ETH Zurich
Institut für Theoretische Informatik
Prof. Dr. Angelika Steger

HS 2015
Exercise Sheet 1

ACM Programming Challenges Lab

Exercise 1 – *Travel Costs*

You are preparing for a long road trip all the way across Europe. You know that due to different tax regimes, different countries have different fuel prices. To avoid paying too much you make a list of all gas stations along the road and an estimate of how much the fuel will cost there. Assuming that your car's average fuel consumption on highways is 10 liters per 100 km and its tank can hold 100 liters, what is the most cost efficient refueling schedule? You don't really care if you have to stop often to refuel even if your tank is not empty, you just want the lowest cost.

You can assume that at a gas station you can fill up any amount you wish with a granularity of 0.1 liters, however you can never fill your tank up to more than 100 liters. You can also assume that your car uses exactly 0.1 liters per kilometer. Just reaching a gas station (or your destination) with 0 liters in your tank is ok, so it is possible to travel between two stations exactly 1'000 km apart on one full tank.

You start your journey on a full tank of gas which does not count towards the total cost of the fuel.

Input The first line of input contains N, the number of test cases. Then N test cases follow.

The first line of each test case contains 2 integers t and n, both between 1 and 5'000. The first one denotes the total distance you plan to travel in km. The second denotes the number of gas stations along the road. Afterwards n lines follow. On each line there are 2 integers d_i and c_i. The first one is the distance in km from the start of the ith gas station, while c_i denotes the cost per liter of fuel at that station. It holds that $1 \leq c_i \leq 5000$ and $1 \leq d_i < t$. No two gas stations occupy the same location. The gas stations are sorted by d_i from low to high.

Output For each test case you have to print one line with one integer denoting the minimum total fuel cost achievable for your road trip. If there is no possible solution such that you don't run out of fuel output "impossible". The cost should always be given with a precision of 1 decimal places. (Note that this allows for an exact solution without any rounding. Consider avoiding floating point variables to avoid rounding errors with repeated sums.)

Sample Input

```
3
2000 3
300 3
1200 2
1700 1
1001 1
500 3
1002 1
1 1
```

Sample Output

```
190.0
0.3
impossible
```