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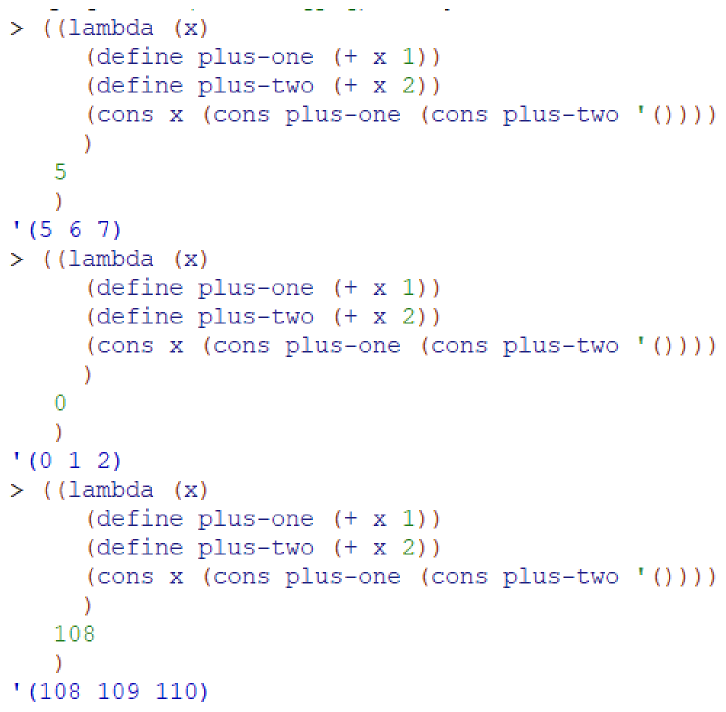
Racket Assignment 4: Lambda and Basic Lisp

Abstract: In this assignment we made use of lambda and basic list in order to manipulate and create lists along with references to specific code inside of the lessons that furthered our understanding.

Demo 1a:



```
> ((lambda (x)
      (define plus-one (+ x 1))
      (define plus-two (+ x 2))
      (cons x (cons plus-one (cons plus-two '())))
      )
    5
    )
'(5 6 7)
> ((lambda (x)
      (define plus-one (+ x 1))
      (define plus-two (+ x 2))
      (cons x (cons plus-one (cons plus-two '())))
      )
    0
    )
'(0 1 2)
> ((lambda (x)
      (define plus-one (+ x 1))
      (define plus-two (+ x 2))
      (cons x (cons plus-one (cons plus-two '())))
      )
    108
    )
'(108 109 110)
```

1b Demo:

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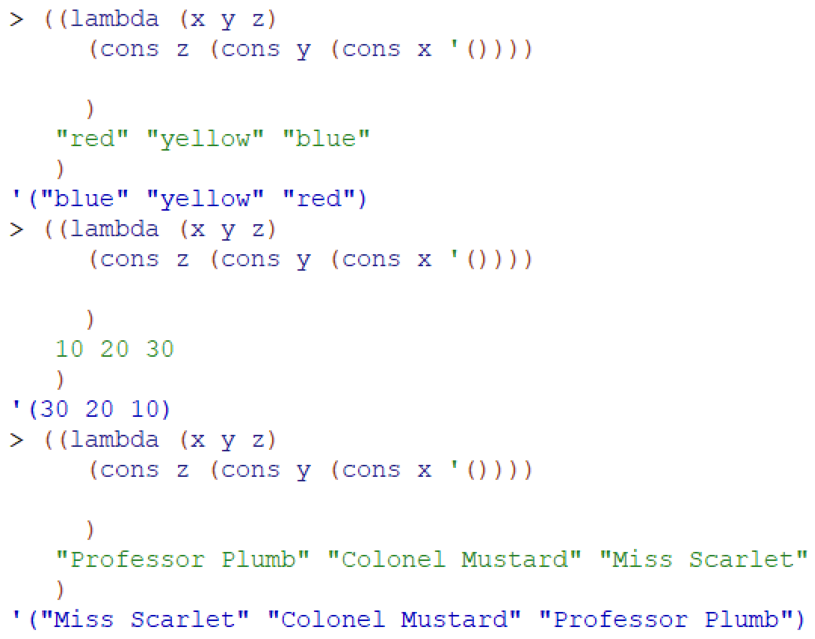


