CS 311 - Programming Language Concepts
Programming Assignment #3

Objective:

- To program using the functional programming paradigm.

Assignment:

Write the following functions using Scheme (Racket):
1. A function `(binomial N k)` that returns the *binomial coefficients* C(N, k), defined recursively as: C(N,0) = 1, C(N, N) = 1, and, for 0<k < N, C(N, k) = C(N-1, k) + C(N - 1, k -1).
2. A function `(mod N M)` that returns the modulus remainder when dividing N by M.
3. A function `(binaryToDecimal b)` that takes a binary number and returns its decimal value. `(binaryToDecimal 1101)` returns `13`.
4. A function `(addBinary binaryList)` that takes a list of binary numbers and returns their decimal sum. `(addBinary '(1101 111 10 101))` returns `27`
5. A function `(min list)` that returns the smallest value in a simple list of integers.
6. A function `(myRemove atm list)` that removes all occurrences of the atom atm from a simple list, returning list with atm removed. `myRemove` should return the original list if atm is not found.
7. A function `(selectionSort list)` that returns a simple list of integers in ascending order using a recursive *selection sort* algorithm. Hint: use your min function.

Include results of your functions and the output produced from testing your functions using the following data:
1. Test binomial for C(4,0), C(8, 8), C(3,2) and C(7, 4).
2. Test mod for arguments 9 and 5, 7 and 9, 100 and 37, 20 and 5, -11 and 3.
3. Test binaryToDecimal with arguments 0, 1011, 111111, 10001.
4. Test addBinary with (1101 111 10 101), (0), (11011).
5. Test min with (4 5 1 2 5), (3), (), (5 5 5)
6. Test myRemove with atom a and list arguments (), (a), (a b c d a b a a), (x y z), (a (x y z) (r s t a)), (((a (l a) b) a) m a).
7. Test selectionSort with lists (), (5), (6 10 23 12 2 9 18 1 0 15), (3 4 7 3 7 7 4 3 2 3 7)

Scheme (Racket) can be found at: https://racket-lang.org