

# Mid-Semester Project

Math 242

due Monday, April 8

Use Mathematica to investigate some mathematical questions. Your project must focus on one or more questions that can be answered (at least partially) by computational investigation.

The following list contains some ideas and links to papers that may provide inspiration for your project. You might choose questions or conjectures from one of these of papers. Or, you might find a theorem in one of these papers that you could try to modify or generalize, producing questions that you could investigate computationally. Don't be limited by this list — feel free to come up with your own idea!

- [Finite Sums of the Alcuin Numbers](#)
- [Conway's Subprime Fibonacci Sequences](#)
- [Double Fun with Double Factorials](#)
- [Prime Number Races](#)
- [PSLQ: An Algorithm to Discover Integer Relations](#)
- [Proof Without Words: Limit of a Recursive Root Mean Square](#)
- [A Spigot Algorithm for the Digits of Pi](#)
- [On an Intriguing Integral and Some Series Related to  \$\zeta\(4\)\$](#)
- Use computation to solve some [Putnam problems](#). For example, Problem B4 from the 2016 Putnam is a great choice for computational investigation, as is Problem B1 from the 2002 Putnam, as well as many others.

You may work with a partner, if you so desire. The professor wants to know your intended topic by Wednesday, April 3.

As usual, your Mathematica notebook should indicate not only what you computed, but also how well you understand what you did. A list of calculations with no reasoning will not suffice. Your goal should be to communicate your work to another person (e.g., another student at your level who is not in this course).

Only submit code that actually runs. If you can't get something complicated to work, try something simpler. It's better to turn in an incomplete assignment that runs instead of a "complete" assignment that doesn't run.

Your notebook will be graded on a scale of 0 to 16 points. The following rubric gives characteristics of notebooks that will merit sample point totals. (Interpolate the following for point totals that are not divisible by 4.)

- 16 points.** Questions and goals are clearly stated, including relevant definitions or parameters. Computations are complete; code runs and is clearly explained. Conclusions are clearly stated and backed up by sufficient computational evidence. Limitations of the methodology, extensions for future work, and conjectures are discussed. Notebook is well-formatted and easy to read.
- 12 points.** Questions and goals are stated well, though relevant definitions or parameters may be missing. Computations are mostly complete; code runs, but explanation is weak. Conclusions are unclear or not well justified. Insufficient discussion of limitations, extensions, and conjectures.
- 8 points.** Statement of questions or goals is unclear. Computations are incomplete; explanation is ambiguous. Code may produce errors when run. Conclusions are possibly correct, but not justified. Little or no discussion of limitations, extensions, or conjectures. Notebook is difficult to read.
- 4 points.** Serious misunderstanding of the questions or goals. Computation is inadequate for the task at hand. Work is not clearly explained. No discussion of limitations, extensions, or conjectures. Notebook is difficult to read.
- 0 points.** Notebook is not turned in.