Caravan

You have been promoted to road manager! No, you don't take care of a band. You oversee the construction of Bitland's roads. Bitland ~~has a series of~~ had a series of roads. Due to unfortunate circumstances we now need a new network. However, like all public planning projects, funds are tight, and you also need to make sure after building the roads, you can purchase enough wagons to carry the cargo across the network. Yes, you also need to purchase the public service vehicles (wagons), but only up to 10 wagons can be purchased.

Let me break it down for you.

Each road has a maximum weight capacity. If a wagon carrying more than the weight capacity crosses it, the road is destroyed (**note the weight of the wagon is already factored in to this amount**). The public would probably stone you with the broken road, if the road breaks happened, so we will ensure each wagon carries at most the given capacity. Unfortunately, not all roads cost the same amount to build, and our budget is not infinite.

The wagon drivers are fearful of their goods being stolen, so they wish to minimize the number of times the caravans need to travel per shipment. The wagon drivers demand that any shipment should be made in **exactly one trip** regardless of the source and destination city. However, the Bitland merchants have unionized and demand their shipments be taken in an exact weight amount.

Lastly, any funds that are left over after construction of the roads will be used to purchase wagons. More wagons mean potentially only one trip assuming the minimum weight capacity of any road on their path from any source city to any destination city is not too low.

Your goal is to determine the possible number of wagons that can be purchased, that allows for a caravan of wagons to transport a shipment between any pair of cities in a final network of roads in exactly one trip. This means that a caravan from any city needs to be capable of reaching any other city.

Input Specification

The first line of input will be two positive integers ***n*** and ***m***, representing the number of cities and the number of possible roads, respectively. The following ***m*** lines will describe a possible road. Each road description 4 integers representing the index of one of the connected cities (indexed starting at 1), the index of the other connected city (indexed starting at 1), the cost to build the road (< 10,000,000), and the weight capacity of the road (< 10,000,000) respectively. The last line of input contains 3 positive integers ***b***, w_{cost}, and ***S***, representing the budget of the project, the cost of buying a wagon, and the total weight of a complete shipment respectively..

Output Specification

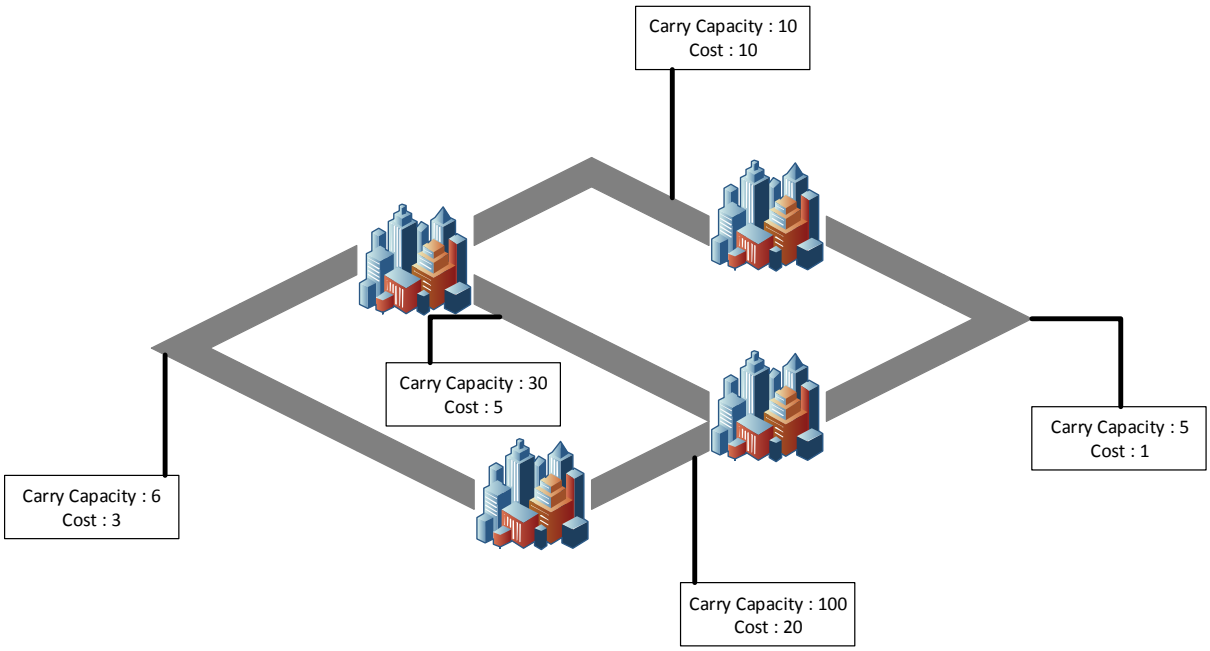
The first line of output should contain a single integer, ***k***, representing the number of possible vehicle counts that can enable the transportation of a shipment in one trip from any pair of cities. The next line should contain ***k*** distinct integers between in the range [1, 10].

