COMP 212 : Functional Programming, Fall 2024

Homework 03

Name: _____

Wes Email: _____

Question	Points	Score
1	21	
Total:	21	

If possible, please type/write your answers on this sheet and upload a copy of the PDF to your google drive handin folder. Otherwise, please write the answers in some sort of word processor and upload a PDF. Please name the file `hw03-written.pdf`.

See the homework handout for descriptions of the problems.

1. **Zip Proof**

(10) (a) Prove the following about your code:

Theorem 1. *For all* `l : (int * string) list`, *`zip(unzip l)`* $\cong l$.

Solution: The proof is by structural induction on `l`.

Case for `[]`

To show:

Proof:

Solution: Case for `x::xs`

Inductive hypothesis:

To show:

Proof:

(5) (b) Prove or disprove:

Theorem 2. *For all* `l1 : int list` *and* `l2 : string list`,

$$\texttt{unzip(zip (l1,l2))} \cong \texttt{(l1,l2)}$$

Solution:

(5) (c) **NON-COLLABORATIVE CHALLENGE PROBLEM** Prove

Theorem 3. *For natural number values* `n`*,* `inverse_adjacent(n)` $=$ `n/n+1`*.*

Solution: The proof is by induction on `n`.

Case for 0

To show:

Proof:

Case for $1 + k$
Inductive hypothesis:

To show:

Proof:

(1) (d) Compare `show(inverse_adjacent 200)` with `show(200.0/201.0)`. Explain why

what you see does not match the theorem you proved in the previous task.

Solution: