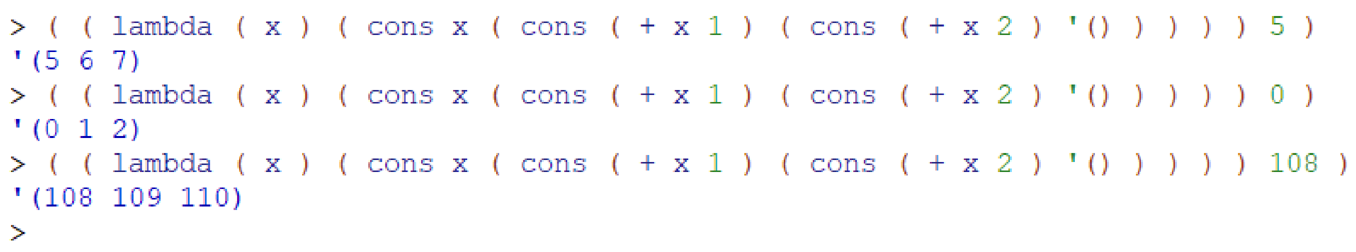
Racket Assignment #4: Lambda and Basic Lisp

Learning Abstract:

The prime objective of this assignment was a basic introduction of lisp and lambda functions. After understanding the assignment, I have a basic knowledge on lambda functions and lisp. This assignment was very helpful for me to understand the power of lisp and how it has become a very important part of programming today. I have grown to understand the importance of lisp through this assignment.

