MATH 214: INFORMATION ON FINAL GROUP PROJECT

1. Overview

The final project for Math 214 is a ten minute group presentation on an application of linear algebra. As Math 214 functions in part as a service course for upper level courses in CS, DS, IOE, and others, we encourage you to discuss some role that linear algebra plays in those subjects.

You may not replicate a **project** that you have done (or plan to do) for another course; rather, we want you to explore the linear algebra aspects more deeply and rigorously than you would in the other class. You **may** replicate the **topic**, provided you go more deeply into the math topics of this course than in the other class.

If you are unsure about choosing a topic, one approach is to raid the websites of upper-level courses you might take (or that a consensus of your group is interested in). Look though topics and projects discussed there.

After choosing a topic, your group will submit a preliminary proposal on Gradescope, due on Tuesday November 22. We will try to grade these rapidly and give some helpful feedback. On December 5th and 6th, your group will make a 10 minute presentation on your topic. Please prepare slides for this presentation; you will upload them later to Gradescope for grading. Most likely, the presentations will be scheduled during your sections meeting times for that Monday and Tuesday, but we may need to vary this plan. Finally, you will hand in a work summary of how the work was accomplished and by whom.

Unless special circumstances arise, all group members will receive the same grade on the project. The breakdown for this grade is as follows:

- Preliminary proposal: 10%
- Explanation of Application: 35%
- Explanation of Mathematics: 35%
- Visuals, etc., of presentation: 20%

The due dates are as follows:

- **Preliminary proposal due: Friday, November 22, 2022.**
- **Final presentations, Monday and Tuesday, December 5-6, 2022**

2. Preliminary Proposal

This should contain the following items, in the following order:

- One paragraph describing the area you wish to study.
- A list of team members, their major field of study/special interests and how their background is relevant to the project.

3. Suggested topics

The following topics, among many others, would be suitable for presentations.

(1) Image compression
(2) Image recognition
(3) Techniques for fast matrix multiplication.
(4) Fitting statistical models
(5) Analyzing stability of mechanical systems
(6) Data clustering
(7) Fourier analysis (to analyze sound signals, time-shifts in data, and much more)
(8) Expander graphs – their applications and the linear algebra behind their definition
(9) Computer graphics
(10) Computer vision
(11) The mathematics of MRI
(12) The mathematics of x-ray crystallography (you can treat the physics as a black box)
(13) Principal component analysis
(14) Instability of Gaussian elimination
(15) Eigenvalues and stability/oscillation of mechanical systems
(16) Eigenvalues and population dynamics
(17) Uses of linear algebra in solving differential equations
(18) Linear algebra in numerical solution of partial differential equations
(19) Quaternions and three dimensional rotations
(20) Linear algebra in the analysis of demography
(21) Spectral clustering in network analysis