

# CS154: Programming Paradigms Lab

## Lab 1: Introduction to Functional Programming

August 5<sup>th</sup>, 2024

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**Q0.** Set up DrRacket with the *sicp* package on your computer.

**Q1.** Compute the value of the following expression using Scheme:

$$\frac{5 + 4 + (2 - (3 - (6 + \frac{4}{5})))}{3(6 - 2)(2 - 7)}$$

**Q2.** Define a function `leastTwo` that returns the sum of the smallest two of its three inputs. For instance:

```
(leastTwo 3 1 2) = 3  
(leastTwo 8 8 3) = 11
```

**Q3.** Given two integers  $x$  and  $n$  and a positive integer exponent  $y$ , write a function `(modexp x y n)` that will output  $x^y \bmod n$ .

**Q4.** Recall Newton's method to compute square roots. Apart from the square-root method (using functions `good-enough`, `improve`, and an initial guess), Newton had also invented a method to compute cube roots. The method is based on the fact that if  $y$  is an approximation to the cube root of  $x$ , then a better approximation is given by:

$$\frac{x/y^2 + 2y}{3}$$

Use this formula to implement a cube-root function analogous to the square-root procedure.

**Q5.** Open the SICP textbook, find the "Counting change" example in Section 1.2.2, and understand the solution laid out in the next two pages. Now implement a version of the solution with denominations in the Indian currency: INR 1, 2, 5, 10, 20, 50, 100, 500, and 2000.