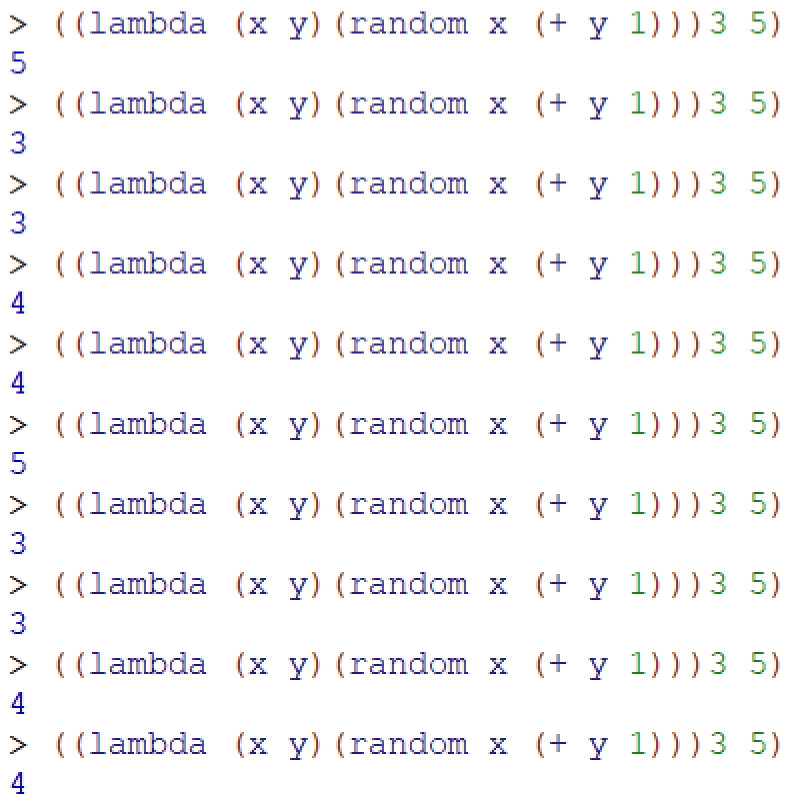
```
> ((lambda (x y z)
     (cons z (cons y (cons x '())))

     )
   "red" "yellow" "blue"
   )
'("blue" "yellow" "red")
> ((lambda (x y z)
     (cons z (cons y (cons x '())))

     )
   10 20 30
   )
'(30 20 10)
> ((lambda (x y z)
     (cons z (cons y (cons x '())))

     )
   "Professor Plumb" "Colonel Mustard" "Miss Scarlet"
   )
'("Miss Scarlet" "Colonel Mustard" "Professor Plumb")
```

1c Demo:



```
> ((lambda (x y)(random x (+ y 1)))3 5)
5
> ((lambda (x y)(random x (+ y 1)))3 5)
3
> ((lambda (x y)(random x (+ y 1)))3 5)
3
> ((lambda (x y)(random x (+ y 1)))3 5)
4
> ((lambda (x y)(random x (+ y 1)))3 5)
4
> ((lambda (x y)(random x (+ y 1)))3 5)
5
> ((lambda (x y)(random x (+ y 1)))3 5)
3
> ((lambda (x y)(random x (+ y 1)))3 5)
3
> ((lambda (x y)(random x (+ y 1)))3 5)
4
> ((lambda (x y)(random x (+ y 1)))3 5)
4
```

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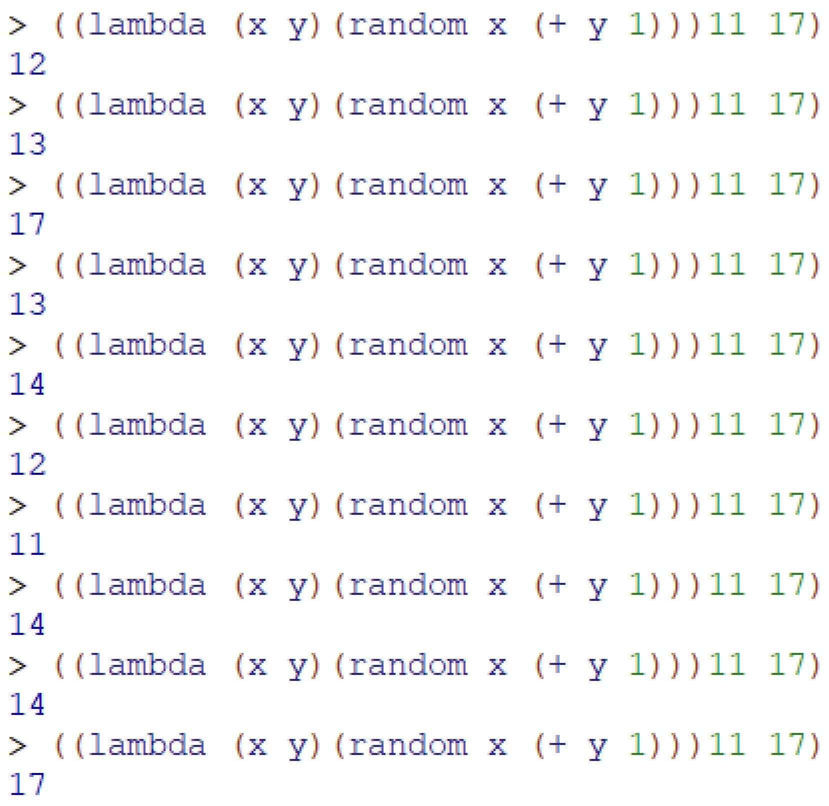

```
> ((lambda (x y)(random x (+ y 1)))11 17)
12
> ((lambda (x y)(random x (+ y 1)))11 17)
13
> ((lambda (x y)(random x (+ y 1)))11 17)
17
> ((lambda (x y)(random x (+ y 1)))11 17)
13
> ((lambda (x y)(random x (+ y 1)))11 17)
14
> ((lambda (x y)(random x (+ y 1)))11 17)
12
> ((lambda (x y)(random x (+ y 1)))11 17)
11
> ((lambda (x y)(random x (+ y 1)))11 17)
14
> ((lambda (x y)(random x (+ y 1)))11 17)
14
> ((lambda (x y)(random x (+ y 1)))11 17)
17
```

