Slide 1

Administrivia

- Reminder: Homework 2 due Monday.
- A note about the reading: We won't cover section 1.5 at all. We'll cover section 1.6, but later.

Slide 2

More Predicate Logic Examples

- (Section 1.4 problems 20, 24, 28.)

Slide 3

Proof Techniques

- In chapter 1 we worked up a formal system for proving "meaningless" formulas — which can prove "meaningful" formulas as special cases.
- Most of the time, though, we want to prove something is valid in a particular context, and the procedure is less formal and makes use of context-specific additional info (e.g., definitions of terms such as "even integer").
- *But* keep in mind that less-formal proofs could be done in the millimeter-by-millimeter style of chapter 1.
- (Why are we doing this anyway? In part because you almost surely will see theorems/proofs in CS theory classes, in part to help with that "mathematical maturity" goal, . . .)

Slide 4

Proof Techniques, Continued

- Suppose you have a "conjecture" (e.g., "all odd numbers greater than 1 are prime"). How to (try to) prove it?
- Well, first must sometimes decide *whether* to prove it. Do you think it's true?
- If it's a statement about all integers, etc., often helpful to start with "inductive reasoning" — try some examples and see what happens.
- If one doesn't work? "Counterexample" that shows conjecture false.
- If all succeed? Just means you didn't find a counterexample. So, turn to "deductive reasoning" to prove — subject of first part of chapter 2.
- Lots of examples/problems will be simple stuff about integers. Why? Something where we supposedly all know the "context".

Minute Essay

Slide 5

- Use predicate logic to prove that the following argument is valid: “All CS majors must take Discrete Structures. Some CS majors are also physics majors. Therefore, some physics majors must take Discrete Structures.” Use predicates $C(x)$, $D(x)$, and $P(x)$.
- Have you been asked to do proofs in a math (or other) course before? What course? Did you find it easy/hard? fun/painful?

Minute Essay Answer

Slide 6

- Hypotheses: $(\forall x)(C(x) \;\rightarrow\; D(x)$, $(\exists x)(C(x) \;\wedge\; P(x)$

  Conclusion: $(\exists x)(P(x) \;\wedge\; D(x)$

  Proof:

1.	$(\forall x)(C(x) \;\rightarrow\; D(x)$	hyp
2.	$(\exists x)(C(x) \;\wedge\; P(x)$	hyp
3.	$C(a) \;\wedge\; P(a)$	2, ei
4.	$C(a) \;\rightarrow\; D(a)$	1, ui
5.	$C(a)$	3, sim
6.	$P(a)$	3, sim
7.	$D(a)$	4, 5, mp
8.	$P(a) \;\wedge\; D(a)$	6, 7, con
9.	$(\exists x)(P(x) \;\wedge\; D(x)$	8, eg