CSc 4330/6330 PLC, Spring 2020, Home Quiz 1
Due: **April 8ᵗʰ (Wednesday)**; Submit 2 files: **hq1.txt** or **hq1.pdf** for problems 1,2 and **hq1.scala** for all the code for problems 3,4
(handin under assignment hq1; i.e. sudo handin4330 hq1 hq1.pdf hq1.scala)

1. Show the result of applying the following substitutions:

    ```
    (λy.((λf.(f x)) y)) [x := (f y)]
    ```

2. Reduce the following expression as much as possible

    ```
    ((λx.((λy.(x y)) x))(λz.w))
    ```

3. Complete the definition of the following function:

    ```
    def singleDigit(num: Int): Int =
    ```

    This function takes a positive integer, num, as input and returns a digit between 0 and 9 as the output. The output is computed as follows: sum all the digits in num to obtain a result; if this result is less than 10 then result is the answer; otherwise take the result and apply the same procedure (i.e. sum its digits and compute a result, …). For example,

    ```
    singleDigit(37425) => (3+7+4+2+5) = 21 => (2+1) = 3
    singleDigit(9876543) => (9+8+7+6+5+4+3) = 42 => (4+2) = 6
    ```

    You probably will need to write a helper function to sum the digits.

4. Given the following function:

    ```
    def extractDigits(num: Int): Set[Int] =
        if (num == 0) Set[Int]()
        else extractDigits(num/10) + (num%10)
    ```

    which extracts the individual digits of a positive number and returns these in a Scala Set. Complete Scala function definitions for the following:

    ```
    def noRepeatingDigits(num: Int): Boolean =
    ```

    ```
    def numBulls(num1: Int, num2: Int): Int =
    ```

    ```
    def numCows(num1: Int, num2: Int): Int =
    ```

    In this problem, num, num1, and num2 are positive integers with <u>all having the same number of digits</u>. The noRepeatingDigits function is self-explanatory. It takes num as input and returns true if num has no repeating digits and false otherwise. For example

    ```
    noRepeatingDigits(12345) = true
    noRepeatingDigits(12452) = false
    ```

    The remaining two functions take two numbers, num1 and num2 as inputs and returns the output as follows:

    BULLS = number of digits that appear in the same positions in the two numbers.
    COWS = number of digits that appear in both the numbers, but at different positions.

    For example, if the two numbers were 2367 and 1327, we have 2 BULLS (for the exact matches for digits 3 and 7) and 1 COW (for the remaining common digit 2 which is in different positions in the two numbers). If the numbers were 9852 and 8926, we have 0 BULLS and 3 COWS and if the numbers were 1234 and 4321, we have 0 BULLS and 4 COWS. It is quite clear that if the two numbers are the same, we have 4 BULLS and 0 COWS.