Task 2:

Demo:

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```
> (define colors '(red blue yellow orange)
> colors
'(red blue yellow orange)
> 'colors
'colors
> (quote colors)
'colors
> (car colors)
'red
> (cdr colors)
'(blue yellow orange)
> (car (cdr colors))
'blue
> (cdr (cdr colors))
'(yellow orange)
> (cadr colors)
'blue
> (cddr colors)
'(yellow orange)
> (first colors)
'red
> (second colors)
'blue
> (third colors)
'yellow
> (list-ref colors 2)
'yellow
> (define key-of-c ' ( c d e))
> (define key-of-g '(g a b))
> (cons key-of-c key-of-g)
'((c d e) g a b)
> (list key-of-c key-of-g)
'((c d e) (g a b))
> (append key-of-c key-of-g)
'(c d e g a b)
> (define pitches '(do re mi fa so la ti))
```

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```
> (car (cdr (cdr (cdr animals))))
 animals: undefined;
 cannot reference an identifier before its definition
> (cadddr pitches)
'fa

> (list-ref pitches 3)
'fa
> (define a 'alligator)
> (define b 'pussycat )
> (define c 'chimpanzee)
> (cons a (cons b (cons c '())))
'(alligator pussycat chimpanzee)
> (list a b c)
'(alligator pussycat chimpanzee)
> (define x '(1 one))
> (define y '(2 two))
> (cons (car x ) ( cons (car (cdr x))y))
'(1 one 2 two)
> (append x y)
'(1 one 2 two)
```

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Task 3 Demo:

```
> (sampler)
(?): (red orange yellow green blue indigio violet)
red
(?): (red orange yellow green blue indigio violet)
blue
(?): (red orange yellow green blue indigio violet)
red
(?): (red orange yellow green blue indigio violet)
indigio
(?): (red orange yellow green blue indigio violet)
orange
(?): (red orange yellow green blue indigio violet)
red
```

```
> (sampler)
(?): ( aet ate eat eta tae tea )
tea
(?): ( aet ate eat eta tae tea )
aet
(?): ( aet ate eat eta tae tea )
eat
(?): ( aet ate eat eta tae tea )
aet
(?): ( aet ate eat eta tae tea )
tae
(?): ( aet ate eat eta tae tea )
tea
```

```
(?): (0 1 2 3 4 5 6 7 8 9)
8
(?): (0 1 2 3 4 5 6 7 8 9)
6
(?): (0 1 2 3 4 5 6 7 8 9)
4
(?): (0 1 2 3 4 5 6 7 8 9)
9
(?): (0 1 2 3 4 5 6 7 8 9)
7
(?): (0 1 2 3 4 5 6 7 8 9)
0
```

