Instructions for the first project

- All projects are to be done in groups, unless you are really strongly opposed to group work, or have a schedule that doesn't work with other people's schedules. You may work with a partner or in a group of three (possibly four). You may change groups for the different projects.
- Project 1 consist of picking a section from the book, reading the section, writing a summary of the main ideas of the section, solving some sample problems (as specified below), and giving a 5-7 minute presentation in class. Each group must choose a different topic.
- The summary of the section needs to be typed, and should be 2-5 pages long, including solved problems (you can write symbols by hand if necessary). The summary will be due on March 24. Summaries are worth 15 points.
- For the presentation, pick the most interesting part of your summary, especially if you looked at a topic that has applications in computer science or real life. Summaries are worth 10 points. Make sure that all group members participate in the presentation. You will give your presentation on March 26.
- Be creative. Feel free to use outside sources and add information that you think is relevant and interesting.

Topics

- Section 3.1. Divisors

  The most interesting part of this section is the discussion about prime numbers. In addition to summarizing the section and solving some problems, also do the following:

  - Look at the following website. Include some interesting facts in your summary and presentation:
    http://mathworld.wolfram.com/PrimeNumber.html
  - Write pseudocode for at least one of the following two problems:
    - Given a positive integer, determine if it is prime.

    - Find the prime factorization for an integer. (This one is more difficult.)

- Section 3.2. Consequences of Well-Ordering

  The most important part of this section are *floor, ceiling,* and *mod* functions. It is not necessary to talk about primes, since that will be done in 3.1.

  In particular, do the following:

  - Do additional research about applications if necessary.
  - Do some proofs using the division algorithm.
  - Look at the following website for applications of the floor and ceiling functions:
    http://en.wikipedia.org/wiki/Floor_and_ceiling_functions

- Section 3.3. Euclid's Algorithm and Lemma

  Explain the algorithm and give examples. In addition:

  - Write pseudocode for the Euclidean algorithm;
  - Write pseudocode for the following problem: given two positive integers, find their greatest common divisor using the Euclidean algorithm.

- Section 3.4. Rational Numbers

  Present the section and show some proofs and solve some problems. In addition,

  - Show that 0.9999999.... = 1
  - Show that the set of rational numbers is countable.

  You can find both proofs on the Internet. You do not need to figure them out yourself.

- Section 3.5. Irrational Numbers

  The most interesting part of this section is the discussion of algebraic and transcendental numbers. You can use the following website: http://sprott.physics.wisc.edu/Pickover/trans.html to get more information.

  In addition, show that the set of irrational numbers is uncountable. the proof can easily be found on the Internet.

- Section 3.6. Modular Arithmetic

  Note that Section 3.2 talks about some modulo arithmetic, so check what's covered in that section to make sure you don't do the same thing. The most interesting part of the section is discussion of ciphers and encryption. This would be most interesting for the class presentation. Do not worry about the last part about groups.

  In addition, write pseudocode that encrypts a message with a linear cipher.

- Section 4.5. Strong Induction

  Show some examples where strong induction makes much more sense to use than ordinary induction. Make sure you do problems 14 and 32. It would also be interesting to talk about the Fibonacci sequence. You can, if you want, talk about the Fibonacci sequence in nature and art (websites on the topic abound). Otherwise, look at the problems about the Fibonacci sequence from the end of the section. Create pseudocode for finding terms of the Fibonacci sequence.

- 4.6. The Binomial Theorem

  Make sure you do problems 21 and 22. Talk about patterns in the Pascal's triangle; see this website: http://ptri1.tripod.com/.