

Lecture #1: Introduction to CPSC 513

Exercises and Review

Questions for Review

1. Define each of the following things (which are often introduced in a mathematics course, and which will be used in this course).
 - (a) **set**
 - (b) **sequence**
 - (c) **function**
 - (d) **relation**
2. What is a **partial function**? What is a **total function**?
3. What is a **predicate**?
4. Define each of the following things (which are also generally introduced in a mathematics course).
 - (a) axiom
 - (b) theorem
 - (c) conjecture
5. Describe one or more **proof techniques** that you have learned about (and, ideally, used) before this course.

Practice Problems

These problems will not be discussed during the lecture, and solutions for these problems will not generally be made available. They can be used as “practice” problems that can help you to practice skill considered in the lecture presentation for Lecture #1.

Consider the simple programming language that was used during the lecture presentation for Lecture #1.

1. Consider a sequence of integers

$$a_0, a_1, a_2, \dots$$

such that, for every integer n such that $n \geq 0$,

$$a_n = \begin{cases} 1 & \text{if } n = 0, \\ -1 & \text{if } n = 1, \\ 1 & \text{if } n = 2, \\ a_{n-1} + a_{n-2} - a_{n-3} & \text{if } n \geq 3, \end{cases}$$

so that

$$\begin{aligned} a_3 &= a_2 + a_1 - a_0 \\ &= 1 + (-1) - 1 \\ &= -1. \end{aligned}$$

- (a) Guess a **closed form** for a_n (which should be a reasonably simple mathematical function of n).
 - (b) Prove that your closed form is correct.
2. Consider the simple programming language introduced in the lecture presentation for Lecture #1.
 - (a) Write a simple program for **integer addition**: Given integer inputs X_1 and X_2 , it should set the value of another variable Z , to be $X_1 + X_2$ — and the variables X_1 and X_2 should have their initial values (once again) when the execution of the algorithm ends. Additional variables $Y_1, Y_2, \dots$ can be used if needed but — as with the program in the lecture presentation — program statements can only set a variable’s value to be zero, add or subtract one to the value of a variable, or conditionally jump to another labelled statement if a variable’s value is not zero.
 - (b) Prove that your program is correct.