

MATH 3411 (Ng/Fall 2024)
Course Project
 September 9, 2024
Written Report: Due by noon via email on November 27, 2024.

The purpose of this project assignment is for MATH 3411 students to be familiar with a variety of applications of the modeling and analysis approaches we study in the course.

Your main goal is to discuss an application of **discrete or combinatorial mathematics** or of any one of the specific topics covered in class this semester. (Look ahead in the syllabus for the topics). The application can be in **any fields or areas of your interest**. You are required to write a report **and** give an oral presentation on this topic.

First, you need to decide on a particular topic or application of Discrete & Combinatorial Math that you would like to discuss. I suggest that you look ahead in the syllabus for upcoming topics as well as browse through any books related to discrete mathematics, combinatorial mathematics or combinatorics, graph theory, applications of discrete math in electronics, or discrete structures in computer science in the **Briggs** library. You may also choose a topic from the list at the end of this handout.

You **must** have your topic selected by **September 16**.

To avoid duplication of projects on the same topic, I need to know and approve what you are planning to do by that date. Thus, the earlier you let me know, the better your chance is to get what you prefer.

Your Project's Grade: Your project consists of five parts, and in the following stages:

Stage 1 please give me a draft of your report by **November 4** - 5 points

Stage 2 please schedule a (\approx 40 min) meeting with me on zoom or in person for the purpose of discussing my written and oral feedback on your draft. You need to do this during Nov 12-14 - 5 points points.

Stage 3 a final written report due Nov 27 - 40 points

Stage 4 an oral presentation in class during the last week/day of class in the semester - 40 points

Stage 5 - an **individually** written one page summary of what you have learned through doing this course project from the initial stage to the final products (written report and oral presentation). What worked well for you in doing this project, and what could use some improvement in doing this project?

What worked well for you in doing this project, and what could use some improvement in your project or paper? In other words, do some self-reflection on what you have accomplished for the course project. Give this to me by the end of the last class day - 10 points

Your Written Report: The purpose of this written report is to give you the opportunity to learn how to communicate, in written form, your mathematical ideas to readers who may or may not be experts in discrete mathematics.

You will be graded on neatness and organization of your written presentation, as well as for the contents especially on the quality of the (discrete) mathematical level in the project.

Your report **MUST** have the following outline structure with **sections and subsections numbered and titled** (with your choice of the titles). (Otherwise, you will lose most credits for organization.)

- Introduction. Description of the problem, including some motivation as to why the problem is worth looking at (according to you or others).
- Appropriate heading related to your topic. Discuss connections between the project and the contents of the course.
- The approach to solving the problem.
- Results and analysis.
- Conclusions.
- Bibliography or references.

Format: Your report should consist of several (≈ 10) neat pages, with text typed and double-spaced. You may hand write mathematical formulations, tables and figures if they are neat. (Note: the 10–pages is just a guideline for you; I value **quality** more than **quantity**. At the same time, **too few pages** is **not** enough to effectively communicate, in an in-depth manner, about what you have done.)

If you wish to retain a copy of your report, make one before you turn it in. All reports become part of the Math Discipline's annual assessment portfolio, and only a "Scoring and Comments" sheet will be returned.

Bibliography or references **must** be used and they can be in any format as long as they are well-documented with authors, dates and the source. (WWW URLs are **NOT** sufficient.)

Oral Presentation: You will be responsible for preparing a 15 ± 1 minutes talk in class about your project. This talk is intended to give you a chance to present some **complicated** ideas in such a way that your audience (who may or may not be knowledgeable in this area) will at least be able to grasp the **big picture** of the topic you worked on.

Your oral presentation should be prepared with the following attributes and outline in mind:

- Introduction
- Description of Problem/Project
- Substance & quality of (discrete) mathematics level used, and connections between the project and the contents of the course.
- Organization & Clarity
- Enthusiasm
- Communication

Examples of Possible Topics:

1. Tour of UMM campus via shortest routes
2. A Traveling Salesman Problem for the 48 contiguous states of USA and a dynamic insertion algorithm to solve it.
3. Designing efficient snow plow routes via euler tours
4. Boolean Algebra in Electronic Circuits
5. Ramsey Theory
6. Discrete Dynamical Modeling
7. Efficiency of Bus Routes for Schools
8. Evacuation of the Student Center at UMM: an application of maximum flow.
9. Finding convex hull of a set of points.
10. Finding the shortest route from Minneapolis to Los Angeles and the best tour routes in a few intermediate cities.
11. Vertex Coloring: The Four Color Theorem & Class Scheduling Problem.
12. Predator-Prey Problem: a Discrete Time Model.
13. Card Counting, Games, Gambling, and Counting Process
14. Applications of combinatorics in molecular chemistry and genetics
15. etc....