Input Output Example

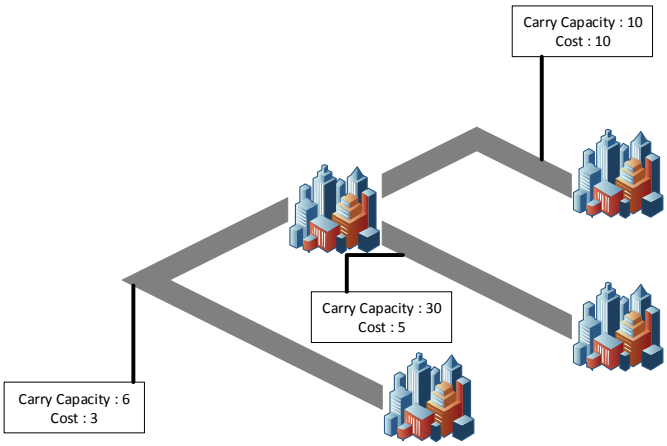
Input	Output
4 5 1 3 3 6 1 2 20 100 2 3 5 30 3 4 10 10 2 4 1 5 27 1 51	1 9
4 5 1 3 3 6 1 2 20 100 2 3 5 30 3 4 10 10 2 4 1 5 41 1 55	2 6 10

Explanation
Case 1:

The kingdom given is the following

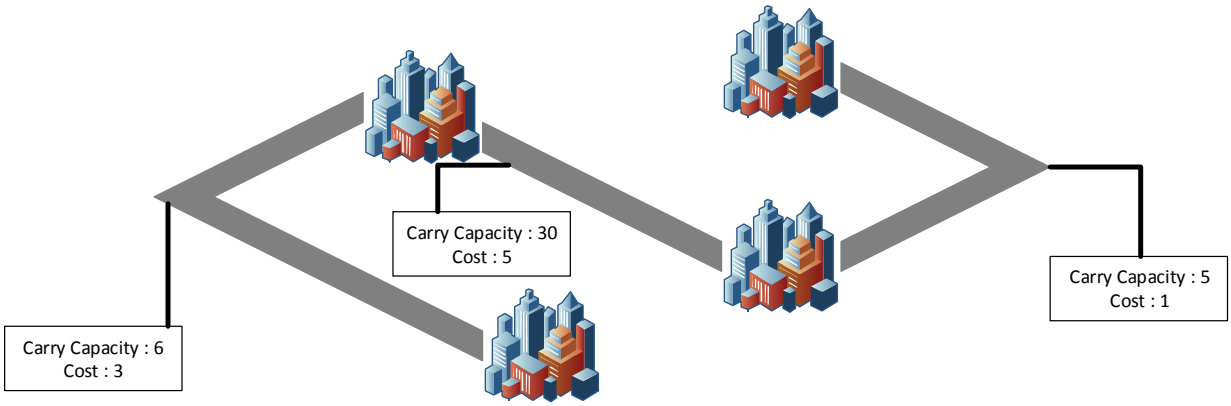


By building the following roads we will have enough money left over for 9 vehicles.



This is because we will spend 18 credits on the network and 9 credits on the vehicles which makes exactly 27 credits (our budget). By having 9 vehicles we need to only transport our goods in one trip. From city 1 to city 3 with 8 vehicles carrying 6kg of goods and 1 vehicle carrying 3kg of goods we make the delivery in one trip. However, we cannot purchase 10 wagons, because we have no money left after the roads and the 9^{th} wagon.

