CSSE 304, Winter 2024/25, Exam 1

Name:_____

By signing below, I certify that (i) all the work for this exam is my own work, (ii) I did not use any materials for the written portion and (iii) I did not use search engines or GenAI tools to look-up or produce answers for this exam. If you do not sign below, you will be assigned a zero (0) for the entire exam.

Your signature: _____

1) [3 pts] We say that in Racket, procedures are first-class procedures. What do we mean by that?

2) [6 pts] (a) Convert the following let-expression to a lambda-application expression.

```
((lambda (x) ((lambda (x) (let ([x x]) x)) (let ([x x]) x))) 5)
```

   [3 pts] What is the value of the expression from part (a)? Justify your answer by showing, which value gets passed to which parameter. Feel free to use arrows to do so.

3) [4 pts] What is the value of the following expression? Justify your answer by showing, which value gets passed to which parameter. Feel free to use arrows to do so.

```
(((lambda (y) (y 7)) (lambda (y) (lambda (x) (* x y)))) 4)
```

4) [6 pts] Consider the following code. What is returned in response to (f1) and what is returned in response to (f2)? Justify your answer.

```
(define foo
  (let ([a 3])
    (lambda ()
      (lambda ()
        (set! a (sub1 a))
        a))))
(define f1 (foo))
(define f2 (foo))
> (f1)
> (f2)
```

5) [8 pts] Consider the following grammar. The start-symbol is **<s-list>**. Derive the following expression: **(() (d ()))**

```
<s-list> ::= () | (<s-exp> <s-list>)
<s-exp>  ::= <symbol> | <s-list>
<symbol> ::= a | b | c | d
```

6) [4 pts] Which of the following expressions are in the language defined by the grammar of (6)? Identify the problem with those expressions that are not in that language.

(()(b))	
((() ()) ())	
((a ()) ())	
(a (b (c)))	