Asia-Pacific Informatics Olympiad

Saturday, 9 May, 2009

	Task		
	OIL	CONVENTION	ATM
Time Limit	1.5 sec	1.5 sec	1.5 sec
Memory Limit	128 MB	64 MB	64 MB
Points	100	100	100
Input	stdin (keyboard)		
Output	stdout (screen)		

Language	Compiler version	Compiler options
C	gcc version 4.2.4	-m32 -O2 -lm
C++	g++ version 4.2.4	-m32 -O2 -lm
Pascal	fpc 2.2.0 for i386	-O2 -Sd -Sh

Digging for Oil

The Government of Siruseri has decided to auction off land in its oil-rich Navalur province to private contractors to set up oil wells. The entire area that is being auctioned off has been divided up into an $M \times N$ rectangular grid of smaller plots.

The Geological Survey of Siruseri has data on the estimated oil reserves in Navalur. This information is published as an $M \times N$ grid of non-negative integers, giving the estimated reserves in each of the plots.

In order to prevent a monopoly, the government has ruled that any contractor may bid for only one $K \times K$ square block of contiguous plots.

The AoE oil cartel consists of a group of 3 colluding contractors who would like to choose 3 disjoint blocks so as to maximize their total yield.

Suppose that the estimated oil reserves are as described below:

```
1  1  1  1  1  1  1  1  1
1  1  1  1  1  1  1  1  1
1  8  8  8  8  8  1  1  1
1  8  8  8  8  8  1  1  1
1  8  8  8  8  8  1  1  1
1  1  1  1  8  8  8  1  1
1  1  1  1  1  1  8  8  8
1  1  1  1  1  1  9  9  9
1  1  1  1  1  1  9  9  9
```

If $K = 2$, the AoE cartel can take over plots with a combined estimated reserve of 100 units, whereas if $K = 3$ they can take over plots with a combined estimated reserve of 208 units.

AoE has hired you to write a program to help them identify the maximum estimated oil reserves that they can take over.

Input format

The first line of the input contains three integers M, N and K, where M and N are the number of rows and columns in the rectangular grid of plots and K is the size of the square block for which bids can be made. The next M lines contain N non-negative integers—each line describes the estimated oil reserves for one row of plots.

Output format

A single line with a single integer indicating the maximum estimated oil reserves that can be taken over by the AoE cartel.

Test Data

You may assume that $K \leq M$ and $K \leq N$ and that at least three disjoint $K \times K$ blocks are available. In 30% of the inputs, $M, N \leq 12$. In all inputs, $M, N \leq 1500$. The estimated oil reserve for each plot is always non-negative and never exceeds 500.

Sample input	Sample output
9 9 3	208

```
9 9 3
1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1
1 8 8 8 8 8 1 1 1
1 8 8 8 8 8 1 1 1
1 8 8 8 8 8 1 1 1
1 1 1 1 8 8 8 1 1
1 1 1 1 1 1 8 8 8
1 1 1 1 1 1 9 9 9
1 1 1 1 1 1 9 9 9
```

The Siruseri Convention Centre

The Government of Siruseri has constructed a new Convention Centre. A number of companies have expressed an interest in renting the auditorium in the Convention Centre to hold their conferences.

A client is willing to rent the auditorium only if it is granted to him exclusively for the entire duration of his conference. The marketing head of the Convention Centre has decided that the best strategy would be to rent the auditorium out to as many different clients as possible. Clearly there may be more than one way to do this.

Consider, for instance, the following example with 4 companies. The companies are listed in the order in which they made requests for the auditorium, with the duration of each conference indicated by the starting and ending day.

	Start	End
Company 1	4	9
Company 2	9	11
Company 3	13	19
Company 4	10	17

In this example, it is possible to rent out the auditorium to a maximum of two companies. The choices are 1 and 3, or 2 and 3, or 1 and 4. Note that the auditorium can be rented out to only one company on any day. Thus, 1 and 2 cannot both be granted the auditorium because their requests overlap on day 9.

