CS115 **Assignment 1** Fall 2019

Due: Wednesday, September 18 @ 10:00 AM (No late submissions)

Assignment Guidelines:

- Submission details:
  - Solutions to these questions must be placed in files **`a01q1.rkt`**, **`a01q2.rkt`**, **`a01q3.rkt`**, respectively, and must be completed in Racket.
  - All solutions must be submitted through MarkUs. Solutions will **not** be accepted through email.
  - Verify your basic test results using MarkUs to ensure that your files were submitted properly and are readable on MarkUs. *Note, however, that passing the basic tests does not guarantee that you will pass all our correctness tests.*
- *For this assignment only,*
  - *your grade will be based entirely on correctness;*
  - *you are not required to use the design recipe (Module 02) when writing functions, though you may use it if you wish. In each case, you are required to include only the function header and body;*
  - *you are not required to use constants (Module 01) or helper functions (Module 02), though you may choose to use them if you wish;*
  - *tests are not required, but you are encouraged to do thorough testing on your own.*
- Download the interface file from the course Web page to ensure that all function names are spelled correctly, and each function has the correct number and order of parameters.
- Restrictions:
  - Unless specifically allowed in the description of the question, you may only use the built-in functions and special forms introduced in the lecture slides in Module 01. See https://www.student.cs.uwaterloo.ca/~cs115/#allowed for details.
  - Read each question carefully to see if any additional restrictions apply.
  - Test data for correctness tests will always meet the stated assumptions for consumed values.
- The solutions you submit must be entirely your own work. Do not look up either full or partial solutions on the Internet or in printed sources.

Plagiarism: The following applies to all assignments in CS115.

All work in CS 115 is to be done individually. The penalty for plagiarism on assignments (first offense) is a mark of 0 on the affected questions and a 5% reduction of the final grade, consistent with School of Computer Science policy. In addition, a letter detailing the offense is sent to the Associate Dean of Undergraduate Studies, meaning that subsequent offenses will carry more severe penalties, up to suspension or expulsion.

To avoid inadvertently incurring this penalty, you should discuss assignment issues with other students only in a very broad and high-level fashion. Do not take notes during such discussions, and avoid looking at anyone else's code, on screen or on paper. If you find yourself stuck, contact the ISA or instructor for help, instead of getting the solution from someone else. Do not consult other books, library materials, Internet sources, or solutions (yours or other people's) from other courses or other terms.

Read more course policies at: https://www.student.cs.uwaterloo.ca/~cs115/#policies

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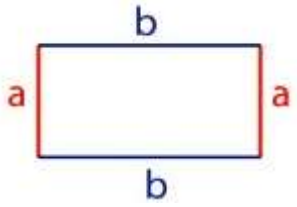
Language level: Beginning Student
Coverage: Module 1

Question 1: *Suppose you are a new math student, who has just received your pink tie. You are in a lecture and start to wonder how many pink ties you would need to go around the perimeter of the classroom? Well, this question will help your get your answer!*

Suppose a classroom is a metres long and b metres wide.



The perimeter of the classroom is $2a + 2b$. If a pink tie measures t metres long, then simply calculating $(2a + 2b)/t$ will give you the number of ties you need. However, since you would never consider cutting up an official pink tie, you would need to round up (that is, taking the ceiling) of that calculated value to determine the minimum number of complete ties needed to cover the perimeter of the room.

Complete the Racket function **`pink-ties-needed`**, that consumes, **`a`** and **`b`**, the length and width in metres of a classroom, and **`t`**, the length of a tie in metres, where **`a,b,t`** are all exact positive numbers, and produces an integer indicating the minimum number of ties needed to cover the perimeter of the classroom. Be sure to use the built-in function **`ceiling`** in your calculations.

