

CSI 35 LECTURE NOTES (Ojakian)

Topic 0: Introduction, Review, and Programming

OUTLINE

(References: Rosen: 3.1)

1. Mathematical Terminology
 2. Review and Programming
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1. Math and Computer Science

- (a) Discrete math versus other math
- (b) Algorithm - mathematics in action
- (c) How do we make imprecise world precise for a machine? Logic!

2. General Mathematical Introduction

- (a) Basic development in mathematics:
 - i. Definition.
 - ii. Theorem (or Lemma or Claim or ...)
 - iii. Proof
- (b) Example:
 - i. How might you define the terminology “even” and “odd”?
 - ii. Theorem: The addition of two evens is even.
- (c) Example:
 - i. DEF: a *Word* is any finite sequence of the 26 letters from the English alphabet.
 - ii. DEF: Say a word is *BRONX* if its length is odd, its first letter is B and its last letter is X.
 - iii. DEF: Given any words, their *concatenation* is the formation of a single word by putting the words one after another.
 - iv. Theorems? - Concatenating 2 *BRONX* words is *BRONX*? Etc?
- (d)

PROBLEM 1. 1) Make up a simple definition, 2) State a theorem that concerns your definition, and 3) Prove your theorem.

3. Math to recall

- (a) Integers
- (b) Definition of positive, negative.
- (c) Divisibility
- (d) Prime

4. Terminology about mathematical reasoning

- (a) Theorem, Lemma, Corollary
- (b) Definition (note: some precise definitions omitted in favor of loose description, e.g. the integers)
- (c) Proof
- (d) Example: What is the sum of two evens? Prove it or test it by a program?
- (e) What about the sum of two odds?

5. Algorithms

- (a) Recall:
 - i. Assignment statements
 - ii. Lists
 - iii. Conditional statements
 - iv. For Loops
 - v. While Loops
 - vi. Functions with return statement

(b)

PROBLEM 2. *Supposing x and y are set to integers. Set z to the larger of x or y .*

PROBLEM 3. *Write the definition of a function which takes an integer n as input and returns n if n is negative, 0 if n is zero, and $-n$ if n is positive (do with with a conditional statement, and without). Graph it.*

PROBLEM 4. *Write the definition of a function which takes two arguments, the first a negative integer s and the second a positive integer t . The function returns the sum of the even integers inbetween s and t (including s and t).*

PROBLEM 5. *Do one of the above for-loop questions with a while loop.*

6. Programs Instead of Proofs?

(a)

PROBLEM 6. *Write program to test the claim: The sum of evens is even (test all pairs of evens up to 100)*

PROBLEM 7. *What do you think the sum of consecutive integers should be? Write a program to test your hypothesis.*

- (b) Do our programs prove the claim? What are the issues?

7. Harder Questions...

- (a) Are there infinitely many prime numbers?
- (b) Are there infinitely many twin primes?
- (c) Test your hypothesis with a program.