

Final Project Requirements

Ultimately, I want you to produce a 12 page paper and give a 25 minute long presentation which covers a topic related to discrete dynamical systems. The topic may be either an application or a more complicated mathematical result than what we have covered in class. Natural places to find projects are in the challenge problems of the book as well as parts where I have clearly stated that I cannot cover the theory in detail (e.g. homoclinic tangles). I should stress though that you should take every effort to interpret work in a way that convinces me you understand the material you have chosen to study. This understanding could be displayed by developing simulations to explore or show various concepts, or you could work out your own examples to supplement the results you are explaining.

Project Proposal Requirements

Your proposal requirement must be a typed, 11 pt, single line spaced two page document which clearly explains what your project will address. A well chosen figure will count towards page length. A paper full of figures will not. You should address the following criteria.

- Background and Motivation: Who has studied this problem? Why is it interesting? What were past approaches that your problem either augments or replaces? What are results that build off of the problem you are studying? What are potential applications?
- Presented Work: What are you going to do? Are you going to present proofs? Will you provide examples to explain more abstract ideas? Will you develop simulations to illustrate phenomena? I understand this will be the hardest part to write, but I am going to push you to articulate this as much as possible. The more you focus on this now, the easier your life will be in the long run.
- Bibliography: Compile as complete of a bibliography as you can produce at this time. Remember, even the book's challenge problems have references. A better project will seek these out and possibly even other related key papers. The bibliography does not count towards your proposal's length.

Grading Criteria for Project Proposal

The proposal will be graded out of 50 points. The breakdown of points is roughly along the following lines

- 30 points for meeting basic requirements. This is meeting page length and bibliography requirements. Well labeled and clearly marked sections which address criteria listed above are a plus. Again, there is not a strict format, but egregious use of large fonts, unnecessary spaces, and what have you will not be looked upon kindly.

- 10 points for clarity and detail in exposition. I really need to be able to understand what you are trying to do. That means you have to distill complicated concepts into a form I can easily follow. This proves you know what you are talking about and not just reciting the words of others. This issue will be even more important in the final project.
- 10 points for novel ideas and willingness to reach. Yes, this is completely subjective. No, there is no clear way to tell you what is novel or interesting enough. This also is not about presenting ‘hard’ material. This is about showing you understand your topic so well that you can create interesting examples or simulations which illustrate core or complicated concepts. This is the most difficult part of both the project and the proposal, and it is where you should spend the most time.

Of course, since I am asking for a proposal, I am not asking for fully formed ideas. You have the remainder of the semester to put those together. But I do want to see a plan. And again, I cannot stress this enough, pick material you can actually handle. I do not want a 12 page book report where you recite results from another text. I am not asking to prove that you can type. Of course, I also do not expect that you can write your own proofs of complicated material. So be judicious. This gets into clarity of exposition, but it also has to do with thinking of novel ways of explaining things.

List of References

- Edward Ott’s webpage at <http://www.chaos.umd.edu/publications/references.html#ottsbook>
- R. May, Simple mathematical models with very complicated dynamics, *Nature*, 261, 1976, p459. For motivational purposes.
- S. Wiggins, *Introduction to Applied Dynamical Systems and Chaos*, 2nd Edition, Springer, 2003. Good for Poincare maps, Smale horseshoe, homoclinic tangles.
- R.L. Devaney, *An Introduction to Chaotic Dynamical Systems*, 2nd Edition, Addison Wesley, 1989. Good for complex dynamics, and more mathematical details of results presented in our book.
- D.K. Arrowsmith and C.M. Place, *An Introduction to Dynamical Systems*, Cambridge University Press, 1990. More and more on wacky maps.