

Task 2: TRUCKING DIESEL

Consider a diesel-powered truck that transports diesel fuel from a start position to a destination. The truck does not have a separate fuel tank, but takes its fuel directly from its diesel storage. You need to compute the maximal number of liters of diesel that the truck can bring from the start position to the destination, without using it up along the way. If the truck cannot reach the destination with the given fuel, your answer must be -1 .

You are given a map of a terrain in form of an m rows by n columns grid of altitudes. The altitudes are in meters, range from 0 to 4000, and are all divisible by 100. The first row of the grid describes the Northern edge of the terrain, the last row the Southern edge, the first column the Western edge and the last column the Eastern edge. The truck starts at the North-Western corner $(0, 0)$, and its destination is the South-Eastern corner $(m - 1, n - 1)$. In one step, the truck can only go to neighboring positions in the grid, East, South or West. Note that the truck cannot go North and cannot go diagonally.

We assume that diesel fuel has a mass of 1.0 kg per liter. In one step, for each downhill or flat segment, the truck uses 10 liters of diesel. For each uphill segment, the truck needs 4 liters of additional fuel for each 100 m altitude difference of the segment and for each ton¹ of its total mass at the beginning of the segment. In this calculation, we are rounding down the mass of the truck to next lower ton. For example, if the total mass of the truck at the beginning of the segment is 25780 kg, and if the truck moves from an altitude of 400 m to an altitude of 700 m, then the truck will need $10 + 3 \times 4 \times 25 = 310$ liters for that segment. At the end of the segment, the truck will have a mass of 25470 kg.

The “unladen” weight of the truck (i.e. weight without fuel) is 8 tons, and it starts out with 25000 liters of diesel fuel.

Example

Let us assume $m = 4$, $n = 4$ and the following altitudes of the grid points.

	0	1	2	3
0	100	200	100	0
1	400	300	100	200
2	200	300	500	500
3	400	400	300	600

Note that initially, the truck has a mass of $8000 + 25000 = 33000$ kg. The best course would be to go

- from the start position $(0, 0)$ to $(0, 1)$, requiring 10 liters for the segment, plus $1 \times 4 \times 33$ for the 100 m altitude difference between 100 m and 200 m (fuel consumption: $10 + 132 = 142$ liters, mass after the segment: $33000 - 142 = 32858$ kg),

¹Note that one ton is 1000kg.

- from $(0, 1)$ to $(1, 1)$, requiring 10 liters for the segment, plus $1 \times 4 \times 32$ liters for the 100 m altitude difference between 200 m and 300 m (fuel consumption: $10 + 128 = 138$ liters, mass after the segment: $32858 - 138 = 32720$ kg),
- from $(1, 1)$ to $(2, 1)$ requiring 10 liters for the segment and no extra fuel (flat segment; fuel consumption: 10 liters, mass after the segment: $32720 - 10 = 32710$ kg),
- from $(2, 1)$ to $(2, 2)$ requiring 10 liters for the segment, plus $2 \times 4 \times 32$ liters for the 200 m altitude difference between 300 m and 500 m (fuel consumption: $10 + 256 = 266$ liters, mass after the segment: $32710 - 266 = 32444$ kg),
- from $(2, 2)$ to $(2, 3)$ requiring 10 liters for the segment and no extra fuel (horizontal segment; fuel consumption: 10 liters, mass after the segment: $32444 - 10 = 32434$ kg),
- from $(2, 3)$ to the destination $(3, 3)$ requiring 10 liters for the segment, plus $1 \times 4 \times 32$ liters for the 100 m altitude difference between 500 m and 600 m (fuel consumption: $10 + 128 = 138$ liters, mass after the segment: $32434 - 138 = 32296$ kg).

The final mass of 32296 kg translates to $32296 - 8000 = 24296$ kg of diesel, which under our assumptions corresponds to 24296 liters of diesel that the truck can transport from the start position to the destination.

Input Format

Your program must read from the standard input. The first line of the input contains m and n . The following m lines contain the altitudes of the grid positions. The example above corresponds to the following file:

```
4 4
100 200 100 0
400 300 100 200
200 300 500 500
400 400 300 600
```

Recall that the altitudes range from 0 to 4000 and are divisible by 100.

Output Format

Your program must write to the standard output an integer, representing the maximal number of liters that can be transported from $(0, 0)$ to $(m - 1, n - 1)$. If the truck can reach the destination with an empty tank, the number is 0. If the truck cannot reach the destination at all, the number is -1 . For the above example, the output is:

```
24296
```

Template

You may use the templates provided. The templates handle the input and output, but without the body of the following subroutines.

- **C program**

```
int truck (int m, int n, int **A);
```

- **Pascal program**

```
function truck (m, n: LongInt; var A: TwoDarray): LongInt;
```

The variable A is the m by n two-dimensional array of integers storing the altitudes. The altitude at North-Eastern corner is stored in $A[0][n-1]$ and $A[0, n-1]$ for the C and Pascal program respectively.

Subtasks

The maximum execution time on each input instance is 0.5 second. Your program will be tested on sets of input instances as follow:

1. (5 marks) $m = 1, n \leq 20$, that is, the map is a line and thus the truck can only move East.
2. (5 marks) $m = 2, n \leq 20$.
(Hint: How many times can the truck move South?)
3. (10 marks) $m \leq 20, n \leq 20$.
4. (20 marks) $m \leq 1000, n \leq 1000$.