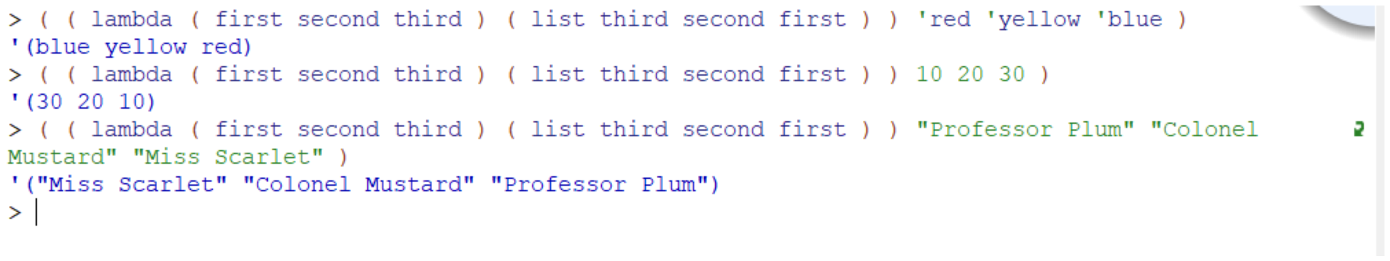
Task 1: Lambda

Demo for Task 1a - Three ascencing integers



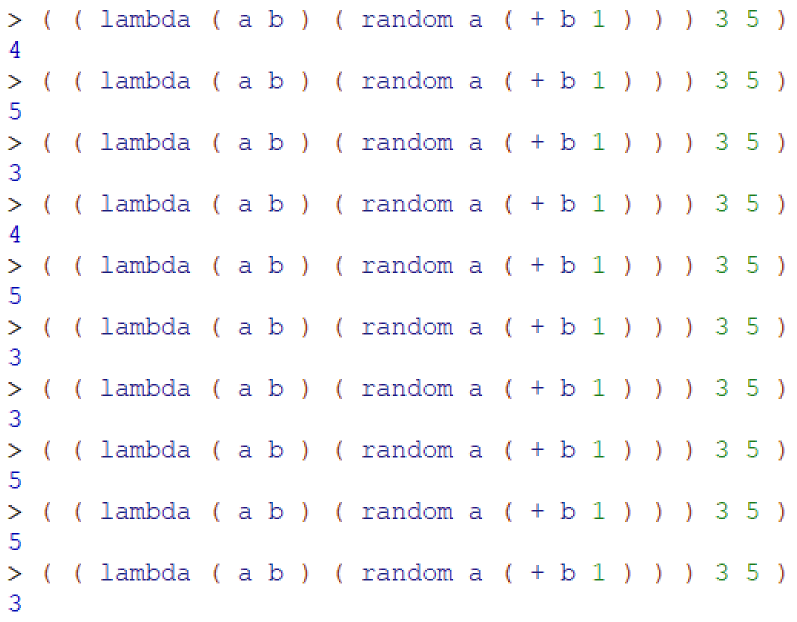
```
> ( ( lambda ( x ) ( cons x ( cons ( + x 1 ) ( cons ( + x 2 ) '() ) ) ) ) 5 )
'(5 6 7)
> ( ( lambda ( x ) ( cons x ( cons ( + x 1 ) ( cons ( + x 2 ) '() ) ) ) ) 0 )
'(0 1 2)
> ( ( lambda ( x ) ( cons x ( cons ( + x 1 ) ( cons ( + x 2 ) '() ) ) ) ) 108 )
'(108 109 110)
>
```

Demo for Task 1b - Make list in reverse order

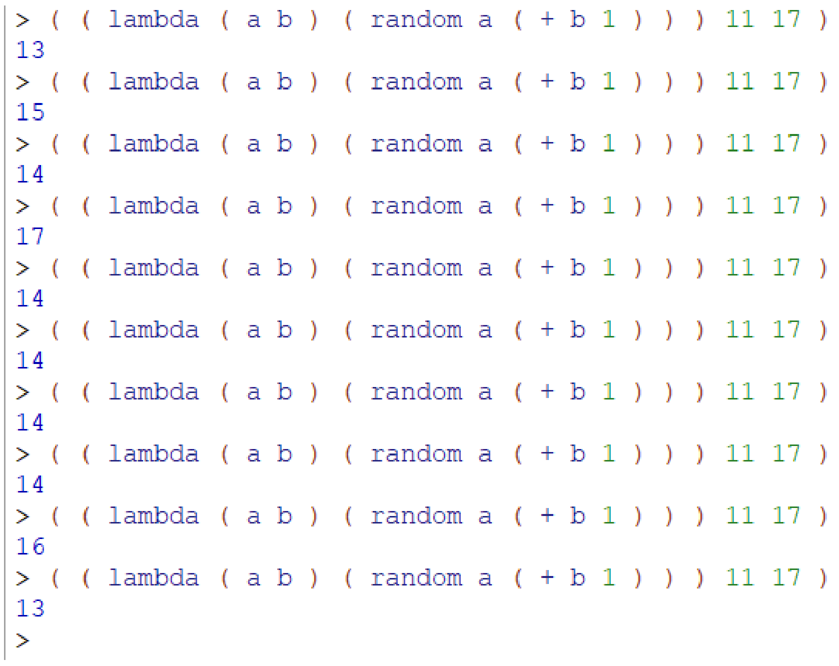


```
> ( ( lambda ( first second third ) ( list third second first ) ) 'red 'yellow 'blue )
'(blue yellow red)
> ( ( lambda ( first second third ) ( list third second first ) ) 10 20 30 )
'(30 20 10)
> ( ( lambda ( first second third ) ( list third second first ) ) "Professor Plum" "Colonel
Mustard" "Miss Scarlet" )
'("Miss Scarlet" "Colonel Mustard" "Professor Plum")
> |
```