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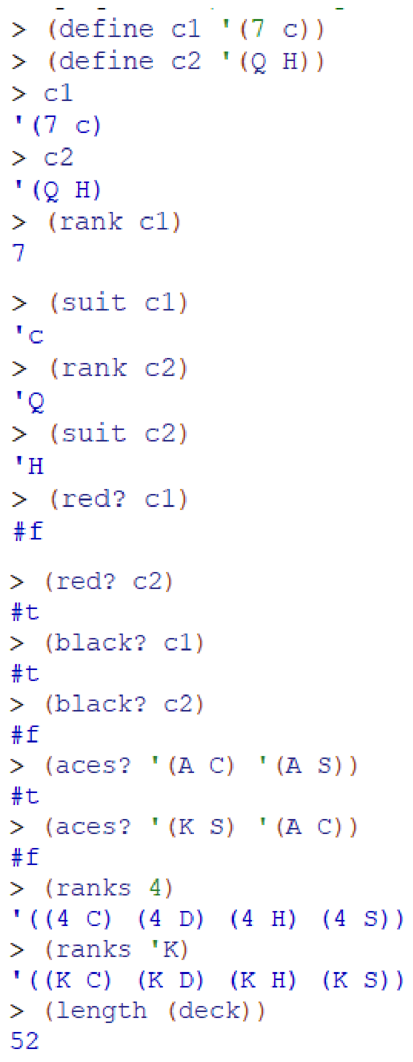
Task 3 code:

```
( define ( sampler )
( display "(?): " )
( define the-list ( read ) )
( define the-element
( list-ref the-list ( random ( length the-list ) ) )
)
( display the-element ) ( display "\n" )
( sampler )
)
```

Task 4:

Demo:



```
> (define c1 '(7 c))
> (define c2 '(Q H))
> c1
'(7 c)
> c2
'(Q H)
> (rank c1)
7

> (suit c1)
'c
> (rank c2)
'Q
> (suit c2)
'H
> (red? c1)
#f

> (red? c2)
#t
> (black? c1)
#t
> (black? c2)
#f
> (aces? '(A C) '(A S))
#t
> (aces? '(K S) '(A C))
#f
> (ranks 4)
'((4 C) (4 D) (4 H) (4 S))
> (ranks 'K)
'((K C) (K D) (K H) (K S))
> (length (deck))
52
```

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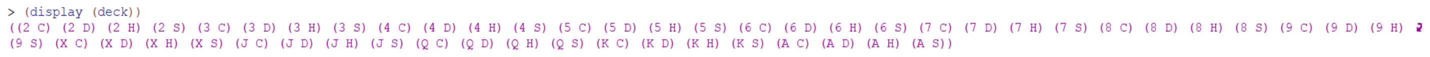
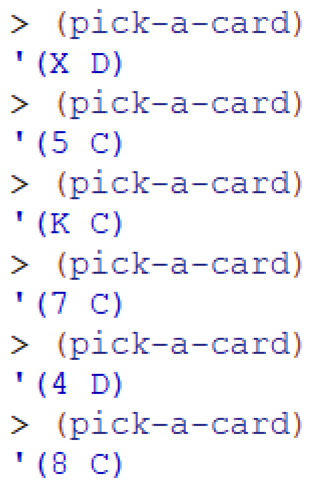


```
> (display (deck))
((2 C) (2 D) (2 H) (2 S) (3 C) (3 D) (3 H) (3 S) (4 C) (4 D) (4 H) (4 S) (5 C) (5 D) (5 H) (5 S) (6 C) (6 D) (6 H) (6 S) (7 C) (7 D) (7 H) (7 S) (8 C) (8 D) (8 H) (8 S) (9 C) (9 D) (9 H)
(9 S) (X C) (X D) (X H) (X S) (J C) (J D) (J H) (J S) (Q C) (Q D) (Q H) (Q S) (K C) (K D) (K H) (K S) (A C) (A D) (A H) (A S))
```



```
> (pick-a-card)
'(X D)
> (pick-a-card)
'(5 C)
> (pick-a-card)
'(K C)
> (pick-a-card)
'(7 C)
> (pick-a-card)
'(4 D)
> (pick-a-card)
'(8 C)
```

Code:

```
( define ( ranks rank )
( list
( list rank 'C )
( list rank 'D )
( list rank 'H )
( list rank 'S )
)
)
( define ( deck )
( append
( ranks 2 )
( ranks 3 )
( ranks 4 )
( ranks 5 )
( ranks 6 )
( ranks 7 )
( ranks 8 )
( ranks 9 )
( ranks 'X )
( ranks 'J )
( ranks 'Q )
( ranks 'K )
( ranks 'A )
)
)
( define ( pick-a-card )
( define cards ( deck ) )
( list-ref cards ( random ( length cards ) ) )
)
( define ( show card )
( display ( rank card ) )
( display ( suit card ) )
)
( define ( rank card )
( car card )
)
( define ( suit card )
( cadr card )
)
( define ( red? card )
( or
( equal? ( suit card ) 'D )
( equal? ( suit card ) 'H )
)
)
( define ( black? card )
( not ( red? card ) )
)
( define ( aces? card1 card2 )
( and
( equal? ( rank card1 ) 'A )
( equal? ( rank card2 ) 'A )
)
)
```