The goal of this project is for you to read (and understand!) a paper on an advanced topic in matrix methods, apply the methods described in the paper to a specific example of interest to you, and prepare a report describing what you have learned. Several potential topics for you to choose from are available in the Projects section of the course webpage (but you may choose any topic you like, whether listed on the webpage or not).

The project will have two milestones. The first is a project proposal, due in class on Friday, October 30th. The project proposal should be no more than two pages long and describe the topic and application that you have chosen to investigate. The second milestone is the final report, between five and ten pages long, due in class on Friday, December 11th. Your report should be written in a manner similar to a research paper. It should be typewritten, although lengthy derivations can be handwritten and included in an appendix. You should identify at least one specific question/problem and the goal of the report should be to answer that question.

Your report should have the following sections:

**Abstract**: A short (1-2 paragraphs) summary of your topic, application, and results. After reading your abstract, the reader should have a good idea of the topic of your report and what you accomplished.

**Introduction**: This section serves to introduce your topic and application and provide any background information. Provide all necessary definitions and concepts for the reader to understand the question that you are investigating. State explicitly what you are planning to do in the upcoming sections of the report.

**Mathematical Formulation**: This section serves to introduce your application of interest and to develop the mathematical tools that you will use to investigate your problem. All mathematical symbols that you use should be defined/identified here. Any assumptions or approximations that you use to simplify your model problem should be clearly stated in this section.

**Examples and Numerical Results (if Appropriate)**: This section describes your algorithms and/or numerical work and/or examples. A descriptive summary of your code and results can be included here. You can put any (well commented!) code that you write in an appendix. Graphs and/or tables with data that you used should be included here.

**Discussion and Conclusions**: What did you discover? Was it what you expected? How can you use your results? What do they tell you about the original question that you set out to investigate? Is there any pertinent future work that should be done, i.e. how could/would you continue to further your understanding of the topic?

**References**: All books, websites, articles that you used in the preparation of your report should be documented in this section. Note that if you don’t properly document your referenced work and attribute results that you used to proper sources then your work is plagiarism.

Some additional requirements/guidelines:

- You must work in groups of **two or three**. You are permitted to form groups with students in the other lecture (clearly indicate on your report which lecture each group member belongs to). Each group needs to turn in only one copy of the project.
• You don’t need a cover page. Just put a title, date, and the names and lectures of each group member at the top.

• Give complete definitions of all terms and symbols used.

• Writing style, clarity, and completeness of explanations is important.

• Numerical experiments and/or examples are important.

• Figures, graphs, and tables should have labels, captions, legends, etc., as appropriate. You should discuss each figure specifically in the text. Don’t make us try to guess what your results are saying. It’s your job to explain them!

• In general, code and lengthy derivations should be included in appendices, and figures/graphs/tables should be in the text where they are first discussed.

• The report should be at least five and no more than ten pages long (not including appendices). Slightly longer reports are acceptable if you have lots of interesting pictures. Check with your professor.

• If you are having trouble coming up with an application, please talk to your professor as soon as possible.