorithm, Coding, Math).

There are N candidate groups each composed of p_i physics experts, a_i algorithm experts, c_i coding experts, m_i math experts. For each group, Eddy can either invite all of them or none of them. If i-th team is invited, they will bring g_i knowledge points which is calculated by Eddy's magic formula. Eddy believes that the higher the total knowledge points is, the better a team could place in a contest. But, Eddy doesn't want too many experts in the same area in the invited groups. Thus, the number of invited physics experts should not exceed P, and A for algorithm experts, C for coding experts, M for math experts.

Eddy is still busy in studying Physics. You come to help him to figure out which groups should be invited such that they doesn't exceed the constraint and will bring the most knowledge points in total.
输入描述：
The first line contains a positive integer N indicating the number of candidate groups.
Each of following N lines contains five space-separated integer p_i, a_i, c_i, m_i, g_i indicating that i-th team consists of p_i physics experts, a_i algorithm experts, c_i coding experts, m_i math experts, and will bring g_i knowledge points.
The last line contains four space-separated integer P, A, C, M indicating the maximum possible number of physics experts, algorithm experts, coding experts, and math experts, respectively.

$1 \le N \le 36$
$0 \le p_i,a_i,c_i,m_i,g_i \le 36$
$0 \le P, A, C, M \le 36$

输出描述：
The first line should contain a non-negative integer K indicating the number of invited groups.
The second line should contain K space-separated integer indicating the index of invited groups(groups are indexed from 0).

You can output index in any order as long as each index appears at most once. If there are multiple way to reach the most total knowledge points, you can output any one of them. If none of the groups will be invited, you could either output one line or output a blank line in the second line.
示例1:
输入
2
1 0 2 1 10
1 0 2 1 21
1 0 2 1

输出
1
1
示例2:
输入
1
2 1 1 0 31
1 0 2 1
输出
0

正确答案：

2. Eddy likes to play with tree. Of course, it's not those green and natural trees, but those trees containing N vertices and N-1 edges and miraculously remaining connected. However, it's difficult for Eddy to remember every tree he likes. Some tree may be too large while some tree may have strange structure which is hard to be encoded in memory(in Eddy's brain). Thus, Eddy comes up with following way to contract a tree:

1. Select a subset of vertices.
2. While there's an unselected vertex with degree 1, delete it.
3. While there's an unselected vertex with degree 2, delete it and connect its neighbors.
4. Output the remaining tree.

However, choosing which subset in step 1 is a hard choice for Eddy. He decides to choose some subset of vertices containing exactly k vertices. From all possible choices, He will uniformly randomly choose one of them.

Now, you are wondering what would be the expected number of vertices after contracting. But, you don't know Eddy chooses which k in the first step. Then, you wants to find out all the answer for each k from 1 to N(total number of vertices).
输入描述：
First line of input contains a positive integer N indicating the number of vertices of the tree.
For each following N-1 lines, each contains two space-separated positive integer u_i, v_i indicating that there's an edge between u_i and v_i.

$1 \le N \le 5000$
$1 \le u_i < v_i \le N$
It's guaranteed that the given input is a tree.
输出描述：
Please output N lines. For i-th line, output one integer Z indicating the expected number of vertices module 1000000007(10^9+7) after contracting when k=i. One can show that the expected number of vertices can be represented as $\frac{P}{Q}$, then Z will be P x Q^{-1} module 1000000007(10^9+7)
示例1:
输入
1
输出
1
示例2:

输入
4
1 2
2 3
3 4
输出
1
2
3
4
示例3:
输入
4
1 2
1 3
1 4
输出
1
2
25000005
4

正确答案：

3. Eddy likes to play cards game since there are always lots of randomness in the game. For most of the cards game, the very first step in the game is shuffling the cards. And, mostly the randomness in the game is from this step. However, Eddy doubts that if the shuffling is not done well, the order of the cards is predictable!

To prove that, Eddy wants to shuffle cards and tries to predict the final order of the cards. Actually, Eddy knows only one way to shuffle cards that is taking some middle consecutive cards and put them on the top of rest. When shuffling cards, Eddy just keeps repeating this procedure. After several rounds, Eddy has lost the track of the order of cards and believes that the assumption he made is wrong. As Eddy's friend, you are watching him doing such foolish thing and easily memorizes all the moves he done. Now, you are going to tell Eddy the final order of cards as a magic to surprise him.