Demo for Task 1c - Random number generator



```
> ( ( lambda ( a b ) ( random a ( + b 1 ) ) ) 3 5 )
4
> ( ( lambda ( a b ) ( random a ( + b 1 ) ) ) 3 5 )
5
> ( ( lambda ( a b ) ( random a ( + b 1 ) ) ) 3 5 )
3
> ( ( lambda ( a b ) ( random a ( + b 1 ) ) ) 3 5 )
4
> ( ( lambda ( a b ) ( random a ( + b 1 ) ) ) 3 5 )
5
> ( ( lambda ( a b ) ( random a ( + b 1 ) ) ) 3 5 )
3
> ( ( lambda ( a b ) ( random a ( + b 1 ) ) ) 3 5 )
3
> ( ( lambda ( a b ) ( random a ( + b 1 ) ) ) 3 5 )
5
> ( ( lambda ( a b ) ( random a ( + b 1 ) ) ) 3 5 )
5
> ( ( lambda ( a b ) ( random a ( + b 1 ) ) ) 3 5 )
3
```

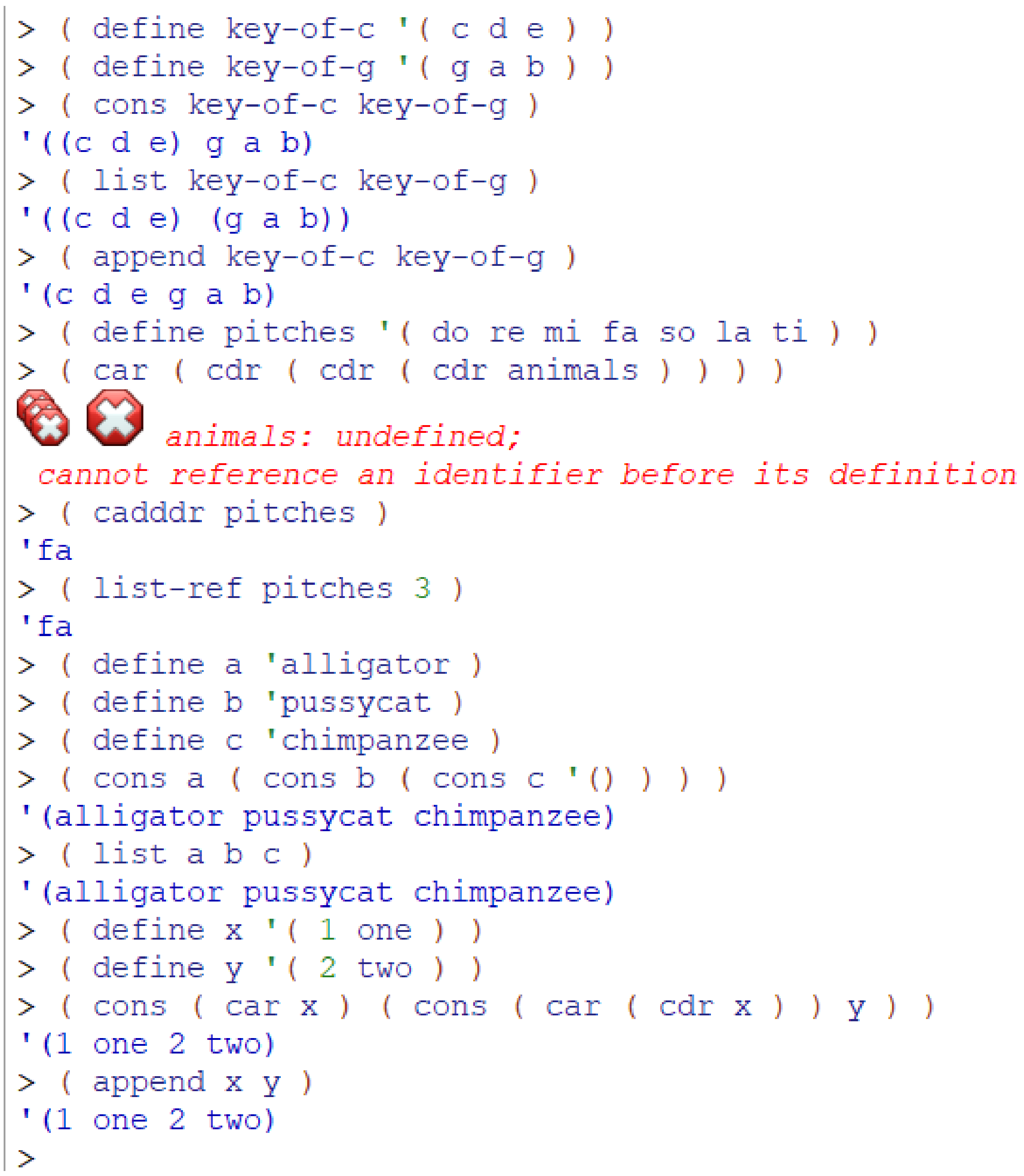


```
> ( ( lambda ( a b ) ( random a ( + b 1 ) ) ) 11 17 )
13
> ( ( lambda ( a b ) ( random a ( + b 1 ) ) ) 11 17 )
15
> ( ( lambda ( a b ) ( random a ( + b 1 ) ) ) 11 17 )
14
> ( ( lambda ( a b ) ( random a ( + b 1 ) ) ) 11 17 )
17
> ( ( lambda ( a b ) ( random a ( + b 1 ) ) ) 11 17 )
14
> ( ( lambda ( a b ) ( random a ( + b 1 ) ) ) 11 17 )
14
> ( ( lambda ( a b ) ( random a ( + b 1 ) ) ) 11 17 )
14
> ( ( lambda ( a b ) ( random a ( + b 1 ) ) ) 11 17 )
14
> ( ( lambda ( a b ) ( random a ( + b 1 ) ) ) 11 17 )
16
> ( ( lambda ( a b ) ( random a ( + b 1 ) ) ) 11 17 )
13
>
```

