Homework #5

You should try to solve these problems by yourself. I recommend that you start early and get help in office hours if needed. If you find it helpful to discuss problems with other students, go for it. **The goal is to be ready for the in class quiz that will cover the same or similar problems.**

Problem 1: Coloring with Dijkstras

Each edge in a connected, unweighted graph G is colored either red or blue. Present an algorithm to compute a path between s and t that traverses the fewest number of red edges. Your algorithm should run in $O(V \log V + E)$. (**hint:** how can I choose to view colored edges?).

Problem 2: Multi-Source Shortest Paths

How do you compute shortest paths when the source is not a single vertex s, but instead a set S of vertices? More precisely, suppose you are given a weighted directed graph $G = (V, E, w)$ with non-negative edge weights, you are given a source set $S \subset V$, and you are given a single target node $t \epsilon V$. Your goal is to find the weight of the shortest path from some vertex $s \epsilon S$ to t. (In other words, among all choices $s \epsilon S$, you want to find the choice that results in the shortest shortest path from s to t.) Describe an efficient algorithm for computing this multi-source shortest path distance. Your algorithm should run in O(V log V + E).

Problem 3: Shuttle Routes

You are trying to move around NC A&T's campus using the shuttle system. Let's model the shuttle system as consisting of N different stations distributed across campus. From any given station you can take a direct (non-stop) trip to a subset of the other stations. The university's shuttle app gives you the average time that each of these T direct trips takes. Your goal is to find the fastest way to get from a given starting station s to a destination station d.

(a) Give an algorithm to determine fastest route.

(b) State and briefly justify the running time of your algorithm. Be sure to define any variables you use.