For example, **`(pink-ties-needed 15 25 1.5) => 54`**

Question 2: *It can seem even colder in the winter than the temperature says (especially in Canada) …*

When it is really cold, weather reports often include a *wind chill* reading as well as the actual temperature. The formula for the wind chill is below *(note that Canadian scientists were among the group that developed this formula). See* https://en.wikipedia.org/wiki/Wind_chill for more information if you like (though it isn't required).

$$T_{wc} = 13.12 + 0.6215\,T_{air} - 11.37\,v^{0.16} + 0.3965\,T_{air}v^{0.16}$$

where

- T_{wc} is the adjusted wind chill temperature (in Celsius)
- T_{air} is the air temperature (in Celsius)
- v is a wind speed measurement (in km/hr)

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Complete the Racket function **`wind-chill`**, which consumes an integer, **`t-air`** and positive integer, **`v`**, and produces the wind chill in Celsius using the above formula. This calculation in Racket will give an inexact number. Inside your function, convert the calculated value to an exact number using the built-in function **`inexact->exact`**, and then, after the conversion, round that result to the nearest integer (using the function **`round`**), so that the function produces an integer. For example, **`(wind-chill -20 5) => -24`**.

Question 3*: This question is designed to help you understand the course grading scheme (though we are ignoring the lab bonus for now).*
https://www.student.cs.uwaterloo.ca/~cs115/#Grading

a) One of the requirements for passing CS115 is that you pass the weighted exam average for the course. Since the midterm is worth 30% of your grade, and the final exam is worth 45%, this means that your midterm grade (*m*) and your final exam grade (*f*) must satisfy:

$$0.30m + 0.45f \geq 37.5$$

where m and f are your exam percentages converted to grades between 0 and 100. This formula can be re-written to determine the minimum final exam grade required to meet this requirement, once the midterm grade is known:

$$f \geq \frac{37.5 - 0.30m}{0.45}$$

Complete the Racket function **`weighted-avg-final`** that consumes **`m`**, your midterm grade (any number between 0 and 100, inclusive), and produces the minimum grade by the above formula that ensures the weighted exam average is passed.

For example, **`(weighted-avg-final 42.5) => 55.`** Do **not** perform any type conversion on your calculated value, even if the produced value is not an integer.

b) Another requirement for passing the course is that you must pass the *standard grade calculation* for the course, where assignments are worth 20%, the midterm exam is worth 30%, participation (through clicker questions answered in your lecture section) is worth 5%, and the final exam is worth 45%, that is

$$0.20a + 0.30m + 0.05p + 0.45f \geq 50,$$

where $a, m, p,$ and f are your assignment, midterm exam, and participation marks (out of 100), and final exam mark, respectively. As in part (a), this formula should be rewritten to determine the minimum final exam grade needed to meet the requirement given the other grades.

Complete the Racket function **`calculation-final`** that consumes **`a`**, your assignments grade, **`m`**, your midterm grade, and **`p`**, your participation grade, where **`a`**, **`m`**, and **`p`** are all between 0 and 100, inclusive, and produces the minimum final exam grade identified in the above formula to ensure that the *standard grade calculation* is at least 50.

For example, **`(calculation-final 75 42.5 60) => 42.7777777`**…. Do **not** perform any type conversion on the calculated answer, even if the produced answer is outside the range 0 to 100, or is not an integer.

c) Write a function **`required-final`** that consumes **`a`**, your assignments grade, **`m`**, your midterm grade, and **`p`**, your participation grade, where **`a`**, **`m`**, and **`p`** are all between 0 and 100, inclusive, and produces the minimum final exam grade which will satisfy both requirements described in parts (a) and (b).

For example, **`(required-final 75 42.5 60) => 55.`** Again, do not convert your answer in any way. Try to reuse the functions written for parts (a) and (b).

Note: For this assignment, you are not required to follow the design recipe (described in Module 2) or apply good programming style techniques, such as helper functions and constants. As a result, you may find some of your functions hard to follow. Throughout the remainder of the course, you will learn various techniques for improving your solutions.