The marketing head believes in fairness and he has decided on the following procedure to choose the combination to which he will rent out the auditorium. A set of requests is a candidate to be chosen if it is of maximum size. Observe that the companies are numbered according to the order in which they make their requests. The companies in each candidate set are listed out in ascending order. Among these, the lexicographically smallest candidate set is chosen.[1]

In this example the auditorium will be rented out to companies 1 and 3— the three candidate sets are $\{(1,3),(2,3),(1,4)\}$ and $(1,3) < (1,4) < (2,3)$ when ordered lexicographically.

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[1]Lexicographic order is dictionary order, so list ℓ_1 is smaller than list ℓ_2 if ℓ_1 is a prefix of ℓ_2 or if at the first position j where ℓ_1 and ℓ_2 differ, $\ell_1[j] < \ell_2[j]$.

Your task is to help the marketing head decide the set of companies to which the auditorium is to be rented.

Input format

The first line contains an integer N, the number of companies that have applied for renting the auditorium. Lines 2 to $N+1$ contain two integers. The integers on line $i+1$ are the starting and ending dates for the request from company i.

Output format

The first line of the output should consist of an integer M, the maximum number of companies to which the auditorium can be rented. This should be followed by a line containing M integers listing the identities of the companies that appear in the lexicographically smallest such set.

Test Data

In 50% of the inputs, $N \leq 3000$. In all inputs, $N \leq 200000$. For each company's request, the starting day is always greater than or equal to 1 and the ending day never exceeds 10^9.

Sample input

```
4
4 9
9 11
13 19
10 17
```

Sample output

```
2
1 3
```

The Great ATM Robbery

The city of Siruseri has only one way roads. Roads meet at intersections and at every intersection, mandated by law, there is an ATM of the Bank of Siruseri. Strangely, the pubs in Siruseri are also located only at intersections, though not every intersection hosts a pub.

Banditji plans to carry out the largest ATM robbery in the history of Siruseri. He will start from the city centre and drive around, robbing all the ATMs that he passes by, before ending the day at one of the city's pubs to celebrate his achievement.

Using his well-honed hacking skills, Banditji has precise information about the amount of cash available at every ATM. He would like you to help him determine the total amount that he can rob by starting at the city centre and ending at one of the city's pubs. He can go through the same intersection or road any number of times. However, there is no money to be picked up at an ATM after the first visit.

For instance, suppose the city had 6 intersections connected by roads as indicated below:
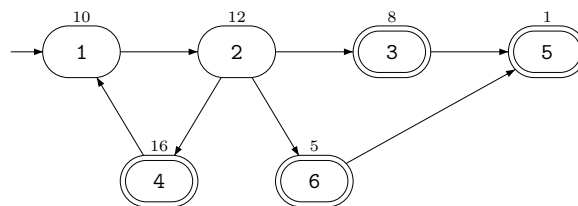
The city centre is at intersection 1, marked by an incoming →, and the intersections where pubs are found are marked by a double circle. The amount of cash available at the respective ATMs is written above each intersection. In this case, Banditji can rob a total of 47 by following the route 1–2–4–1–2–3–5.

Input format

The first line of input contains 2 integers N and M, where N is the number of intersections and M is the number of roads. This is following by M lines, each with two integers in the range $1, 2, \ldots, N$, giving the starting and ending intersection for one of the roads. This is followed by N lines, each containing

a single integer, giving the amount of cash available at the ATMs at the N intersections. The following line contains two integers S and P, where S is the starting intersection (the city centre) and P is the number of pubs. This is followed by a line with P integers listing the intersections that contain pubs.

Output format

The output should be a single integer, the maximum amount of money that Banditji can rob on his way from the city centre to any one of the pubs.

Test Data

In 50% of the inputs, $N, M \leq 3000$. In all inputs, $N, M \leq 500000$. The amount of cash available at a single ATM is always non-negative and never exceeds 4000. You are guaranteed that at least one pub can be reached from the city centre by following Siruseri's one way roads.

Sample input	Sample output
6 7	47
1 2	
2 3	
3 5	
2 4	
4 1	
2 6	
6 5	
10	
12	
8	
16	
1	
5	
1 4	
4 3 5 6	