Eddy has showed you at first that the cards are number from 1 to N from top to bottom.

For example, there are 5 cards and Eddy has done 1 shuffling. He takes out 2-nd card from top to 4-th card from top(indexed from 1) and put them on the top of rest cards. Then, the final order of cards from top will be [2,3,4,1,5].
输入描述：
The first line contains two space-separated integer N, M indicating the number of cards and the number of shuffling Eddy has done.
Each of following M lines contains two space-separated integer p_i, s_i indicating that Eddy takes p_i-th card from top to (p_i+s_i-1)-th card from top(indexed from 1) and put them on the top of rest cards.

$1 \le N, M \le 10^5$

$1 \le p_i \le N$

$1 \le s_i \le N-p_i+1$

输出描述：

Output one line contains N space-separated integers indicating the final order of the cards from top to bottom.

示例1:

输入

5 1

2 3

输出

2 3 4 1 5

示例2:

输入

5 2

2 3

2 3

输出

3 4 1 2 5

示例3:

输入

5 3

2 3

1 4

2 4

输出

3 4 1 5 2

正确答案：

4. Eddy is eavesdropping the messages passed between Alice and Bob. He has collected several cipher texts. From those cipher texts, Eddy has discovered that Alice and Bob is using Caesar cipher to encrypt their messages and successfully recover the Caesar table they used. Now, Eddy wants to extract some information from their communication. However, Eddy found that the Caesar encryption system they used is a little bit broken. That is, if some character should be encrypted into c, the ascii code of actual output might be differed by one. For example, if some character should be encrypted into `g`, it may output `f` or `g` or `h`. But, if one should be encrypted into `a`, it may output `a` or `b`.

Eddy has found that the plain text of target key word is S and eavesdropped the message decrypted into T. He is now wondering how many substring of T may be actually the same as S considering that the Caesar system is broken.

A substring T' may be actually the same as S if we can encrypt T' into E(T') in the broken way. Then, decrypt E(T') into D(E(T')) in normal way, where D(E(T'))=S

输入描述：

The input contains 3 lines.

The first line is the target key word S.

The second line is the decrypted plain text T.

The third line is the Caesar table P used where `a` will be encrypted into the first character of P, `b` will be

encrypted into the second one, and so on.

1 ≤ |S| ≤ |T| ≤ 250000
The strings S and T are consisting of lowercase English letters.
|P|=26, which is a permutation of lowercase English letters.
输出描述：
Please output one or two lines.
The first line is the number of possible matching positions.
If there is any matching position,
output one more line with matching positions in ascending order and separated by a space.
示例1:
输入
any
amyisaboy
abcdefghijklmnopqrstuvwxyz
输出
2
1 7
示例2:
输入
uagn
elbkanlrgthwzgrnohlned
cmlkixrnvwusqhajbtpofzgdye
输出
0

正确答案：

5. Eddy likes to play with string which is a sequence of characters. One day, Eddy has played with a string S for a long time and wonders how could make it more enjoyable. Eddy comes up with following procedure:

1. For each i in [0,|S|-1], let S_i be the substring of S starting from i-th character to the end followed by the substring of first i characters of S. Index of string starts from 0.
2. Group up all the S_i. S_i and S_j will be the same group if and only if $S_i=S_j$.
3. For each group, let L_j be the list of index i in non-decreasing order of S_i in this group.
4. Sort all the L_j by lexicographical order.

Eddy can't find any efficient way to compute the final result. As one of his best friend, you come to help him compute the answer!
输入描述：
Input contains only one line consisting of a string S.

1≤ |S|≤ 10^6
S only contains lowercase English letters(i.e. **"a-z"**).

输出描述：
First, output one line containing an integer K indicating the number of lists.
For each following K lines, output each list in lexicographical order.
For each list, output its length followed by the indexes in it separated by a single space.

