

## [L] Lost in the Vault

Time limit: 2 second  
Memory limit: 65535 kBytes

### Description

You come to your senses in a dim, humming underground vault. The corridors twist endlessly, some blocked by heavy metal doors marked with a key symbol. Somewhere in the maze lies a single key; once you find it, the locked doors will yield. Your goal: reach the exit in as few steps as possible. If the exit can't be reached, the vault wins.

The map is a rectangular grid. Each cell is one of:

- S — your starting cell (exactly one)
- E — the exit cell (exactly one)
- K — a single key (exactly one)
- D — a locked door (can only be passed if you already have the key)
- # — an impassable wall
- . — an empty cell you can walk on

You can move in the four cardinal directions (up, down, left, right) by one cell per step. Stepping onto the key K gives you the key permanently; after that you may move through D cells. Walls # block movement.

Find the minimum number of steps required to reach the exit E from the start S. If the exit is unreachable, print -1.

### Input

The first line contains two integers  $N$  and  $M$  ( $1 \leq N, M \leq 1000$ ), the number of rows and columns of the grid.

Then follows  $N$  lines, each containing  $M$  characters describing the map.

The map contains exactly one S, exactly one E, and exactly one K.

### Output

Print a single integer: the minimum number of steps to reach E from S, or -1 if it is impossible.

## Example

### Input

```
5 6
S.....
..K...
..D...
#.....
#...E.
```

### Output

8

### Explanation

One shortest path is:  $(0, 0) \rightarrow (0, 1) \rightarrow (0, 2) \rightarrow (1, 2)$  [pick up key]  $\rightarrow (2, 2)$  [pass door]  $\rightarrow (3, 2) \rightarrow (4, 2) \rightarrow (4, 3) \rightarrow (4, 4)$ . Total moves = 8.

It is not necessary to pick up the key if there's a shortest path to the exit that does not pass any of the doors. In the example, the path  $(0, 0) \rightarrow (0, 1) \rightarrow (1, 1) \rightarrow (2, 1) \rightarrow (3, 1) \rightarrow (4, 1) \rightarrow (4, 2) \rightarrow (4, 3) \rightarrow (4, 4)$  is a valid shortest path too.