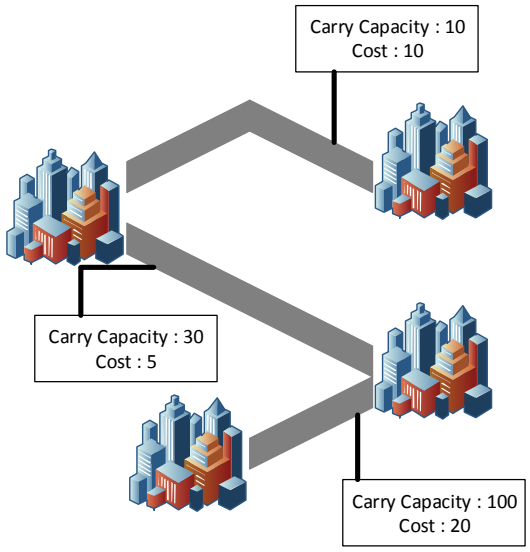
Suppose we try to use the following network instead



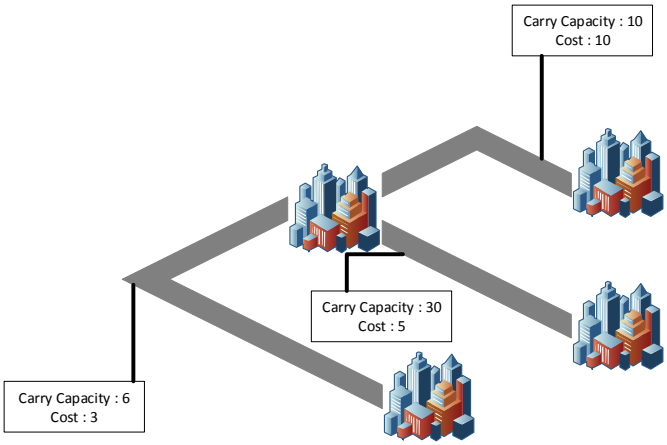
Then we could buy 10 wagons. However, a caravan could only transport 50kg of cargo over the road from 2 to 4. This means a shipment of 51kg could not be transported in exactly one trip for all pairs of city. Since there is no other road structure that would allow us to purchase 10 wagons we cannot field a network with 10 vehicles.

Case 2

We have the original kingdom description as above. This time the city raised the price of the budget, and the weight needed to transport. We can purchase the following roads to enable a 1 trip transfer in the worst case (e.g. city 2 to city 3) with 6 vehicles. Note that we cannot purchase 7 vehicles and the following network of roads.



Additionally, with the following set of roads we can buy 10 wagons (and have plenty of extra cash) and still transport a shipment from any pair of cities in one trip. However, with the following set of roads we cannot purchase 9 wagons and transport our shipments in one trip. This is because with 9 wagons we would only be able to transport 54kg of cargo across the road from city 1 to city 3.



Hints ***Spoilers***

Use the information given to make some assumptions.

1. **Knowing the weight of the cargo is very useful.**
2. **Consider first purchasing some number of wagons.** Suppose we decide we want to purchase 4 wagons. Then we know how much weight our wagons should carry. If our shipment is 25kg, then at least one of our wagons needs to carry at least 7kg. This is like an extension to pigeon hole principle.
3. **Ignore roads that don't have the required capacity**. If we need at least 7kg in one of our wagons, we cannot support a road in the network with less than 7kg of capacity. Otherwise, our caravan would break the road when traveling between the two cities.
4. **Try to construct a connected network from the remaining roads**. If no network is possible, then we cannot support the chosen number of wagons.
5. **Check the price of the resulting network**. If the price of the wagons we purchase plus the network's cost breaks the budget, then we probably cannot support the chosen number of wagons.

Grading Information

Reading from and writing to standard input – 10 points

Using minimum spanning tree code – 10 points

Comments, white space usage, and reasonable variable names – 10 points

Your program will be tested on 14 test cases – 5 points each

No points will be awarded to programs that do not compile.

Only cases that finish within the maximum of {5 times my solution, 10 seconds} will be graded.

This is a much easier problem than the first version.