Problem Set 1
COMP301 Fall 2020
Week 3: 19.10.2020 - 23.10.2020

Please use the code boilerplate, which includes several tests for you to see if your code is correct. Submit your code to BlackBoard as `yourIDno_username.rkt` (scm extension is also fine). Example: `1234567_etezcan19.rkt`. You are expected to submit by the end of PS, however, you have an additional 1 hour to submit after the PS. The solutions will be available on the course BlackBoard after Friday. **Read the questions carefully. Good luck!**

Problem 1: In the previous lectures, you have seen that there are 2 implementations to represent natural numbers (other than Scheme Number Representation[1]):

- Unary Representation[2]
- BigNum Representation[3]

Part A. Please explain how natural numbers are represented in Unary and BigNum Representations.

Part B. Implement these representations in Scheme. For each of these representations, implement the following procedures below:

- `create`: gets an integer number (and a non-zero integer number as base number only for BigNum representation) as input and creates the representation for that particular number.
- `is-zero?`: returns `#t` if the representation belongs to 0, otherwise returns `#f`.
- `successor`: gets a representation of a number (and a non-zero integer number as base number only for BigNum Representation) as input and returns the representation of the successor number.

Part C. Please explain what are Constructors, Observers, Extractors and Predicates. For each procedure explained in Part B, please indicate if they are Constructors, Observers, Extractors or Predicates.

Problem 2: Implement `count-free-occurrences`, which returns how many times a variable occurs free in an expression.

[1] EOPL 3rd ed. p. 33
[2] EOPL 3rd ed. p. 33
[3] EOPL 3rd ed. p. 34