

Assignment 3

CSE 655

Due Friday, Feb 20, by 9:30 am

Note: When writing code for your answers, the *only* Scheme built-in functions you can use are the ones discussed in class. Do *not* use any other built-in Scheme functions.

1. (2 pts) Write down the result of each of the the following function applications; if any of them are erroneous, indicate the kind of problem

a. `(car '(() . 55))` b. `(cdr '(() . 55))`
c. `(cons '(a) '(b))` d. `(null? (cdr '(a)))`

2. (5 pts) Using Scheme syntax, define a function `bar` that takes a list of integers P as its first argument, an integer x as its second argument, and returns the count of how many elements y of P are such that $y/2 \geq x$.
3. (5 pts) Using Scheme syntax, define a function `prepend` that takes two lists P_1 and P_2 as arguments, and returns a list containing the elements of P_2 (in the same order) followed by the elements of P_1 (in the same order). For example, `(prepend '(7 4 9) '(11 4 33))` should produce `(11 4 33 7 4 9)`.
4. (6 pts) Using Scheme syntax, define a function `rev` that takes as argument a list P and returns a list whose elements are single-element lists. The first element of the produced list is a single-element list, where the single element is the last element of P . The second element of the produced list is a single-element list, where the single element is the next-to-last element of P , and so on. For example, `(rev '(3 1 4 3 5))` should produce `((5) (3) (4) (1) (3))`.
5. (5 pts) Using Scheme syntax, define a function `buildlist` that takes three arguments x , y , and z (precondition: the value of z is a non-negative integer). The function returns a list of size equal to three times the value of z , containing as elements $y, y, x, y, y, x, y, y, x, \dots, y, y, x$ in this order. Describe in words what is the result of evaluating the expression `(buildlist car cdr 2)`.
6. (7 pts) Using Scheme syntax, define a function `map2` that takes as arguments two lists P_1 and P_2 (precondition: the size of P_1 is equal to the size of P_2). List P_1 contains binary functions. List P_2 contains lists, each of which contains 3 integers. The result of applying `map2` is a list in which the i -th element is a list containing a single value. That value is obtained as follows: (1) apply the i -th element of P_1 to the first two integers stored in the i -th element of P_2 , and then (2) apply the i -th element of P_1 to this result and the third integer stored in the i -th element of P_2 . For example, suppose we have `(define (f1 x y) (- (- x y) 1))` and `(define (f2 x y) (+ (* 2 x) y))`. For `(map2 (buildlist f1 f2 2) '((1 2 3) (4 5 6) (7 8 9) (10 11 12) (13 14 15) (16 17 18)))`, the resulting value would be `((11) (32) (-12) (74) (95) (-21))`.

- Assignments are to be done independently. General high-level discussion of assignments with others in the class is allowed, but the actual work should be your own. Assignments that show excessive similarities will be taken as evidence of cheating and dealt with accordingly.
- Assignments should be turned in **by the beginning of class** on the due day. Late assignments turned in by the beginning of the next class will be graded with 30% reduction. Assignments turned in later than that will not be accepted.
- Make the assignments readable and understandable. They are to be handed in on regular paper, legibly written or typed. If you have more than one sheet, **staple the sheets together**. If the grader has trouble reading or understanding what you have done, points will be deducted even if it can finally be determined that you have the correct answer.
- Your solutions have to be **precise and detailed**: you have to work out **all** details that are necessary to solve the problem using the approaches discussed in class. You also have to write your solutions in a way that convinces the grader that you understand all these details. Be careful, precise, and thorough.