

MATH220: Discrete Structures

Spring 2024

Final Project: Discrete Mathematics “In the Wild”

Assignment is DUE as indicated on the course schedule.

*This is a **group assignment**. Work with 2-3 classmates, and submit as a group on Gradescope. **Individual assignments will not be accepted unless prior approval is obtained.***

Overview

For your final project you will use a topic covered in this class to explain or investigate a real-world phenomenon. For example, think about the stamp problem we looked at for introducing induction. The Towers of Hanoi game we used to understand recursion. Real world scenarios we can model with sets and graphs (like networks of people). Examples of sequences, like the Fibonacci sequence, showing up in nature. Etc.. You can choose any discrete and real-world topics that are of interest to you, as long as you pick something original, creative, and interesting.

This project will be a large portion of your final grade, and is broken up into milestones, described below. Be sure to submit each milestone on time and to put your best effort into all pieces. Your final grade will be based on your grades for all milestones.

All milestones must be well formatted and readable. Text must be proofread, use good grammar, and communicate clearly.

Milestone 1: Proposal – 20 points

For your project proposal you will identify your project group, a plan for working together, your topic of interest, and potential roadblocks. Type up a document that answers the following questions. Your document should be 1 – 2 pages long and well formatted. **Submit as a group on Gradescope before class on the proposal due date.** Your proposal will be reviewed in class so that you get quick feedback.

1. Group
 - a. With whom do you plan to work? Groups must be 2 – 3 members (you must speak with me if you would like to work with a different size group).
 - b. Talk about your schedules. Detail a plan for coordinating your work throughout the project.
2. Topic
 - a. Which discrete topic(s) will you work with?
 - b. What real world topic(s) are you interested in working with?
 - c. What makes your real-world topic interesting/important to understand?
3. Building Blocks
 - a. How will you model your real-world phenomenon with discrete math?
 - b. What makes your project topic creative?
 - c. Your project must demonstrate a deep understanding of the discrete topic(s) you chose – how do you intend to do this? In other words, you cannot rely solely on definitions, you must dig a little deeper or look at something in a creative new way.
 - d. You will ultimately give a presentation on your work, what ideas do you have for making that presentation interactive for the audience?
4. Roadblocks
 - a. What roadblocks do you anticipate as you complete your project?
 - b. Detail your plan for dealing with these roadblocks. How will you overcome them, or if you cannot, how will you modify your project?

Points will be awarded for answering each question above fully (each question is 2 points, 0 points will be awarded for missing or nonsensical answers, 1 point for partial answers, and 2 points for complete and correct answers).

Milestone 2: Check-in – 20 points

Your check-in will focus on making substantial progress on your project. **The work you submit is not expected to be complete**; it is expected to show that you have made significant progress towards completing your project.

1. In-progress work
 - a. Submit the math and brainstorming you have so far; it does not need to be perfect but should be readable and well documented.
 - b. Roughly half to two-thirds of your project should be completed at this point.
2. Revised plans
 - a. Have you run into any roadblocks that significantly changed your project plan? Briefly explain what happened and how you adapted.

In-progress work will be awarded up to 15 points as follows:

	Missing / Not Complete (0)	Approaching (1-9)	Meets (10-14)	Exceeds (15)
Work	No work is included in the assignment, or the work included is unreadable.	Work is not clear, concise, and understandable; improvements could be made. Some conceptual issues are present.	Work is clear, concise, and understandable, but improvements could be made. No major conceptual issues are present, but minor corrections need to be made.	Work is clear, concise, and easy to understand. No major conceptual issues are present in it.

Revised plans will be awarded up to 5 points as follows:

	Missing / Not Complete (0)	Approaching (2)	Meets (4)	Exceeds (5)
Plans	No explanations included, or most are incorrect or missing.	Text demonstrates some conceptual understanding of discrete topics, but multiple details are incorrect.	Text demonstrates a conceptual understanding of discrete topics, but one or a few details are incorrect.	Text demonstrates a deep conceptual understanding of discrete topics. All explanations are accurate.

Milestone 4: Final Report and Presentation – 20 points

Your final milestone includes all the final deliverables for your project. Your submissions should be well formatted, proofread, and clear. **Submit on as a group Gradescope before class on the day presentations begin. No late submissions will be accepted. There will be no exceptions to this rule.** You will submit a final report, and give a presentation to the class.

1. Your **final report** should include:
 - a. Text that is well formatted.
 - b. Text that is proofread.
 - c. An introduction to your project with your discrete and real-world topics and a brief explanation of why the ones you chose are interesting and important.
 - d. An overview of the discrete topics you chose. Define them and provide high-level background information on them.
 - e. An overview of the real-world topic you chose. Explain what the topic is and why it is interesting.
 - f. An explanation of how you modeled your real-world topic using discrete. Walk the reader through your reasoning and findings in detail.
 - g. A conclusion. Sum up what you learned from your project.
 - h. Future work. If you were to do this project again, what would you change? Or if you were to build on this project what would you add?
 - i. Include citations for any sources referenced.
2. Your **presentation** should include:
 - a. Appropriate visual aids.
 - b. Clear speaking.
 - c. An introduction to your project with your discrete and real-world topics and a brief explanation of why the ones you chose are interesting and important.
 - d. A brief overview of the discrete topics you chose. Define them and provide high-level background information on them.
 - e. A brief overview of the real-world topic you chose. Explain what the topic is and why it is interesting.
 - f. An explanation of how you modeled your real-world topic using discrete. Walk the reader through your reasoning and findings in detail.
 - g. An interactive component to get the audience involved. Be creative, how can you engage your classmates in the work you did here?
 - h. A conclusion. Sum up what you learned from your project.

- i. Future work. If you were to do this project again, what would you change? Or if you were to build on this project, what would you add?
- j. Contributions from all group members (each person must talk).
- k. Time for Q&A. [In total, your presentation should be ~15 minutes.]

Points will be awarded for addressing each bullet point above fully (each question is 1 point, 0 points will be awarded for missing or nonsensical work, 1 point for complete and correct work).

Reflection

Your reflection is an individual portion of the project that you will submit on Gradescope individually. The purpose is to reflect on your own work, and how your group worked together.

Write a few short paragraphs that address these points:

1. Your specific contributions to the project.
2. Your teammates' specific contributions to the project.
3. Whether you navigated any conflict or discrepancy in workloads with your teammates.
4. How you navigated those conflicts or redistributed work.

You will not receive points for your reflection; however answers may be used to adjust individual's project grades if the distribution of work was not even.