CS 1101   A-Term 2021   Professor Engling

Homework 2 - Itemizations & List Processing (175 Points)

Due: Tuesday, September 14 at 11:00pm

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

For weeks, firefighters have been battling wildfires in California. Floods have plagued areas in Louisiana, Tennessee, and metro New York. In this assignment, you'll create data definitions for various kinds of weather-related phenomena, and write programs over those data definitions.

A storm can be any one of the following (*use the names in bold to name your structs*):

- **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 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 the number of inches of rainfall, the maximum wind gust in miles per hour, the velocity of the storm in miles per hour, and its heading.
- **fire** A fire is represented by the number of square miles it covers, the number of days it has been raging, and the number of people displaced by the fire.

1. **(20 Points)** Develop a data definition for each type of storm described above, and a data definition for an itemization for storms. 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 storm.

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

Writing Programs for Itemizations

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*.

3. **(25 Points)** Write a function `high-impact?` that consumes a storm and produces a boolean. The function returns true if the storm is a category 4 or 5 hurricane, a thunderstorm with more than 3 inches of rainfall and winds exceeding 60mph, or a fire covering at least 50 square miles.

4. **(25 Points)** Write a function `change-heading` that consumes a storm and a heading and produces a storm. The storm is returned unchanged if the given storm is a fire. Otherwise, the storm that's produced is a storm the same as the original, except that the heading has been changed to the given heading.

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
```


5. **(25 Points)** Develop a function `character-count` that consumes a ListOfString and counts the total number of characters in all strings in the list.

6. **(30 Points)** Develop a function `numeric-strings` that consumes a ListOfString and produces a ListOfString. The list that's produced contains only those strings from the original list that consist entirely of numeric characters. (Hint: check the DrRacket help desk for various built-in string functions that will help you solve this problem).

7. **(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.