示例1:
输入
abab
输出
2
2 0 2
2 1 3
示例2:
输入
deadbeef
输出
8
1 0
1 1
1 2
1 3
1 4
1 5
1 6
1 7

正确答案 :

6. Eddy likes to play with digits. However, as you may know, Eddy is a programmer not a normal human. Thus, he likes to play with hexadecimal digits(base 16) instead of decimal digits(base 10). One day, he found that sum of digits(\texttt{SOD}) is very interesting. Then, he invents following function.

```
func SOD(v):
 if v<16: return v
 return SOD(sum of digits of v in hexadecimal)
```

After playing with **SOD** several times, Eddy found that for one integer, the computation is too easy to make him happy. Thus, Eddy generates a string of hexadecimal digits S, and takes some subsegment(consecutive digits) of it. Then, Eddy takes all the non-empty subsequence(not necessary consecutive digits) from the subsegment as the inputs of the **SOD** function. It becomes a little challenging for Eddy now. But, Eddy is still not satisfied. He wants to change the string sometimes and keeps taking some subsegments as queries. Now, it's really a problem for Eddy. You, as one of the friends of Eddy, come to rescue him and are going to compute the answer for him.

Since the number of outputs would be too many(which will be equal to the number of non-empty subsequences), you are only required to compute the number of each output and report the number $(\sum(\text{number of outputs being } i) \times 1021^i) \mod 10^9+7(1000000007)$ to Eddy.

For example, the hexadecimal string S equals \texttt{12345}. Eddy takes the subsegment [1,1] which is \texttt{1}. All the non-empty subsequence is $[1]$. Thus, the answer will be $\sum 1 \times 1021^1 \mod 10^9+7 = 1021$.

If Eddy takes the subsegment [1,3] which is \texttt{123}. All the non-empty subsequence is

$[1, 2, 3, 12, 13, 23, 123]$. Then, the answer will be 267411465.

输入描述：

First line of input contains two space-separated integer N, Q indicating the length of hexadecimal digits S and number of operations Eddy will take.

Second line of input contains a string S indicating the hexadecimal string Eddy generates.

Following Q lines, each line will be one of following form:

$1\ p\ c$: changing p-th digit of S into c.

$2\ l\ r$: taking the subsegment [l, r] and compute the answer.

$1 \le N,Q \le 10^5$

$|S|=N$, length of S will be N

character of S will be hexadecimal digit(**0123456789ABCDEF**)

$1 \le p \le N$, c will be hexadecimal digit

$1 \le l \le r \le N$

输出描述：

For each second type operation($2\ l\ r$), output one line indicating the corresponding answer.

示例1:

输入

5 2
12345
2 1 1
2 1 3

输出

1021
267411465

示例2:

输入

5 3
12345
2 1 5
1 1 A
2 1 5

输出

930616025
659780022

正确答案：

7. Christmas is coming! Eddy has received a Christmas tree as gift. Not surprisingly, the tree consists of N vertices and N-1 edges and magically remains connected. Currently, all the vertex of the tree is uncolored. Eddy wants to color each vertex into one of K colors. However, there are too many way to color the tree(i.e. K^N ways). Eddy doesn't want the result of coloring being too boring. Thus, he defines the colorness of a tree as follow:

The colorness of a tree is the minimum distance between two vertex colored in the same color.

Now, Eddy is wondering how many way to color the tree such that the colorness of the tree will be D.
输入描述：
The first line of input contains three space-separated integer N, K, D indicating the number of vertices, number of colors, and the required colorness.
For each following N-1 lines, each contains two space-separated positive integer u_i, v_i indicating that there's an edge between u_i and v_i.

$1 \le K < N \le 5000$
$1 \le D \le N$
$1 \le u_i < v_i \le N$
It's guaranteed that the given input is a tree.

输出描述：
Output one line contains an integer indicating the number of way to color the tree resulting in colorness being D.
示例1:
输入
2 1 1
1 2
输出
1
示例2:
输入
4 3 2
1 2
2 3
3 4
输出
18
示例3:
输入
4 3 2
1 2
1 3
1 4
输出
24

正确答案：

8. Eddy has solved lots of problem involving calculating the number of coprime pairs within some range. This problem can be solved with inclusion-exclusion method. Eddy has implemented it lots of times. Someday, when he encounters another coprime pairs problem, he comes up with diff-prime pairs problem. diff-prime pairs problem is that given N, you need to find the number of pairs (i, j), where $\frac{i}{gcd(i,j)}$ and $\frac{j}{gcd(i,j)}$ are both prime and i ,j ≤ N. gcd(i, j) is the greatest common divisor of i and j. Prime is an integer greater than 1 and has only 2 positive divisors.

