Assignment 3
Ant Colony Optimization

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Approach and findings

Here I'll go through the implementation step by step and comment on findings.

1. **Loading graph data and creating the pheromone matrix:**
   First we load the graph data containing nodes connected by edges with their weights. Then we create a pheromone matrix as an adjacency matrix. Here we store the pheromone values for each edge. Initially, all pheromone values are set to a small constant value of 0.01. The exact number isn't that important. However, setting the initial value to a small constant is important it encourages exploration in the early stages and allows the algorithm to gradually go towards a good solution.
2. **Ant movement:**
   Here we simulate the movement of 10 ants from the start node (0) to the end node (29). Each ant moves randomly across nodes, randomly selecting a neighbor node until reaching the destination.
3. **Keep store of the ants path:**
   In this step we store the paths taken by the ants.
4. **Updating the Pheromone Matrix:**
   After each ant's traversal, the pheromone matrix is updated based on the path taken and its associated travel cost. Paths with lower costs results in a higher pheromone deposit.
5. **Visualization:**
   We visualize the graph where the edges are colored based on their pheromone values. Darker edges represent paths that were frequently taken or had lower costs.
6. **Comparing with shortest path:**
   We se that Dijkstra's algorithm determines the shortest path to be ['0', '4', '15', '22', '27', '29'] with a cost of approximately 0.0411. Comparing this with the paths taken by ants, it's evident that while the ants do not always find the absolute shortest path, their paths are influenced by the pheromone updates and tend to converge towards efficient routes.