

Task: PLA

Schedule

UFAM Workshop, contest #3. Source file pla.* Available memory: 128 MB.

Mr. Wojciech decided to run a new business. He wants to set up a school called *SSH (Saturday's School of Hacking)*. Of course he will be a headmaster of this school. Mr. Wojciech has written an educational program of his school, which was confirmed by ministry of education. He wants to hire n teachers, rent s classrooms and create k groups of students.

Unfortunately, now it is time to form a schedule of classes for SSH. Mr. Wojciech tried to do that, but he is not satisfied with the results of his work. He knows, that as a headmaster, he will be obliged to stay in school until the end of the last classes. According to the actual schedule the headmaster will spend in school the whole day. Your task is to help Mr. Wojciech and form optimal schedule.

There will be p subjects, that will be taught in the school. Each subject will have its teacher and group of students that will learn this subject. Each Saturday each subject will have its time period, in which it will be taught.

At the same time each teacher may teach only one subject, each students group may learn only one subject and each classroom may hold one classes only.

Example

Suppose, that SSH hires two teachers and there are two student groups and six subjects: (1,1), (1,1), (1,2), (2,2), (2,2), (2,2). We represent a subject as a pair of numbers (teacher number, student group number). It is possible, that a teacher will teach more than one subject to the same students group.

If there would be only one classroom, Mr. Wojciech would spend 6 time periods in school (it is impossible to teach two subjects simultaneously, and we have 6 of them). But assuming that a headmaster will rent 2 classrooms, he will stay only 4 hours in school. Optimal schedule may be:

time period	classroom 1	classroom 2
1	(1,2)	
2	(2,2)	
3	(1,1)	(2,2)
4	(1,1)	(2,2)

Task

Write a program that: reads the number of teachers, student groups and classrooms in the school; and finds the minimal number of time periods, which Mr. Wojciech will be obliged to spend in school each Saturday, and optimal schedule.

Input

The first line of standard input contains four integers n, k, p, s , separated by single spaces ($1 \leq n, k, p, s \leq 1000$). These integers are: the number of teachers, number of student groups, number of subjects and number of classrooms respectively.

Next p lines contain representations of subjects, one in a line. The i -th line contains two integers n_i, k_i representing i -th subject ($1 \leq n_i \leq n, 1 \leq k_i \leq k$). These two integers are: teacher number and student group number, and are separated by single space.

Output

In the first line of standard output your program should write one integer G – the minimal number of time periods, which the headmaster will be obliged to spend in school each Saturday. (It is not said that a time period will be 45 minutes, so G could be quite big). In the next p lines of output your program should write the optimal schedule. Line number $(i + 1)$ should contain one integer, not greater than G , which represent the time period number, during which the i -th subject will be taught.

If there is more than one optimal schedule your program may write any one of them.

Example

For the input data:

```
2 2 6 2
1 1
1 1
1 2
2 2
2 2
2 2
```

the correct result is:

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