Task 2: List Processing Referencers and Constructors

Demo

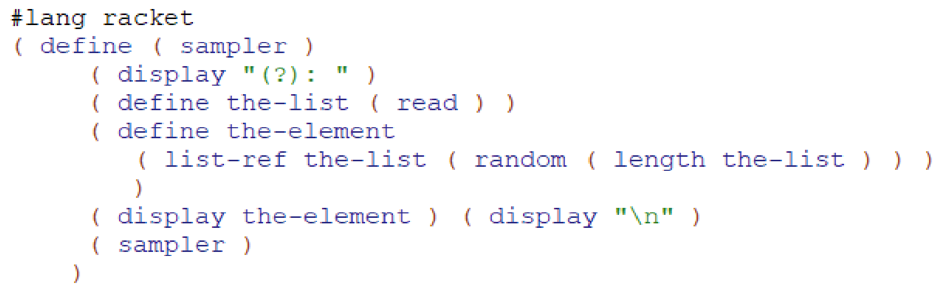
```
Welcome to DrRacket, version 8.8 [cs].
Language: racket, with debugging; memory limit: 128 MB.
> ( define colors '( red blue yellow orange ) )
> colors
'(red blue yellow orange)
> 'colors
'colors
> ( quote colors )
'colors
> ( car colors )
'red
> ( cdr colors )
'(blue yellow orange)
> ( car ( cdr 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 ) )
> ( 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)
>
```

