CS3230: Assignment for Week 1

Due: Monday, 15th Aug 2022, 7 pm SGT.

Please upload a PDF file containing your solution (hand-written & scanned, or typed) by 15th Aug, 7 pm on Canvas. You may discuss the problems with your classmates, though you should write up your solutions on your own. Please note the names of your collaborators in your submission. You may want to refer to the plagiarism policy from Lecture 0.

1. Suppose that in an instance of the Stable Matching problem where a man m ranks a woman w as his first choice, and the woman w also ranks the man m as her first choice. Prove that in any stable matching, m and w will be matched.

2. In this problem, you will investigate what happens when participants cheat when reporting preferences to the Gale-Shapley algorithm.

   Consider the example discussed in lecture, where the men are Ashish, Bao, and Charlie, and the women are Xinyu, Yashoda, and Zuzu. Recall that Gale-Shapley results in the men-optimal stable matching: (Ashish, Xinyu), (Bao, Yashoda), (Charlie, Zuzu). Show that Xinyu can misreport her preferences so as to force Gale-Shapley to output the women-optimal stable matching: (Ashish, Yashoda), (Bao, Xinyu), (Charlie, Zuzu).

3. Read this article about how bias and unfairness can arise in algorithmic decisions. Write a paragraph summarizing the problem the article discusses.

   Optional: If you are interested in following up, try the assignment on "Criminal Justice" described here.