

# CSE 3302/5307 Programming Language Concepts

Make-up Assignment: Inductive Proofs - Fall 2024

Due Date: Sep. 9, 2024, 11:59p.m. Central Time

## Problem1 - 100%

**Inductive Definition** for  $fib\ n_1\ n_2$

$$\frac{}{fib\ Z\ Z} fibZ \quad \frac{}{fib\ S(Z)\ S(Z)} fibSZ \quad \frac{fib\ n_1\ n_2 \quad fib\ S(n_1)\ n_3 \quad add\ n_2\ n_3\ n_4}{fib\ S(S(n_1))\ n_4} fibS$$

**Inductive Definition** for  $fibsum\ n_1\ n_2$

$$\frac{}{fibsum\ Z\ Z} fibsumZ \quad \frac{fibsum\ n_1\ n_2 \quad fibsum\ S(n_1)\ n_3 \quad add\ n_2\ n_3\ n_4}{fibsum\ S(n_1)\ n_4} fibS$$

This indicates the sum of the first  $n_1$  Fibonacci numbers is  $n_2$

- (a) **Explain each inference rule** above using pseudo-code. Use the notation  $n_2 = Fib(n_1)$  and  $n_2 = Fibsum(n_1)$
- (b) **Prove by induction:** If  $fibsum\ n\ m$  then  $fib\ succ(succ(n))\ succ(m)$

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