Project1: Graph Theory

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Date: December 26, 2024

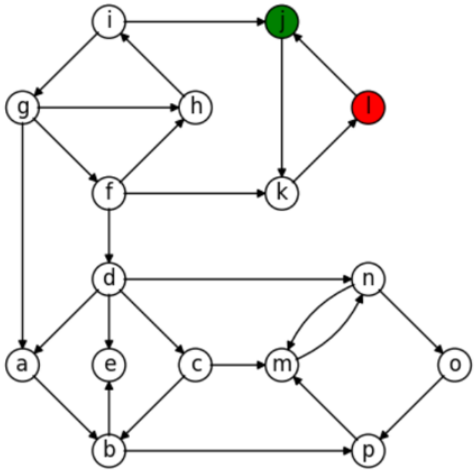
Problem: Catch The Thief

One day, a thief committed a crime. He known for his cunning and stealth, successfully robbed a large of money from the central bank. The police, determined to bring the criminal to justice, have launched a massive investigation.They have narrowed down the thief's location, but with the city's complex layout, finding and capturing him won't be easy.

Part1: The city's layout is represented as a directed graph, with nodes symbolizing various locations and edges showing the connections between them. The green node represents the police's position, and the red node represents the thief's location is show in figure below:

: police

: thief



Condition:

- Police Movement: The police can move to any adjacent node that is directly connected to their current position.
- Thief Movement: The thief can also move to any adjacent node, trying to evade capture.

Objective: The goal for the police is to plan their movements to arrest the thief. To ensure success, the police need to positioning the thief in such a way that the police can catch him. Develop a strategy based on the graph's structure and start preparing your plan.

Q1. In which nodes of the graph $G0$ are able to assign thief's position so that the police can catch him? List all possible results.

Q2. Now, by adding a directed edge from node(e) to node(d) noted graph $G1$, is it still possible for the police to catch the thief? Justify your answer.

Q3. If not, how many assistants are needed to help the police at a minimum? Assign the positions for each assistant on graph $G1$ and draw the graph to show your final solution.

Part2: After the thief was captured, the police put him into a prison. However, one night, the thief mysteriously disappeared from his cell and is now hiding in one of the nodes (you can initialize) within the prison's map. If the police fail to find the thief, he will escape the prison, and note that the thief can leave only one position as show in the figure.

Condition:

- Police Movement: The police can move like depth first search or breadth first search.
- Thief Movement: The thief can move like depth first search or breadth first search.

Objective: The goal for the police is to search for the thief's hiding place inside the prison. Develop a strategy to search each node and find the thief. Plan the police's movement step by step and make sure the thief is located as efficiently as possible.

Task: Execute your algorithm and display each step on the graph using Python.

Q1. Model the problem in Graph *G2* and Initialize the thief location.

Q2. Simulation both of them in 10 times of their movements.Do you expect the police to catch the thief? Remarkable this situation.

Q3. What if the thief can leave both open location. Do the same question **Q2**.