Cs301 assigment 5

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Define the decision version of the optimization problem described above

Our problem is different version of Traveling Salesman Problem. We need to get the destination city with shortest itinerary from our source city. But we need to visit travel agency's suggested cities too. In example we want to go Kırıkkale from Ankara but there is a subset of cities comes from Kırıkkale in shortest time. Optimization problem is: Traveling from origin to destination city while visiting subset of the destination city in shortest time with only visiting cities once. Decision version of this can be as: Does starting from initial city travel to destination city from it's subset cities form under k (k is a integer we define to check) time?

Prove that this decision problem is NP-complete: Membership? Hardness?

Problem wants that one visit to every city and in shortest time which is simply TSP which is NP-Hard. To show that we can use Hamiltonian cycle which is NP-Complete then reduce to our problem. Assume G = (V, E) to be an instance of Hamiltonian cycle. This can be our initial city to next city. We choose one vertex to go to other city. This can be repeated for every stop. We choose the shortest paths as we create the road map. This way we create the neighbours in subset cities. After the path we reach the destination city. So it doesn't need to be Hamiltonian cycle. Then we can do this in polynomial time. It is NP-Hard.