CS 1101 A-Term 2022 Engling Ahrens Bohrer

Homework 2 - Itemizations & List Processing (175 Points)

Due: Tuesday, September 13 at 1:00pm

Read the Expectations on Homework posted atop the Assignments module in Canvas.

Assignment Goals

- To make sure you can define itemizations and write programs over itemizations
- To make sure you can define lists and write programs over lists

The Assignment

Writing Data Definitions for Itemizations

Climate change is warming the Earth's atmosphere. Scientists believe this warmer air is intensifying winds generated by storms. In this assignment, you'll create data definitions for various kinds of weather-related phenomena, and write programs over those data definitions.

A windstorm can be any of the following (*use the names in* **red** *to name your structs*):

- **tornado** A tornado is represented by its Fujita **scale** rating ("F0", "F1", ... , "F5"), the **distance** it travels (in miles), and its maximum winds (**max-winds**)
- **hurricane** Information required for a hurricane consists of the **name** of the hurricane, the **category** (a number between 1 and 5, inclusive), the maximum sustained wind (**max-winds**) in miles per hour, the **velocity** of the storm in miles per hour, and the storm's **heading** (for example, "NNW").
- **thunderstorm** The definition of a thunderstorm consists of its **heading**. the **velocity** of the storm in miles per hour, the number of inches of **rainfall**, and the maximum wind (**max-winds**) gust in miles per hour,

1. **(20 Points)** Develop a data definition for each type of windstorm described above, and a data definition for an itemization for windstorms. When creating a struct, the order of the fields in the struct should match the order given in the descriptions above. For example, the fields of the struct for a hurricane should be the name, category, maximum wind, velocity, and heading, in that order. *Failure to define the fields in the given order will cause our auto-tester to fail, and you will lose points*.
   Provide at least one example for each kind of windstorm.

2. **(20 Points)** Provide the templates for functions for *each* data definition you made in Problem 1 (including the itemization for `windstorm`).

Writing Programs for Itemizations

3. **If you're working with a homework partner...** You and your partner should review the data definitions and templates you each came up with in Lab 2. Make changes, if necessary, and complete any of the exercises you didn't get to during the lab. Create your Homework 2 file according to the naming conventions for homework files posted on Canvas, and copy/paste your data definitions and templates into your homework file.
   If you're working by yourself... copy your Lab 2 work into your Homework 2 file (name your file `yourLastName-yourFirstName-hw2`), and continue working on Homework 2.
   Everyone... Make sure your function names are exactly the same as the names given in the problems. *Otherwise, our auto-tester will fail, and you will lose points.*

4. **(25 Points)** Write a function `violent?` that consumes a windstorm and produces a boolean. The function returns true if the windstorm is a tornado with a Fujita scale rating of "F4" or "F5", a category 4 or 5 hurricane, or a thunderstorm with more than 5 inches of rainfall and winds exceeding 50 mph.

5. **(25 Points)** Write a function `change-max-winds` that consumes a windstorm and a number representing wind speeds and produces a windstorm. The windstorm that's produced is a windstorm the same as the original, except that its max-winds is changed to the new wind speeds.

Writing Programs for Simple Lists

In the following problems, use this data definition for ListOfString:

```
;; a ListOfString is one of
;;  empty
;;  (cons String ListOfString)
;; interp:  ListOfString represents a list of strings
```

6. **(25 Points)** Develop a function `acrostic` that consumes a ListOfString and produces a String. The function produces a string consisting of just the first character of each string in the ListOfString.
   Example: `(acrostic (list "Always" "Be" "Closing")) -> "ABC"`

7. **(30 Points)** Develop a function `ickle-strings` that consumes a ListOfString and produces a ListOfString. The list that's produced contains only those strings from the original list that have "ickle" as a substring somewhere in them. (Hint: check the DrRacket help desk for various built-in string functions that will help you solve this problem).
   Example: `(ickle-strings (list "pickles" "nickels" "tickle")) -> (list "pickles" "tickle")`

8. **(30 Points)** Write a data definition to represent a list of natural numbers (call it ListOfNatural). Then develop a function `lengths-of-strings` that consumes a ListOfString and produces a ListOfNatural. The function produces a list of the lengths of each of the strings in the given ListOfString.

What to Turn In

The rubric the graders will use for Homework 2 is posted below this assignment on Canvas. Programs must run in order to receive credit.

Note that code that is commented out will not be graded.

Using Canvas, turn in a single file containing all code and documentation for this assignment.

Name your file according to the naming conventions posts in the Assignments block on Canvas.

If this is a joint submission, make sure both partners' names and login names appear at the top of the file in a comment.