HW 1: Haskell

CS 440: Programming Languages and Translators
Due Sat Feb 2, 11:59 pm (all assignments will be due just before midnight)
Changed Wed 1/30

How to submit
See http://cs.iit.edu/~cs440 → Homework Policies for information on working with others, how to submit, etc. If you want to submit multiple files, zip them together and submit the zipped file.

Problems [50 points total] Haskell Programming

1. [5 points] Using head and reverse, define a function (i.e., write the definition for a function) last' that mimics last: It takes a list and return the last element. E.g., last' [1,2,3] = 3. You should cause a runtime error if you're passed the empty list, but it doesn't have to be the same error message as last.

2. [8 points] Define a function head_repeats n x that returns True if the first n elements of x equals the second n elements of x. E.g., head_repeats 2 [3, 5, 3, 5, 7] should return True. If n ≤ 0, return True.

3. [10 points] What's wrong with the following definition? Suggest a change to the definition that changes the arguments of f but preserves the spirit of the definition below. Also give the type of your new function f.

   f 0 = 1
   f n x = n * n * x

4. [15 points] Define a function swap_ends that takes a list and returns the same list but with the first and last elements swapped. E.g., swap_ends "hello" = "oellh" (remember, strings are lists of characters). Use function definition by cases to ensure that swap_ends [] = [] and swap_ends [x] = [x]. (I.e., return empty and singleton lists as is).

5. [8 points] Here's a buggy definition for the general case of swap_ends. Briefly explain the nature of the bug and why we can't eliminate the bug if we rewrite the left hand side
of the definition but use the same right-hand side of the definition. Two or three sentences is enough.
\[
\text{swap ends } ([x] ++ y ++ [z]) = [z] ++ y ++ [x]
\]

6. [4 points] What is wrong with the definition below? Give a corrected definition of \( f \). Explain briefly.
\[
\begin{align*}
f &:: (\text{Num } a) => a -> [a] \\
f x &= [x \div 2]
\end{align*}
\]