Question 1:

You are given a undirected, weighted graph with at most 20000 nodes and edges, and four special nodes.

1. What is the minimum length of a path that visits all four special nodes? The path may start and end anywhere, and may visit nodes and edges more than once.

2. Imagine that the weight of each edge describes the amount of snow that covers it. What is the minimum amount of snow needed to be removed to connect the four special nodes? (In other words, compared to part 1, we only count the weight of a distinct edge once).

Question 2:

You are given a tree of up to 10^6 nodes, with each edge assigned a weight from 0 to 15. You can perform the following operation:

1. Choose two nodes A and B

2. Choose a number X between 0 and 15

3. XOR every edge on the path between A and B with X

What is the minimum number of operations needed to change every edge to 0?

There is a hint on the next page if you need it.

Hint: Prove that every edge is 0 if and only if for every node, the XOR of the edges connected to it is 0.