

Project

Background:

In this course, you will become a network scientist through your own research project. You may work on this project individually or with a partner. If you work with a partner, I expect that the project will be larger in scope. The major requirements of the project are that 1) The project must be in Network Science; and 2) The project must have a computational aspect - done in Julia.

Components:

0. Survey on Project Interests – due Saturday 9/19 at 11:59pm central time
1. Project Proposal – due Saturday 9/26 at 11:59pm central time
2. Presentation – during week of 10/12
3. Final Report & Code – due 10/21 at 5:00pm central time

Learning Outcomes:

Completion of this assignment will show growth towards executing Learning outcomes 1, 3, 4, 5, 6, and 8 from the syllabus. Completion of this assignment will demonstrate the ability to...

(#1) develop an experiment, model, or algorithm which expands upon fundamental Network Science techniques learned in the course.

(#3) gather, interpret, and evaluate evidence, and incorporate it into writing.

(#4) describe an advanced Network Science topic to your peers.

(#5) compose novel code in Julia for the purpose of network or matrix computations.

(#6) solve problems in the domain of network science.

(#8) prioritize time effectively to meet individual, team, and course goals.

Resources

- Schedule an appointment with the [writing lab](http://grinnell.edu/academics/centers-programs-and-resources/writing-lab) (grinnell.edu/academics/centers-programs-and-resources/writing-lab)
- [The Grinnell Guide to Writing, Research, and Speaking](#) (on GrinnellShare)
- [APA style guide](http://apastyle.apa.org/style-grammar-guidelines/references/examples) (apastyle.apa.org/style-grammar-guidelines/references/examples)
- [Grinnell Library](http://libweb.grinnell.edu/sp/subjects/CSC) (libweb.grinnell.edu/sp/subjects/CSC)

Choosing a project:

Choose a topic for your project that interests you. Below I list a few ideas which should be taken for inspiration, and need to be fleshed out. Only one person/group may work on a given topic. You are also highly encouraged to develop your own ideas based on things you've seen this semester. You should send me your project topic idea via email *before the proposal deadline* – I will check for scope and that no other group has claimed the idea.

Idea 1: A comparison of a particular model on real-world data while varying the properties of the data (e.g., size), the task (e.g., linkage between training and test set), and/or model parameters (e.g., number of clusters). Links to publicly available data can be provided.

Idea 2: Reproduce the results of a paper in the field of Network Science. In addition to the papers we read this semester, here are some more ideas:

- *Cascading extinctions and community collapse in model food webs*, by Jennifer A. Dunne and Richard J. Williams
- *The Power of Pivoting for Exact Clique Counting*, by Shweta Jain and C. Seshadhri
- *Higher-Order Label Homogeneity and Spreading in Graphs*, by Dhivya Eswaran, Srijan Kumar, and Christos Faloutsos

Idea 3: Extend a Network Model to handle a novel analysis task, such as:

- Find communities in evolving network data
- Incorporate attribute information in dynamic models
- Link prediction in partially observed networks
- Analysis of graphs from multiple data sources

Idea 4: (For a heavier mathematical project) Dive into different matrix factorization (also called matrix decomposition) algorithms. We used the LU factorization, without understanding how it works. In addition to LU you could look into QR, SVD, and Cholesky. In addition to understanding how they work, explore the applications in which they are used, and implement 2 or more of the algorithms in Julia.

Idea 5: Investigate the spread of COVID-19 on a graph model. I'm imagining nodes in the network are *people*, and links connect people if they interact in real life. (Note: This project would probably be more work for the literature review – there is currently a **ton** of unpublished research on this topic.)

Idea 6: Investigate *agent-based modeling*, and create a simulation for the spread of COVID-19 in a particular environment - e.g. a school, airport, etc. (Note: This project would probably be more work for the literature review – there is currently a **ton** of unpublished research on this topic.)

Part 1: Proposal**Due:** Saturday 9/12, 11:59pm Central Time**Submission:** Pweb, in PDF form**Format:**

Your project proposal should be typed using LaTeX, and submitted in Pweb as a PDF. Your proposal should include an overview of the topic/idea you are working on, the specific goal of the project, and a literature review.

There is no specific length requirement for the proposal, however, you may want to aim for 3-5 pages (to help with the final project submission).

The form of the literature review should be similar to an annotated bibliography. Each reference should include a 1-2 paragraph description of the results of the source, and the relevance to your project. You should have at least 10 references in your literature review.

Grading Rubric:

I may test your proposal in a plagiarism tool. Plagiarized work renders this rubric null. Please ask for help if you have any doubt about what is considered plagiarism.

