Power Failure

Rob Kolstad, 2008
Points: 350

A vicious thunderstorm has destroyed some of the wires of the farm's electrical power grid! Farmer John has a map of all N (2 <= N <= 1,000) of the powerpoles, which are conveniently numbered 1..N and located on integer plane coordinates x_i,y_i (-100,000 <= x_i <= 100000; -100,000 <= y_i <= 100,000).

Some W (1 <= W <= 10,000) power wires connect pairs of power poles Pi and Pj (1 <= Pi <= N; 1 <= Pj <= N).

He needs to get power from pole 1 to pole N (which means that some series of wires can traverse from pole 1 to pole N, probably through some intermediate set of poles).

Given the locations of the N poles and the list of remaining power wires, determine the minimum length of power wire required to restore the electrical connection so that electricity can flow from pole 1 to pole N. No wire can be longer than some real number M (0.0 < M <= 200,000.0).

As an example, below on the left is a map of the 9 poles and 3 wires after the storm. For this task, M = 2.0. The best set of wires to add would connect poles 4 and 6 and also poles 6 and 9.

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   After the storm          Optimally reconnected

3 . . . 7 9 . . . . .       3 . . . 7 9 . . . . .
                                   /
2 . . 5 6 . . . . . .       2 . . 5 6 . . . . . .
                                 /
1 2-3-4 . 8 . . . . .       1 2-3-4 . 8 . . . . .
  |                           |
0 1 . . . . . . . . .       0 1 . . . . . . . . .

  0 1 2 3 4 5 6 7 8 9         0 1 2 3 4 5 6 7 8 9
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The total length is then 1.414213562 + 1.414213562 = 2.828427124 .

Input

- Line 1: Two space-separated integers: N and W
- Line 2: A single real number: M
- Lines 3..N+2: Each line contains two space-separated integers: x_i and y_i
- Lines N+3..N+2+W: Two space-separated integers: Pi and Pj

Output

- Line 1: A single integer on a single line. If restoring connection is impossible, output -1. Otherwise, output a single integer that is 1000 times the total minimum cost to restore electricity. Do not perform any rounding; truncate the resulting product.

Example

Input:
9 3
2.0
0 0
0 1
1 1
2 1
2 2
3 2
3 3
4 1
4 3
1 2
2 3
3 4

Output:
2828

Input details

Just as in the diagram above.

Output details

As above.