Day 1: Linear Algebra and Ranking Systems

Homework (due July 12th 11:00am)

1. Read through the GitHub notebook `Day1_IntroToPython.ipynb`. Familiarize yourself with Colab, GitHub and the general workflow for coding with Python. By the end you should be able to use Python to solve linear systems and interpret the corresponding results. There are some additional cells in the notebook that you can use to answer the following questions.

2. Consider the linear system below:

$$\begin{bmatrix} 1 & 2 & 5 \\ -1 & 3 & 7 \\ 0 & 5 & 12 \end{bmatrix} \vec{x} = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$$

   (a) Solve the system for $\vec{x}$ using Gauss-Jordan elimination. Make sure you show all your steps. How many solutions does it have?

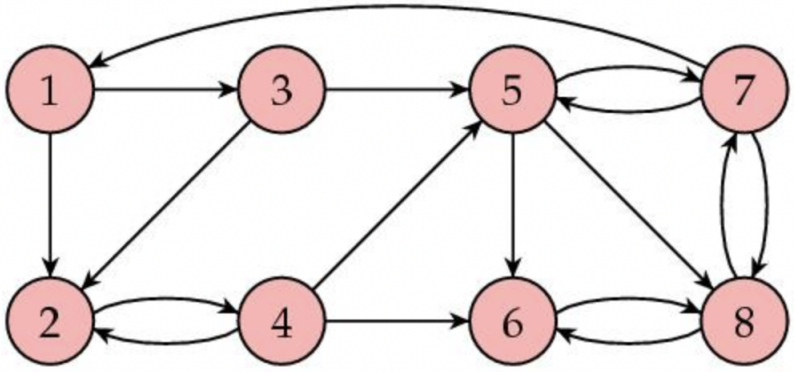
   (a) Check your answer by solving the system using computer aid. You don't need a computer for this example, but it is a good way to check that you can interpret the results appropriately.

3. Today in class we discussed the basics of Google's PageRank algorithm. The image below represents a network of eight websites. The arrows indicate links between different websites. For example, an arrow from vertex 1 to vertex 3 indicates that website 1 has a link to website 3.

   (a) Write the equations satisfied by the variables $x_1, \ldots, x_8$, denoting the importance of each site following PageRank's idea.

   (b) Write the corresponding system and associated matrix.

   (c) Rank the websites by solving the linear system in (a). You may use software to do so.



4. Read the handout `sports_rankings.pdf` that describes different methods to rank teams, and answer the corresponding questions.

5. (Optional: Real Data Problem. This problem doesn't have a due date, and it is submitted separately on Gradescope). Can you predict the winner of the next MLB world series? Read through the notebook `MLB_rankings.ipynb`.