Recitation 3 (10/3 - 10/7)

Reminders -

- Your algorithm/proof idea should give a summary or overview of your algorithm/proof details. In other words, the grader should understand the premise of your solution without even having to look at your details.

    - Most common mistake in HW2 Q2 (homewrecker problem) - Proof idea saying "I will find a pattern and then generalize it to work for any n", or "I will show the existence of a homewrecker in the case of n=2 and then generalize it to work for any n". Both these ideas are inadequate because they don't describe *what* pattern you aim to leverage or *how* you will achieve this generalization to any n.

- Look at the requirements at the end of a question. Some questions only need proof idea/details, while some also need algo idea/details, big O/omega analysis etc. If you do not provide all required sections you're already losing some points

DFS/BFS overview -

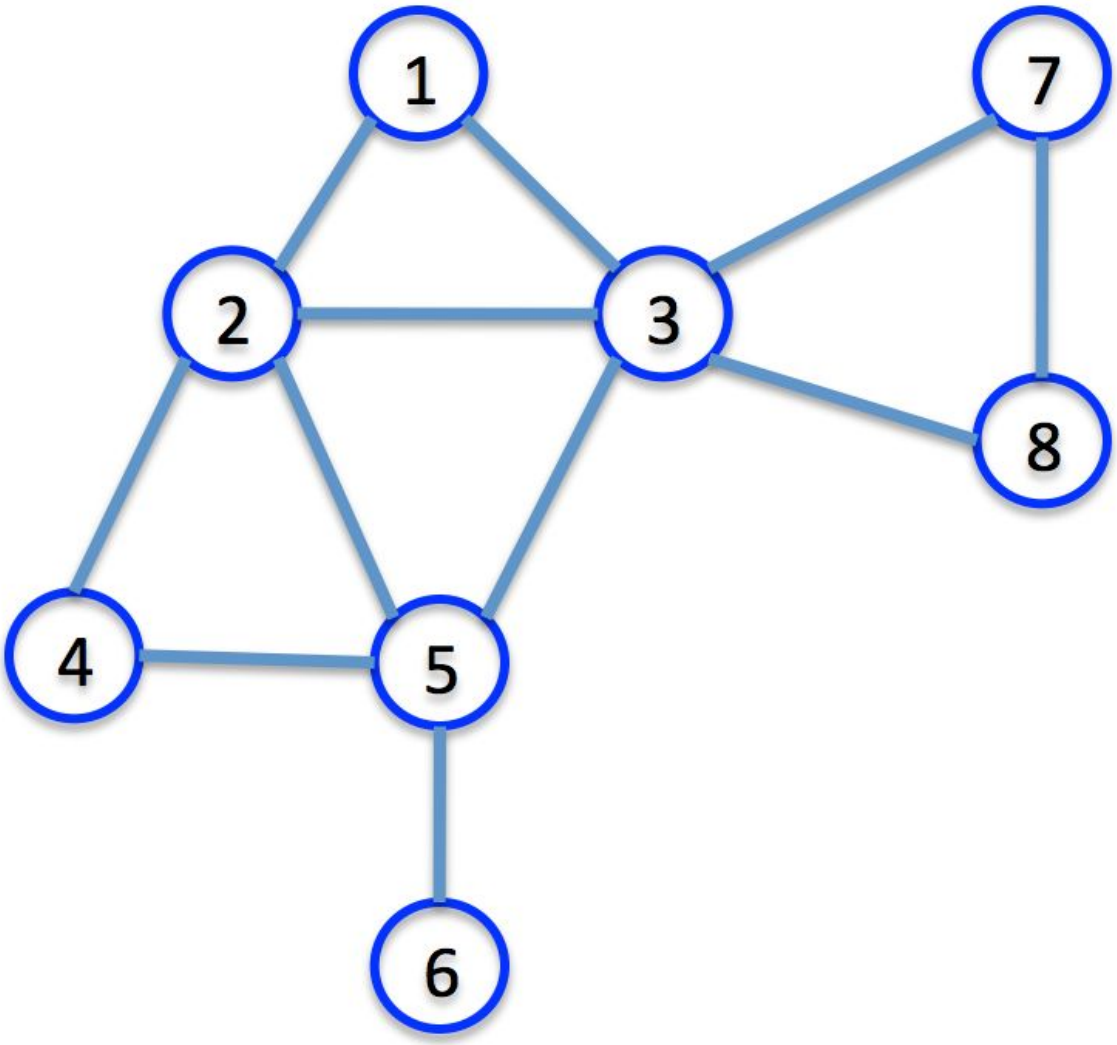
- Just give definitions for now (BFS explores nearest neighbors of node before moving on to the next set of neighbors, DFS fully explores a certain path as far as possible before backtracking). Take questions (if any), but make sure students understand the 2 algorithms before moving on to next step.
- Mention that DFS does not compute distance correctly. Eg. consider the following (undirected) graph
  $G=(\{A,B,C,D\},\{(A,B),(B,C),(C,D),(D,A)\})$G=({A,B,C,D},{(A,B),(B,C),(C,D),(D,A)}), i.e. this is a cycle with four nodes. To compute the distance from A to D, DFS would either output 1 or 3 depending on which path it takes first (and if we're looking for minimum distance, 3 would be the wrong answer).
  Mention that DFS *can* be modified to calculate distance, but it is not what it's made for.

Homework 4 Question 2 -

- Go over definitions of *admissible distance, distance compatible property* and *friendship distance* from the homework description. Go over example given in the homework description as well.
- Point out all the sections students have to provide answers for in the grading guidelines.

Homework 4 Question 3 -

- Review definition of BFS and DFS tree by showing the students the run of BFS/DFS on this graph - (start from node 1, and show them the BFS/DFS tree that is formed when you traverse the graph)



- Show BFS run on a triangle for an example when the BFS tree is unique, and on a 4-cycle (essentially a square) where the BFS tree is not unique.
- Show DFS run on a triangle for an example when the DFS tree is unique, and on a 4-cycle (essentially a square) where the DFS tree is not unique *if you fix the adjacency list*. Consider the same graph as in the overview -

  $G=(\{A,B,C,D\},\{(A,B),(B,C),(C,D),(D,A)\})$G=({A,B,C,D},{(A,B),(B,C),(C,D),(D,A)})

  If you start DFS from node A and fix B to appear before D in the adjacency list of A, then the DFS tree would be unique.
- For the Q, when we talk about uniqueness it is over all possible ordering in the adjacency lists.
- Take an example of 3 nodes connected together (like in a linked list). No matter which node you start from, the BFS/DFS tree are for this example are same and unique. The students' job in Q3 is if given a graph G and node r such that it has a tree T rooted at r which is the BFS *and* DFS tree, either prove that T is the only BFS tree *and* the only DFS tree for G, or prove this statement false with a counter-example.