Muddy City

Adapted from CS Unplugged

*(*[*www.unplugged.canterbury.ac.nz*](http://www.unplugged.canterbury.ac.nz)*)*

Once upon a time there was a city that had no roads. Getting around the city was particularly difficult after rainstorms because the ground became very muddy — cars got stuck in the mud and people got their boots dirty. The mayor of the city decided that some of the streets must be paved, but didn’t want to spend more money than necessary because the city also wanted to build a swimming pool. The mayor therefore specified two conditions:

 1. Enough streets must be paved so that it is possible for everyone to travel from their house to anyone else’s house only along paved roads, and

 2. The paving should cost as little as possible.

Below is the layout of the city. The number of paving stones between each house represents the cost of paving that route. Find the best route that connects all the houses, and mark which routes should be paved (insert a shape of your choice over each place to be paved).



After you have marked the best route, answer the following questions by adding text in a non-black color after each question:

1. What is the cost of your solution (i.e. how many paving stones were required?)
2. Describe how you solved the problem. If you were given another map, what set of steps would you use to find the optimal solution? Be specific.
3. In general, how many roads (i.e. a sequence of paving stones) are needed for a best solution? Hint: Does it depend on the number of houses?

Grading Criteria:

* 15% - Completeness of paving solution (all houses must be linked by paved roads)
* 10% - Efficiency of solution (does it have minimal cost)
* 40% - Solution description (number 2)
* 20% - Complexity analysis (number 3)
* 15% - Instructions followed carefully (paving marked with inserted symbols, paragraph answers in another color)