Project – 100 points total

This research project is intended to be **several months in preparation**. 6110 students will complete individual projects. 5110 students may work in groups of one, two or, three.   Students who wait until the final weeks to make significant progress will not succeed. In this project, you will improve your skills in reading current research, identifying directions for future research, and limiting the focus of your project to something that is small enough to be doable but large enough to be challenging. The difference between 5110 and 6110 is in the research quality of the project. CS6110 students are expected to pick a topic which is suitable for publication (if one were to add several more months of work).

Components

1. Peer evaluation of proposal and project (15 points).
2. Proposal (15 points): Two page problem introduction (with references).
3. Experimental Results (70 points): This consists of two parts. The code and the write-up.   The write-ups will consist of the introduction to the problem, a description of your experiment, and the results. For a one person project, the write-up should be five pages (1 inch margins, 11 point font, single spaced). Each additional person on the project should add another two pages.

Introduction to Project

Select a research article of your choosing. Some good choices are in the section "Research Topics" available from the "Files" tab on canvas. More than one person can select the same article.   Selecting the area is probably the most important part of the project. If you can find something you have some ideas about, the rest will be much easier. Doing research is tough. Start early. Give yourself plenty of time to understand the article you select. Give yourself time to study, search, and gain insight.

Proposal (Due March 9th)

The research proposal should be written well enough to be used as the problem statement your final paper.

The main article you have selected will have several other papers in refers to. That is a great place to start reading.   You will need to cite at least three papers in your project. At least two papers you cite must be published within the last five years. (You may read MANY more papers in deciding what is useful.)

Experiment Writeup (Due April 21st) [40 points]

Information about writing standards and expectations is found on our website. Read it! You will write up your experiment in a form containing the following sections:

- **Introduction:** A description of the problem and its importance.
- **Previous work:** A brief history of what others have done to solve the same problem you are trying to solve. Use citations to give credit. Do not copy text or figures from other sources.
- **My contribution:** Identify what is new or novel about what you are doing.
- **Experimental Design**: Unless you have gotten approval to do a purely theoretical paper, you are to have implemented something that will aid researchers in understanding the problem or judging the approach.
- **Results:** The results of your experiment. If you have been unable to get any results, identify how the implementation will be used (in the future) as a basis for interesting results.
- **Future work**: What you would do to turn this paper into a publishable paper.

Clearly identify the original parts of the research project. While it is not expected that you will have a publishable paper, you should have some original ideas. You should have explored the ideas well enough (through reading and implementation) that you are reasonably certain they are worth pursuing. I am hopeful that a few of you will actually use this paper as a springboard to an actual research project.

Implementation (Due April 21st) [30 points]

Submit the code you have produced. Include a readme document which outlines:

- The objective of the code
- How to run the code
- Ten minute video clip showing the results and explaining the importance of the output to your project.

How to Do Research

1. Reading research papers is hard work. They were not written for students, but for those who already experts in the field. Be prepared to carefully select the papers on which you base your research.
2. Be efficient. There will be lots of articles to pick from. Read the abstract and conclusion first to determine if the paper is one you want to read.
3. Plan on reading most things only once. Really detailed material will require you to go back and reread it (perhaps several times), but lots of things can be summarized fairly well with one reading. If you have a paper copy of the article, highlighting key phrases is helpful. If you have an electronic copy of the paper, creating a file of notes for each paper (giving complete reference, basic ideas, and your reaction to them) can save a lot of time. Summarize as you read. Write down the strengths and weaknesses of each paper after you read it. Also, jot down ideas that you have for improving upon the work.
4. What makes a good topic? I would go for something that is interesting to you. Other criteria are: understandable (something you have the background to read),

easy to find material, lends itself to implementation, something you have your own ideas about.

5. Have a plan. Ask yourself, "How would I demonstrate to others that my ideas are valid? If I could show these results, why would anyone care?" Pick an area that is important for some reason. Tweak what has already been done to create something original. Design tests to validate your ideas.

Project Report

1. Your report should answer the questions: Why is the problem important? What has been done previously? What is my solution? What are my original contributions? What are my results?
2. Organize your report using subheadings. Include the following sections: Introduction, Previous work, My contribution, Experimental Design, Results, Future Work.
3. Have a major point to your paper. Just like a good mystery leaves clues throughout the book, your paper should constantly gives clues as to where you are going and why the subtopic is important to the goals of the paper. Don't just present a concept or a result and assume the reader understands the importance. Clearly state what you believe to be true.
4. Present the concepts in a logical manner so that it can be comprehended by someone who has not studied the papers for two months.
5. Have at least two important references with recent publication dates. Not everything you find in print has the same value. You need articles that appear in peer-reviewed publications (of the type found on IEEE or ACM digital libraries) rather than articles in trade magazines.
6. Give credit for ideas by referencing the cited work. See a major CS journal for an illustration of how this is done.
7. Use common terminology. Don't make up new terms for common ideas. If the various papers are inconsistent in terminology, you must decide which terminology you will use throughout the paper. The reader is more concerned that you are consistent within your paper than that you use the notation used by the original author.

How to Find Articles

1. The ACM digital library is an excellent, searchable source of peer-reviewed articles. USU libraries has paid for the service so that you can access it without paying. Here is the link to ACM digital library from the USU library website . USU students have free access to the ACM digital library.
2. The IEEE digital library is also an excellent, searchable source of peer-reviewed articles (free to USU students).   Anyone can use the search facilities without paying the fees - and then look up the articles from the paper copies in the library.

3. If you know the names of the key researchers in the area, you can do a google search to locate their homepages. Often their recent publications are listed. If they don't have links to the copies of the paper, you can email them and ask for a copy. (Obviously you would only do this for journals not carried by the library.)
4. Once you find one article you like, look for more references at the end of that article.