Eddy tried to solve it with inclusion-exclusion method but failed. Please help Eddy to solve this problem.

Note that pair (i_1, j_1) and pair (i_2, j_2) are considered different if $i_1 \neq i_2$ or $j_1 \neq j_2$.
输入描述：
Input has only one line containing a positive integer N.

$1 \leq N \leq 10^7$
输出描述：
Output one line containing a non-negative integer indicating the number of diff-prime pairs (i,j) where i, j ≤ N
示例1:
输入
3
输出
2
示例2:
输入
5
输出
6

正确答案：

9. Currently, Eddy is reading this paper "On the Expected Complexity of Random Convex Hulls"(1997). It states that the expected number of vertices of the convex hull of N points, chosen uniformly and independently from a disk is $O(N^{\frac{1}{3}})$, and $O(K \log N)$ for the case a convex polygon with K sides, and so on. Eddy thinks it's very interesting and now wants to research something about it. But, it seems too hard to start with something like disk or polygon.

Thus, as his first step in the research, Eddy first chooses a triangle. Now, Eddy wants to find out the expected number of points on the convex hull when uniformly randomly picking N points within the triangle. However, Eddy can't find any way to solve this problem. As his best friend, you come to help Eddy finish his research debut.
输入描述：
For first three lines, each contains two space-separated integer x_i, y_i indicating the points(x_i, y_i) of the triangle Eddy chooses.
Forth line contains one integer N indicating that N points will be randomly uniformly chosen within the given triangle.

$-10^9 \leq x_i, y_i \leq 10^9$
$3 \leq N \leq 10$
It's guaranteed that given input forms a non-degenerate triangle
输出描述：
Output a floating number indicating the expected number of points on the convex hull.

Absolutely or relatively error within 10^{-4} will be considered correct.

示例1:
输入
0 0

1 0
2 1
3
输出
3.000000000000

正确答案：

10. Eddy has graduated from college. Currently, he is finding his future job and a place to live. Since Eddy is currently living in Tien-long country, he wants to choose a place inside Tien-long country to live. Surprisingly, Tien-long country can be represented as a simple polygon on 2D-plane. More surprisingly, Eddy can choose any place inside Tien-long country to live. The most important thing Eddy concerns is the distance from his place to the working place. He wants to live neither too close nor too far to the working place. The more specific definition of "close" and "far" is related to working place.

Eddy has M choices to work in the future. For each working place, it can be represented as a point on 2D-plane. And, for each working place, Eddy has two magic parameters P and Q such that if Eddy is going to work in this place, he will choose a place to live which is closer to the working place than $\frac{P}{Q}$ portion of all possible living place choices.

Now, Eddy is wondering that for each working place, how far will he lives to the working place. Since Eddy is now busy on deciding where to work on, you come to help him calculate the answers.

For example, if the coordinates of points of Tien-long country is (0,0), (2,0), (2, 2), (0, 2) in counter-clockwise order. And, one possible working place is at (1,1) and P=1, Q=2. Then, Eddy should choose a place to live which is closer to (1, 1) than half of the choices. The distance from the place Eddy will live to the working place will be about 0.7978845608.
输入描述：
The first line contains one positive integer N indicating the number of points of the polygon representing Tien-long country.
Each of following N lines contains two space-separated integer (x_i, y_i) indicating the coordinate of i-th points. These points is given in clockwise or counter-clockwise order and form the polygon.
Following line contains one positive integer M indicating the number of possible working place Eddy can choose from.
Each of following M lines contains four space-separated integer x_j, y_j, P, Q, where (x_j, y_j) indicating the j-th working place is at (x_j, y_j) and magic parameters is P and Q.

$3 \le N \le 200$
$1 \le M \le 200$
$1 \le P < Q \le 200$
$|x_i|, |y_i|, |x_j|, |y_j| \le 10^6$
It's guaranteed that the given points form a simple polygon.
输出描述：
Output M lines. For i-th line, output one number indicating the distance from the place Eddy will live to the i-th working place.

Absolutely or relatively error within 10^{-6} will be considered correct.
示例1:

输入
4
0 0
2 0
2 2
0 2
1
1 1 1 2
输出
0.797884560809
示例2:
输入
3
0 0
1 0
2 1
2
0 0 1 2
1 1 1 3
输出
1.040111537176
0.868735603376

正确答案：