	Exceptional	Effective	Developing
Focus, Purpose	Engaging and full development of a clear project idea, appropriate to the assignment.	Project topic is an appropriate choice, though may be lacking in development.	Project topic is not relevant to the assignment; missing a computational component or a link to network science.
Structure, Organization	Organization is sequential and appropriate to the assignment; paragraphs are well developed and appropriately divided; ideas linked with smooth and effective transitions.	Competent organization, without sophistication. Competent paragraph structure.	Organization, while attempted was unsuccessful. Paragraphs are simple, disconnected, and formulaic. No planned sequence.
Mechanics	Virtually free of punctuation, spelling, capitalization errors; appropriate format.	Contains only occasional punctuation or other errors.	Contains many errors. Errors interfere with meaning in some places.
Annotated Bibliography	Quality sources are used, explanation of value for your argument	Explanation of the value of the source may be insufficient.	Sources are not quality, explanation of the value is missing.

Part 2: Presentation**Due:** week of 10/5**Submission:** During synchronous sessions.**Format:**

Your presentation should be approximately 10 minutes in length. Most presentations will use PowerPoint (or equivalent) to facilitate the presentation, however other formats of presentations are allowed. Your presentation should include: The names of the members of the group; The goal/topic of the project; Key difficulties during the project; The (perhaps initial) results of your project.

If your project is done in a group of 2, the students will co-present.

If there are technical difficulties during the week of the presentation, we will make other arrangements so that you can fulfil this requirement of the project. You should talk with me as soon as possible if you think this might be the case.

Grading Rubric:

	Exceptional	Effective	Developing
Content	Presentation contains all required elements, and is 9 to 11 minutes in length; Extra content is included which is helpful for context.	One element is missing, or superfluous information is included.	Presentation is not the appropriate length, or missing major components.
Structure, Organization	Organization is sequential and easy to follow; ideas linked with smooth and effective transitions.	Competent organization, without sophistication.	Organization, while attempted was unsuccessful. No planned sequence. Partners may appear to not be "on the same page"
Elocution	Student uses a clear voice, loud enough for all audience members to hear throughout the full presentation.	Student often speaks clearly, but at times cannot be understood.	Student mumbles, incorrectly pronounces terms, or speaks too softly.

Part 3: Final Report & Code**Due:** Wednesday 10/14 at 5:00pm Central Time**Submission:** Pweb, report in PDF form and code in a .jl file**Format:**

Your report should be typed in LaTeX, submitted in a PDF format, and 6-12 pages in length. Much of your report can and should build upon your proposal. You did all that work – use it! Any feedback you received on the project proposal should be addressed in this final submission. The audience of your report is a peer in network science, who has never heard of the project you are working on.

Your code should be included in a separate .jl file. Your code should be well documented. To ensure that your documentation is sufficient, use the 6P's. Code should be complete, meaning you should include anything that you used for experiments or figures. Code should be cleaned and organized so it is easier for an outsider to read.

An outline of your report could be of the form:

- 1 – Introduction: Explain the context of the problem you are considering, and why this problem is interesting.
- 2 – Previous Work: Incorporate all of the sources you found for your annotated bibliography. This should be an as complete as possible overview of the state of this work in the past.
- 3 – Methods: An explanation of the things that you tried. If you did experiments, this should carefully explain the details and parameters of those experiments. If you made theoretical attempts, explain the details. As the reader, I will be constantly asking “Why did the author make those choices?”, so keep that in mind in your writing.
- 4 – Results: Explain the conclusion from your work, discuss whether or not you answered your initial research question. If not, discuss the difficulties. Address any limitations to your work, and any potential biases you brought to the project. Figures should be used sparingly, to help the reader in understanding (not to fill a page requirement).
- 5 – Future Work: If you were to continue working on this project, what would be the next things that you would try? Do you have new revised goals for the project?

Grading Rubric:

I may test your report in a plagiarism tool. Plagiarized work renders this rubric null. Please ask for help if you have any doubt about what is considered plagiarism.

	Exceptional	Effective	Developing
Structure, Organization	Organization is sequential and appropriate to the assignment; paragraphs are well developed and appropriately divided;	Competent organization, without sophistication. Competent paragraph structure.	Organization, while attempted was unsuccessful. Paragraphs are simple, disconnected, and formulaic. No planned sequence.

ideas linked with smooth
and effective transitions.

Mechanics	Virtually free of punctuation, spelling, capitalization errors; appropriate format.	Contains only occasional punctuation or other errors.	Contains many errors. Errors interfere with meaning in some places.
Ideas, Support, Development	The content of the report is complete and thorough; ideas work together as a unified whole; main points are sufficiently supported (with evidence); support is valid and specific.	The content leaves the reader with unanswered questions, in one or more sections of the report. Ideas are supported sufficiently; support is sound, valid, and logical.	Many questions left unanswered; Insufficient, non-specific, and/or irrelevant support.
Code	Julia code is sophisticated, concise, well organized and well documented. The results of the report are easily replicated by the code.	Julia code is complete, but may be lacking details needed for clarity, or may feel disorganized.	Julia code is incomplete or undocumented.