Problem D1: Running on Fumes - Chapter 1

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Problem My Submissions Solution

Note: This problem shares similarities with Chapter 2. The solution to either chapter may help with solving the other, so please consider reading both first.

You just landed yourself a gig as a delivery driver for a nationwide supply chain. You've been assigned a series of long-haul jobs, so it's time to get to work.

For each job, you will be provided with a map of the relevant region, which includes N cities (numbered from 1 to N) and $N-1$ two-way roads running amongst them. **The cities are connected by roads in a single line**, such that there's a road between each pair of consecutive cities. In other words, cities i and j are directly connected by a road if and only if $|i-j|=1$.

You will begin in city 1 with a shipment of supplies to be delivered to city N, and with a full gas tank having a capacity of M gallons. You will then have two options at each point in time:

1. Drive along a road from your current city to an adjacent one, using up 1 gallon of gas. You may not do this if your tank is empty, but it's fine if your tank becomes empty as a result.
2. Fill your tank all the way back up to M gallons of gas at a cost of C_i dollars, where i is your current city. Note that the cost is independent of how much gas your tank had before refueling. You may not do this if city i has no gas station (indicated with $C_i = 0$).

Determine the minimum cost required to arrive at city N, if it's possible at all.

Input

Input begins with an integer T, the number of long-haul jobs you've been assigned. For each job there is first a line containing the space-separated integers N and M. Then, N lines follow, the ith of which contains the single integer C_i.

Output

For the ith job, output a line containing *"Case #i: "* followed by a single integer, the minimum cost in dollars to get from city 1 to city N, or -1 if it's impossible.

Constraints

$1 \leq T \leq 85$
$2 \leq N \leq 1,000,000$
$1 \leq M \leq N$

$0 \leq C_i \leq 1,000,000,000$

The sum of N across all jobs is at most 4,000,000.

Sample Explanation

In the first job, you will begin in city 1 with 3 gallons of gas. You cannot drive all the way to your destination (city 5) without refueling along the way, as that would require a total of 4 gallons of gas. The cheapest option is to drive to city 2, top up your tank for a cost of $20, and then drive through cities 3 and 4 before reaching city 5 with no more gas to spare.

In the second job, your gas tank only has a capacity of 2 gallons. In this case, the cheapest strategy involves depleting all of your gas to drive to city 3, refueling there for $30, and then depleting all of your gas to reach city 5.

In the third job, your gas tank only has a capacity of 1 gallon. No matter what you do, you will deplete all of your gas in the drive from city 3 to city 4, where there will be no way to refuel to reach city 5.

Sample Input

```
7
5 3
0
20
30
0
10
5 2
0
20
30
0
10
5 1
0
20
30
0
10
4 1
99
88
77
66
4 4
99
88
77
66
6 2
0
0
20
30
0
10
12 3
0
1
4
7
```

Sample Output

```
Case #1: 20
Case #2: 30
Case #3: -1
Case #4: 165
Case #5: 0
Case #6: 50
Case #7: 19
```

```
0

5
9
8
0
3
0
6
```

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