

COL351 Holi2023: Tutorial Problem Set 12

1. The **SetBisection** problem is defined as follows. Given a set A of n integers, determine whether there exist a partition of A into two sets, say A_1 and A_2 such that the sum of numbers in A_1 equals the sum of numbers in A_2 . Prove that **SetBisection** is **NP-complete**.
2. Recall the travelling salesperson problem (TSP), where you are given an edge-weighted (complete) directed graph, and you wish to find a minimum weight Hamiltonian cycle in it. Define the *natural* decision problem associated with TSP and prove that it is **NP-complete**.
3. Consider the following bi-criteria version of the shortest path problem. A network of roads is represented by an undirected graph. You need drive your car from a city s to a city t . Each road (edge) e has two parameters: ℓ_e , the time taken to traverse e , and v_e , the volume of fuel consumed by your car to traverse e . You initially have a volume V of fuel and need to reach t from s in time at most L . The problem asks you to determine whether this is possible, given the numbers V , L , and (ℓ_e, v_e) for each edge e . Prove that this problem is **NP-complete**.
4. Consider another version of the assignment scheduling problem. You are given n assignments, where the i 'th assignment is specified by 3 parameters: r_i , its release date, t_i , the number of days needed to finish it, and d_i , its deadline. Needless to say, you cannot start an assignment before it is released and you cannot submit it after its deadline. You wish to determine whether it is possible to complete all assignments. Prove that this problem is **NP-complete**.