

CSE 461: Programming Languages Concepts

Prof. G. Tan
Spring 2022

Homework 7
Due on Apr 27th at 6pm;

Submission: **Only a 3-day late submission will be allowed**, as we want to release the solution early for you to prepare for the final exam. Please submit your homework via Canvas. It's okay if you submit a scanned version of your on-paper answers, but please make sure your scanned version is legible.

1. (4 points) For each of the following Racket lists, draw its memory representation using atom and cons cells:

- (a) `'(everyday (is a) new beginning)`
- (b) `'((everyday is) (a) new (beginning))`

2. (4 points) For each of the following Racket expressions, draw the memory representation of its result after its evaluation:

- (a) `(cons (cons 'b 'c) (cons 'b 'c))`
- (b) `((lambda (x) (cons x x)) (cons 'b 'c))`

3. We have a Racket program below:

```
(define lst '(Racket (is fun)))  
(define lst (car (cdr lst)))  
(define lst (cons 'Racket lst))
```

- (a) (2 points) Draw the memory layout in terms of cells for each execution step of the above program. Assume Garbage Collection does not run in intermediate steps.
- (b) (1 point) What is the value of `lst` at the end?
- (c) (1 point) Suppose the system decides to perform a Mark-and-Sweep Garbage Collection at the end, which memory cells would be recycled?