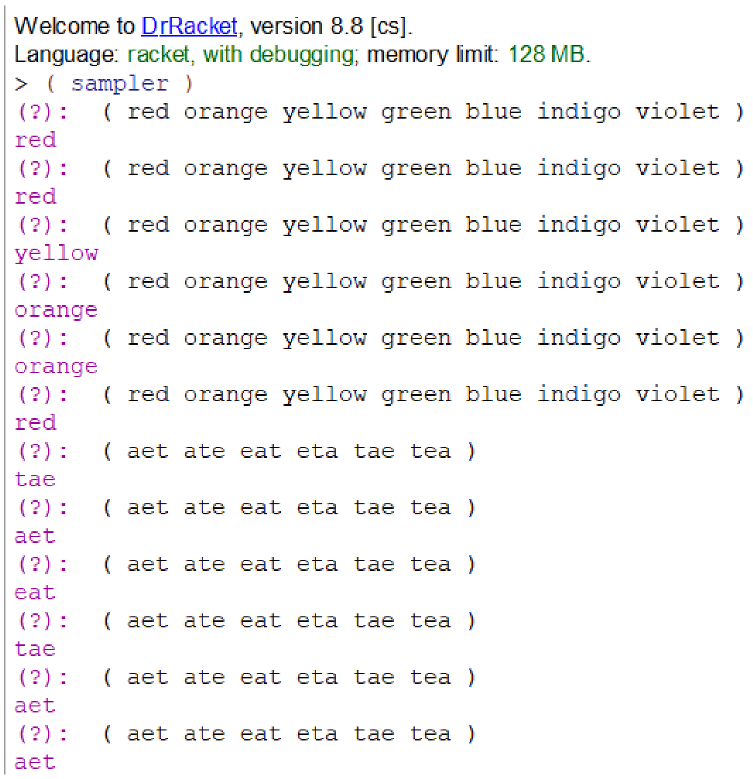
Task 3 - The Sampler Program

Code

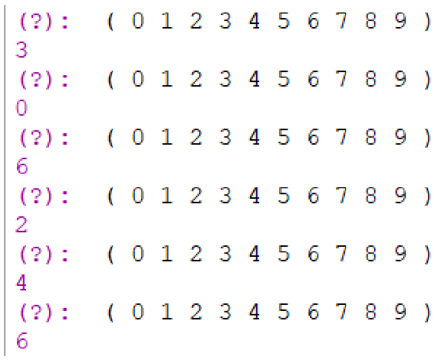


```
#lang racket
( define ( sampler )
     ( display "(?): " )
     ( define the-list ( read ) )
     ( define the-element
        ( list-ref the-list ( random ( length the-list ) ) )
        )
     ( display the-element ) ( display "\n" )
     ( sampler )
   )
```

Demo



```
Welcome to DrRacket, version 8.8 [cs].
Language: racket, with debugging; memory limit: 128 MB.
> ( sampler )
(?):  ( red orange yellow green blue indigo violet )
red
(?):  ( red orange yellow green blue indigo violet )
red
(?):  ( red orange yellow green blue indigo violet )
yellow
(?):  ( red orange yellow green blue indigo violet )
orange
(?):  ( red orange yellow green blue indigo violet )
orange
(?):  ( red orange yellow green blue indigo violet )
red
(?):  ( aet ate eat eta tae tea )
tae
(?):  ( aet ate eat eta tae tea )
aet
(?):  ( aet ate eat eta tae tea )
eat
(?):  ( aet ate eat eta tae tea )
tae
(?):  ( aet ate eat eta tae tea )
aet
(?):  ( aet ate eat eta tae tea )
aet
```



