COMP 212 : Functional Programming, Spring 2025

Homework 08

Name: _____

Wes Email: _____

Question	Points	Score
1	12	
Total:	12	

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 `hw08-written.pdf`.

1. **Analysis**

   (a) The following append function was a task in lab (see the lab handout and the lecture notes for last week for an explanation of how tabulate works):

```
fun myAppend (s1 : 'a Seq.seq, s2 : 'a Seq.seq) : 'a Seq.seq =
    Seq.tabulate (fn i => case i < Seq.length s1 of
                            true => Seq.nth (i, s1)
                          | false => Seq.nth (i - (Seq.length s1), s2),
                  Seq.length s1 + Seq.length s2)
```

(2) i. Give a tight O-bound for the work of `myAppend`. Make sure you explicitly state what quantities you are analyzing the work in terms of. Briefly explain why your answer is correct.

Solution:

(2) ii. Give a tight O-bound for the span of `myAppend`. Make sure you explicitly state what quantities you are analyzing the span in terms of. Briefly explain why your answer is correct.

Solution:

(b) Consider the following reverse function:

```
fun reverse' (s : 'a Seq.seq) : 'a Seq.seq =
    Seq.reduce (fn (x,y) => myAppend (y, x),
                Seq.empty(),
                Seq.map (Seq.singleton, s))
```

`Seq.singleton` and `Seq.empty` take constant time. To analyze the running time of `Seq.reduce`, you can assume it is implemented like your tree implementation from HW07, run on a balanced tree; use a recurrence.

(2) i. Give a tight O-bound for the work of `reverse'`, in terms of the length of `s`. Briefly explain your answer.

Solution:

(2) ii. Give a tight O-bound for the span of `reverse'`, in terms of the length of `s`. Briefly explain your answer.

Solution:

(c) Consider the following alternative implementation of the reverse function:

```
fun reverse (s : 'a Seq.seq) : 'a Seq.seq =
    Seq.tabulate (fn i => Seq.nth ((Seq.length s) - (i + 1), s), Seq.length s)
```

(2) i. Give a tight O-bound for the work of `reverse`, in terms of the length of `s`. Briefly explain why there is a discrepancy between this and the work of `reverse'`.

Solution:

(2) ii. Give a tight O-bound for the span of `reverse`, in terms of the length of `s`. Briefly explain why there is a discrepancy between this and the span of `reverse'`.

Solution: