A. Coffee Central

Warning: This problem is a multi-test problem. There is only one test file and it contains all test data. Because of that Time limit is 10 seconds.

Is it just a fad or is it here to stay? You're not sure, but the steadily increasing number of coffee shops that are opening in your hometown has certainly become quite a draw. Apparently, people have become so addicted to coffee that apartments that are close to many coffee shops will actually fetch higher rents.

This has come to the attention of a local real-estate company. They are interested in identifying the most valuable locations in the city in terms of their proximity to large numbers of coffee shops. They have given you a map of the city, marked with the locations of coffee shops. Assuming that the average person is willing to walk only a fixed number of blocks for their morning coffee, you have to find the location from which one can reach the largest number of coffee shops. As you are probably aware, your hometown is built on a square grid layout, with blocks aligned on north-south and east-west axes. Since you have to walk along streets, the distance between intersections (a, b) and (c, d) is $|a - c| + |b - d|$.

Input

The input contains several test cases. Each test case describes a city. The first line of each test case contains four integers dx, dy, n, and q. These are the dimensions of the city grid dx × dy ($1 \le dx, dy \le 1000$), the number of coffee shops n ($0 \le n \le 5 \cdot 10^5$), and the number of queries q ($1 \le q \le 20$). Each of the next n lines contains two integers x_i and y_i ($1 \le x_i \le dx$, $1 \le y_i \le dy$); these specify the location of the i-th coffee shop. There will be at most one coffee shop per intersection. Each of the next q lines contains a single integer m ($0 \le m \le 10^6$), the maximal distance that a person is willing to walk for a cup of coffee.

The last test case is followed by a line containing four zeros.

Output

For each test case in the input, display its case number. Then display one line per query in the test case. Each line displays the maximum number of coffee shops reachable for the given query distance m followed by the optimal location. For example, the sample output shows that 3 coffee shops are within query distance 1 of the optimal location (3, 4), 4 shops are within query distance 2 of optimal location (2, 2), and 5 shops are within query distance 4 of optimal location (3, 1). If there are multiple optimal locations, pick the location that is furthest south (minimal positive integer y-coordinate). If there is still a tie, pick the location furthest west (minimal positive integer x-coordinate).

Follow the format of the sample output.

Sample input

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

Sample output

```
Case 1:
3 (3,4)
4 (2,2)
5 (3,1)
Case 2:
0 (1,1)
0 (1,1)
```

B. Kingdom of Magic

Kingdom of Magic has a network of bidirectional magic portals between cities since ancient times. Each portal magically connects a pair of cities and allows fast magical communication and travel between them. Cities that are connected by the magic portal are called neighboring. Prince Albert and Princess Betty are living in the neighboring cities. Since their childhood Albert and Betty were always in touch with each other using magic communication Orbs, which work via a magic portal between the cities.

Albert and Betty are in love with each other. Their love is so great that they cannot live a minute without each other. They always carry the Orbs with them, so that they can talk to each other at any time. There is something strange about their love — they have never seen each other and they even fear to be in the same city at the same time. People say that the magic of the Orbs have affected them.

Traveling through the Kingdom is a complicated affair for Albert and Betty. They have to travel through magic portals, which is somewhat expensive even for royal families. They can simultaneously use a pair of the portals to move to a different pair of cities, or just one of them can use a portal, while the other one stays where he or she is. At any moment of their travel they have to be in a neighboring cities. They cannot simultaneously move through the same portal. Write a program that helps Albert and Betty travel from one pair of the cities to another pair. It has to find the cheapest travel plan — with the minimal number of times they have to move through the magic portals. When they move through the portals simultaneously it counts as two moves.

Input

The first line of the input file contains integer numbers n, m, a1, b1, a2, b2. Here n ($3 \le n \le 100$) is a number of cities in the Kingdom (cities are numbered from 1 to n); m ($2 \le m \le 1000$) is a number of magic portals; a1, b1 ($1 \le a1, b1 \le n$, a1 != b1) are the neighboring cities where Albert and Betty correspondingly start their travel from; a2, b2 ($1 \le a2, b2 \le n$, a2 != b2) are the neighboring cities where Albert and Betty correspondingly want to get to (a1 != a2 or b1 != b2).

Following m lines describe the portals. Each line contains two numbers p_{i1} and p_{i2} ($1 \le p_{i1}, p_{i2} \le n$, p_{i1} != p_{i2}) — cities that are connected by the portal. There is at most one portal connecting two cities.

Output

On the first line of the output file write two numbers c and k. Here c is the minimal number of moves in the travel plan; k is the number of neighboring city pairs that Albert and Betty visit during their travel including a1, b1 at the start and a2, b2 at the end.

Then write k lines with two integer numbers ai and bi on each line — consecutive different pairs of neighboring cities that Albert and Betty visit during their travel. If there are multiple travel plans with the same number of moves, then write any of them. It is guaranteed that solution exists.

Sample input

4 5 1 2 2 1
1 2
2 3
3 4
4 1
1 3

Sample output

3 3
1 2
2 3
2 1

C.Ход конем

7	8	9
4	5	6
1	2	3
	0	

Рис. 1.1

Шахматная ассоциация решила оснастить всех своих сотрудников такими телефонными номерами, которые бы набирались на кнопочном телефоне ходом коня. Например, ходом коня набирается телефон 340-49-27 (см. рис. 1.1). При этом телефонный номер не может начинаться ни с цифры 0, ни с цифры 8.

Напишите программу, определяющую количество телефонных номеров длины *N*, набираемых ходом коня.

Входные данные

Во входном файле записано целое число *N* (1<=*N*<=100).

Выходные данные

Выведите в выходной файл искомое количество телефонных номеров.

Пример входного файла

```
2
```

Пример выходного файла

```
16
```