Extra Credit Project

Math 242

due Monday, April 6

Investigate one of the following mathematical topics. Each topic is a link to a math paper, which explains the topic and serves as a starting point for computational investigation.

- Prime Number Races: Choose a large number N. Of all primes less than N, are there more that are congruent to 1 (mod 4) or to 3 (mod 4)? Does this depend on your choice of N? What can you say about the counts of primes if you reduce modulo m instead of 4? You may also choose some other ideas from the paper to investigate for yourself.
- Conway's Subprime Fibonacci Sequences: What cycles occur in the *subprime Fibonacci sequences* defined in this paper? What patterns do you notice among the even and odd terms of these sequences? What other questions do you find to investigate regarding subprime Fibonacci sequences?
- Double Fun with Double Factorials: This paper defines *double factorials* and *multi-factorials*. Can you verify some of the identities and theorems about these factorials? How do double factorials relate to continuous functions? Also investigate some other questions that the paper prompts you to think about.
- A Spigot Algorithm for the Digits of Pi: Implement the spigot algorithm for π, as described in this paper, and explain why it works. How does this algorithm compare with the other algorithms for approximating π that we have implemented? What questions does this paper prompt you to consider?

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).

This project will be worth up to 16 points of extra credit, to be added onto your project grade. The more computational investigation you do, the more points you could receive.

As you write your notebook, remember to do the following:

- Clearly state questions and goals, including relevant definitions and parameters.
- Make sure your code runs and is clearly explained.
- Draw conclusions supported by computational evidence.
- Discuss conjectures based on your investigation, limitations of your methodology, and possible extensions for future work.
- Make sure your notebook is well-formatted and easy to read.