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Assignment - 11

Problem: Professor Adam has two children who, unfortunately, dislike each other. The problem is so severe that not only do they refuse to walk to school together, but in fact each one refuses to walk on any block that the other child has stepped on that day. The children have no problem with their paths crossing at a corner. Fortunately both the professor's house and the school are on corners, but beyond that he is not sure if it is going to be possible to send both of his children to the same school. The professor has a map of his town. Show how to formulate the problem of determining whether both his children can go to the same school at a maximum-flow problem.

Solution: Let us assume that the town can be represented as a graph $G(V, E)$ where 'V' are the vertices, 'E' are the edges i.e., roads of the town.

We try to solve this approach with the Ford Fulkerson method.

Let the 'source' be Professor Adam's house.

Let the 'sink' be School.

Let the 'weights' be the road-distance between 2 vertices

The source and the sink are on corners.

Here we find the bottleneck capacity of the path from Professor's Adam's house to the school.

i.e., It will be the most optimal path from the source to the sink, for the first child.

- The first child and the second child paths does not overlap at any edges.
- So let's assume that the first child finds a path from Professor Adam's house to school. He can opt the same path while returning to his house without overlapping any edges with the other child as well.
- Since the flow is passing over one link/edge, the same edge/road will not be used by the other child.
- Hence, both children can go to school from Professor Adam's house with flow's of atleast 2. i.e., there must be 2 different unique flows paths from house to school for both the childrens. without any overlapping of the edges.
- If either of the flow is not possible i.e., the max flow path from house to school is less than 2. Then the situation of children going to school is not possible.

return 0.

Algo (source, sink, edge).

Find Max-Flow (Ford Fulkerson)

Save paths to arrays.

```
if len(saved_path_array) > 2:
    return "children go to school"
else:
    return "children can't go to school"
```