Midterm Exam

Name/Username: _____________________________ Room/Date: _______________________

You have 150 minutes (2 hours and 30 minutes for this test). Exam is closed-book, on paper, the only thing(s) allowed are: pencil, eraser and your letter-size “cheat sheet”.

1. (10 points) Write a program that receives as input a Fahrenheit temperature \( f \), and converts it to its Celsius equivalent \( c = \frac{5}{9}(f - 32) \).

2. (45 points) Consider the following data representation for ManyTemperatures:

```scheme
; Temperature is a
; -- Number
; ManyTemperatures is one of:
; -- Temperature
; -- (make-many Temperature ManyTemperatures)
(define-struct many (temp temps))
```

2.1 (15 points) Write a program that takes a ManyTemperatures as input value and calculates and returns the sum of all temperatures inside it.

2.2 (15 points) Write a program that takes in a ManyTemperatures as input value and calculates returns the number of temperature values in it.

2.3 (15 points) Write a program that receives a ManyTemperatures as input value and calculates and returns the average temperature (average of temperatures values) in it.

3. (20 points) Write a function that takes a list (in other words use cons, first, rest, empty?, empty in your data representation and definition) of Fahrenheit temperatures and returns them as a list, in the same order, but converted to their Celsius values.

4. (25 points) A patient's temperature monitor in her hospital room looks like a traffic light monitor with four colors: green indicates normal temperature (95.9F-99.5F), yellow indicates fever (99.5F-100.9F), red indicates hyperthermia (> 100.9F) and blue indicates hypothermia (< 95.9F). Write a big-bang program that simulates and monitors the patient’s temperature over time. Initial temperature should be taken to be 98 degrees F. Your program should modify the temperature randomly every second by ±0.2 degrees F. The program should display the current temperature in plain text on the traffic-light-like monitor interface (see picture on next page).
Here’s the monitor showing a temperature of 100.27°F (fever)

Here’s the monitor showing a temperature of 104.91°F (hyperthermia)

Here’s the monitor showing a temperature of 97.88°F (normal temperature)

Finally here’s the monitor showing a case of hyperthermia (94.28)

Please understand that we don’t in any way want to make the exam more difficult than necessary. We just want to test your design prowess. However designing a program is a structured process that includes careful planning for the program’s graphical user interface (GUI). In this case we expect you to be able to sketch a simple output and position four circles and a number in an image such as the temperature is clearly visible and its category (hypo-, hyper-, normal, fever) is shown in the appropriate color.