COMPSCI/SFWRENG 2FA3

Discrete Mathematics with Applications II

Winter 2020

Extra Credit Assignment 1

Dr. William M. Farmer

McMaster University

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Extra Credit Assignment 1 consists of one problem. You must write your solution to the problem using LaTeX.

Please submit Extra Credit Assignment 1 as two files, `EC_Assignment_1_YourMacID`.tex and `EC_Assignment_1_YourMacID`.pdf, to the Extra Credit Assignment 1 folder on Avenue under Assessments/Assignments. *YourMacID* must be your personal MacID (written without capitalization). The `EC_Assignment_1_YourMacID`.tex file is a copy of the LaTeX source file for this assignment (`EC_Assignment_1`.tex found on Avenue under Contents/Assignments) with your solution entered after the problem. The `EC_Assignment_1_YourMacID`.pdf is the PDF output produced by executing

        pdflatex EC_Assignment_1_YourMacID

This assignment is due **Sunday, February 2, 2020 before midnight.** You are allow to submit the assignment multiple times, but only the last submission will be marked. **Late submissions and files that are not named exactly as specified above will not be accepted!** It is suggested that you submit your preliminary `EC_Assignment_1_YourMacID`.tex and `EC_Assignment_1_YourMacID`.pdf files well before the deadline so that your mark is not zero if, e.g., your computer fails at 11:50 PM on February 2.

Although you are allowed to receive help from the instructional staff and other students, your submission must be your own work. Copying will be treated as academic dishonesty! If any of the ideas used in your submission were obtained from other students or sources outside of the lectures and tutorials, you must acknowledge where or from whom these ideas were obtained.

Background

Let Nat be the inductive set defined by the following two constructors:

1. $0 : \mathsf{Nat}$.

2. $S : \mathsf{Nat} \to \mathsf{Nat}$.

Let $+ : \mathsf{Nat} \times \mathsf{Nat} \to \mathsf{Nat}$ be defined by pattern matching as:

1. $x + 0 = x$.

2. $x + S(y) = S(x + y)$.

Let $* : \mathsf{Nat} \times \mathsf{Nat} \to \mathsf{Nat}$ be defined by pattern matching as:

1. $x * 0 = 0$.

2. $x * S(y) = (x * y) + x$.

Extra Credit Problem [2 bonus points]

Prove that the mathematical structure

$$(\mathsf{Nat}, 0, S(0), +, *)$$

is a commutative semiring.

Put your name, MacID, and date here.

Put your solution here.