

# CSC 3205: Structure and Interpretation of Computer Programs

## Exercise 1

1. Predict the outcome of the following expressions and check your answer.

- a. 75
- b. (+ 0 1 2 3 4)
- c. (\* 4 7)
- d. (+ 4 (\* 5 1 (/ 20 4)))
- e. (define z 9)
- f. (define y (+ z 1))
- g. (if (< z y)  
z  
y)
- h. (if (< z y)  
z)
- i. (+ z (if (<= z y)  
z  
y))
- j. (set! z y)
- k. (cond  
((= z y) (\* z y))  
(< z y) (- z y))  
(else (+ z y)))
- l. (case (+ 3 4)  
((4) "four")  
((5) "five")  
((6 7 8) "six or seven or eight")  
(else "unknown"))
- m. (let  
((w 11)  
(z 12))  
(+ w z))

- n. v
  - o. `(define (double x) (+ x x))`
  - p. `(double 2)`
  - q. `(define double2 (lambda (x) (+ x x)))`  
`(double2 2)`
2. Write Scheme expressions for the following
    - a. If a person is above 18 years of age, print a message that allows them to vote, otherwise print an error message
    - b. A certain university uses the following criteria for grading students:  
if mark is greater than 80, give an A  
If mark is between 65 and 80, give a B  
If mark is between 50 and 65, give a C  
Otherwise, the student has failed.  
Write a Scheme expression to grade students.
  3. Procedure definition; write procedures for the following tasks: (Note: extra marks for use of higher-order procedures, let, lambda, conditional expressions, etc, where appropriate.)
    - a. A procedure cube that returns the cube of a given number.
    - b. A procedure sum-of-cubes that returns the sum of cubes of given numbers.
    - c. A procedure to convert a given temperature from
      - i. Celsius to Fahrenheit
      - ii. Fahrenheit to Celsius
    - d. A procedure, leap-year?, that tells whether a given year say 2019 is a leap year or not.
    - e. A procedure minimum, which when given 2 values, finds the smallest value.
    - f. A procedure maximum, which when given 2 values, finds the biggest value.
    - g. A procedure divisible?, which when given 2 values a and b, is able to tell whether a is divisible by b, otherwise, it returns the remainder.
    - h. A procedure simple-calc, which takes as arguments a sign(+, -, /, \*) and 2 values, and returns the result of applying the sign to the 2 given values.
  4. Recursion and Iteration. (Note: extra marks will be given for use of higher-order procedures, let, lambda, conditional expressions, etc, where appropriate.)

- a. Write a recursive procedure (count-down n count), that counts down from a given number n by the value count. For instance (count-down 100 10) counts down from 100 to 0 by reducing by 10.
- b. Define a procedure double that takes a procedure of one argument as argument and returns a procedure that applies the original procedure twice. For example, if inc is a procedure that adds 1 to its argument, then (double inc) should be a procedure that adds 2.
- c. Write a recursive procedure that returns the sum of cubes of integers between 1 and 10. Rewrite the same procedure as an iterative process.