CPS111- Homework 1
Due on January 15, 2008

Questions may continue on the back. Please write clearly. What I cannot read, I will not grade. Typed homework is preferable. A good compromise is to type the words and write the math by hand.

The questions in sets 1 and 2 below are aimed at understanding where you are coming from, and what you would like to get out of this class. Your answers to these two sets of questions will only be graded cumulatively with a single 1 (pass) or 0 (fail). A pass requires a non-perfunctory\(^1\) answer to each applicable question. There is no wrong answer, so there is no penalty for a wrong answer here. Problems 3 and 4, on the other hand, will be graded numerically. The resulting grade for 3 and 4 will be multiplied by the single grade you got for sets 1 and 2.

1. This set of questions concerns your background. There is no stigma in not having studied a particular topic in the past. All I want is a feel for how fast or slow to go in class on various topics. So it would be entirely counter-productive not to be candid in your answers.

(a) What mathematical courses have you taken in college, if any?

(b) Some mathematical knowledge may have come from high school, independent reading, or other sources. How comfortable are you with calculus, linear algebra, and probability? Please answer with one brief paragraph for each. Do not just say “very comfortable.” Here is a minimal sample answer: I have taken some linear algebra in high school. I understand how to solve a linear system, and I know the definition of eigenvalue. However, I have no intuition as to what an eigenvalue actually is or where it is used. Add as much detail as you can. Again, it’s OK to say that you have no clue.

(c) What do you think about mathematics in general? Anything that crosses your mind here is fine: opinions, wishes, regrets, experiences, other. Again, answer with a few paragraphs. Think of this as a mini-essay on math.

(d) Do you know any programming language (C, C++, Basic, Java, Matlab, ...)?

(e) If you do, how many programs have you written, and of what length? What did they do?

2. This set of questions is for me to understand your expectations about this class.

(a) Why are you interested in modeling? Please be detailed: what do you think you’ll be modeling, for what purpose, for research, in industry, and so forth.

(b) How knowledgeable are you in the domain(s) in which you would like to apply modeling? For instance, if you are interested in economic models, how much do you know about economics?

(c) Think of a simple phenomenon, event, or scenario that you think is worth modeling (in any application domain). Describe it clearly, and state what you think are the most important quantities involved. Please be as precise as you can. Give units of measure when appropriate. Please remember that I may not know the domain of application you are referring to, so be as clear and detailed as possible.

(d) Can you think of what equations could plausibly hold for these quantities? I’m not interested in correct answers, just in your way of thinking about the problem. Please explain clearly. Again, no penalty for wrong answers.

(e) Do you know any software packages that might be relevant to this modeling problem? Searching Google is acceptable for this and other answers.

(f) Any other thoughts you would like to share about this class?

3. (Real grading from now on) Study pages 1-9 of the textbook. Do part (c) only for problems 1, 2, 3, 4 in Section 1.1. In 4(c), \(\Delta p\) should read \(\Delta p_n\). Approximate results to four decimals where needed.

4. Problem 10 in Section 1.1. Your answer to “when?” can be either found by brute-force calculation (use a scientific calculator) or by reasoning. Either solution gets full credit. However, the reasoning solution is only discussed later, in Section 1.3. It amounts to writing out a few iterations of the dynamical system, and guessing a general formula for \(a_n\) that depends only on \(a_0\). If you follow this route, you may want to look up the notion of a geometric sum.

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\(^1\)Perfunctory: characterized by routine or superficiality, or lacking in interest or enthusiasm (Merriam-Webster).