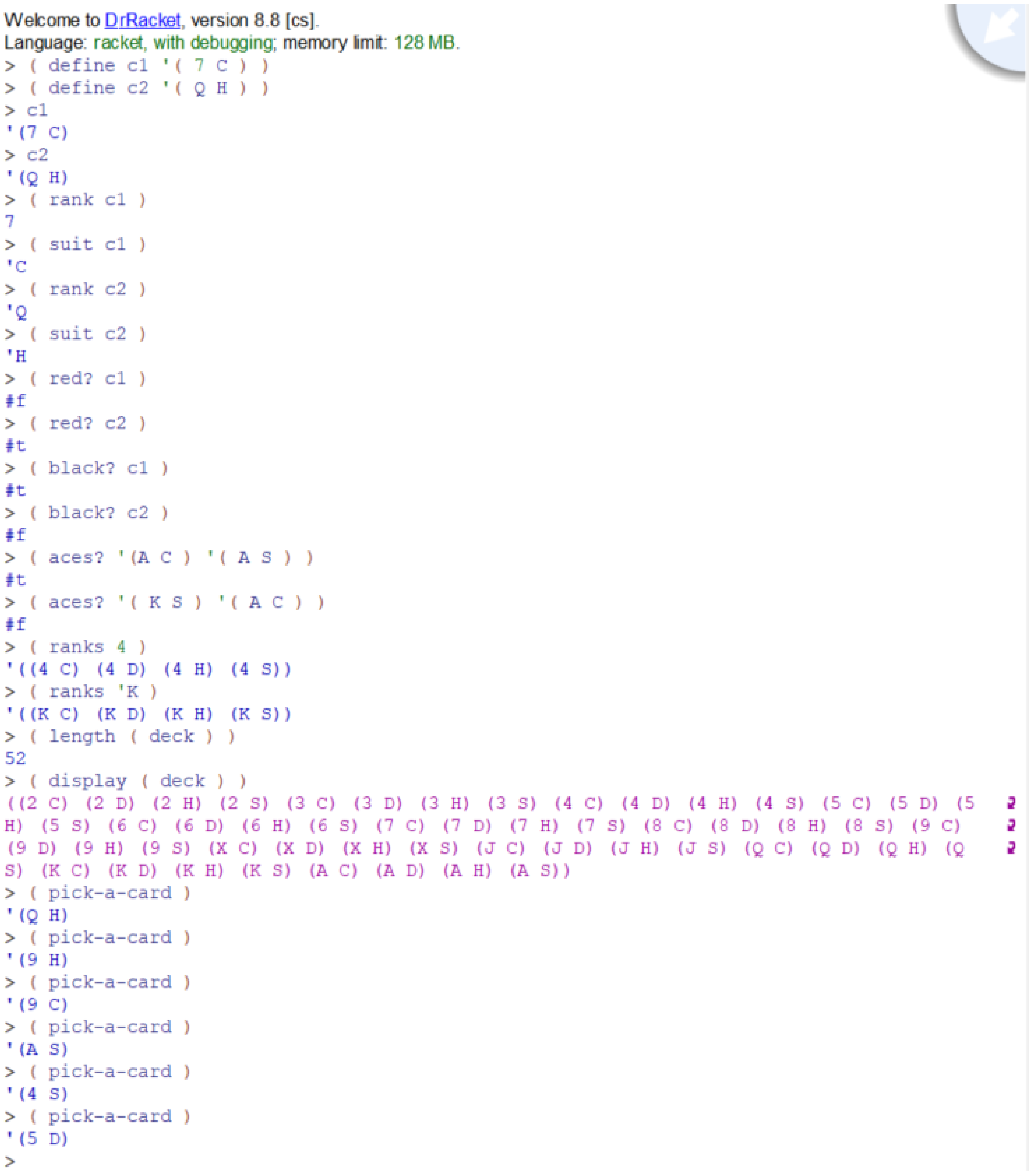
```
(?):  ( 0 1 2 3 4 5 6 7 8 9 )
3
(?):  ( 0 1 2 3 4 5 6 7 8 9 )
0
(?):  ( 0 1 2 3 4 5 6 7 8 9 )
6
(?):  ( 0 1 2 3 4 5 6 7 8 9 )
2
(?):  ( 0 1 2 3 4 5 6 7 8 9 )
4
(?):  ( 0 1 2 3 4 5 6 7 8 9 )
6
```

Task 4 - Playing Cards

Code

```
#lang racket
( 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 )
     )
   )
```

Demo



```
Welcome to DrRacket, version 8.8 [cs].
Language: racket, with debugging; memory limit: 128 MB.
> ( 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
> ( 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 )
'(Q H)
> ( pick-a-card )
'(9 H)
> ( pick-a-card )
'(9 C)
> ( pick-a-card )
'(A S)
> ( pick-a-card )
'(4 S)
> ( pick-a-card )
'(5 D)
>
```