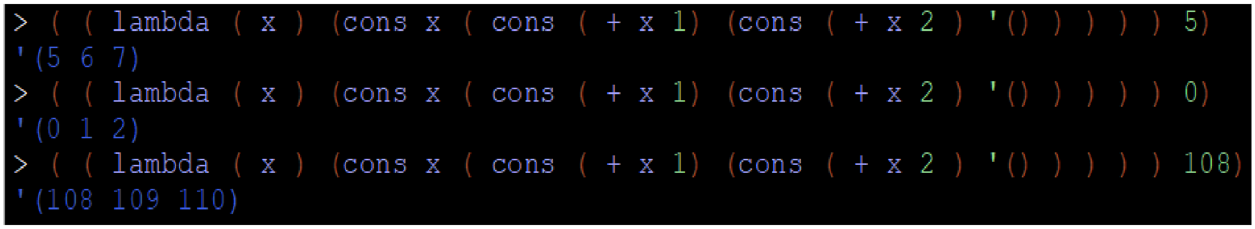
## Abstract:

In this task, I'll grasp the basics of Lisp processing and Lambda functions with Racket programming language. By doing practical exercises, I'll acquire a solid comprehension of these concepts and their efficient implementation in Racket.

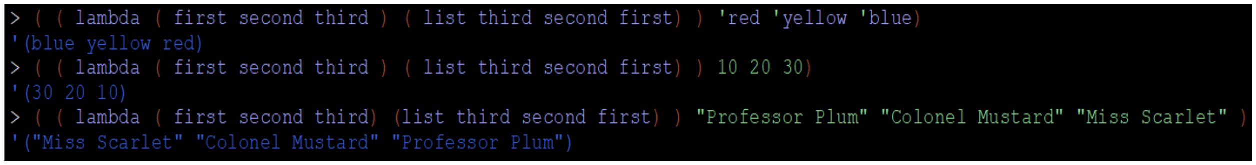
## Task 1: Lambda

### Demo for Task 1a - Three ascending integers



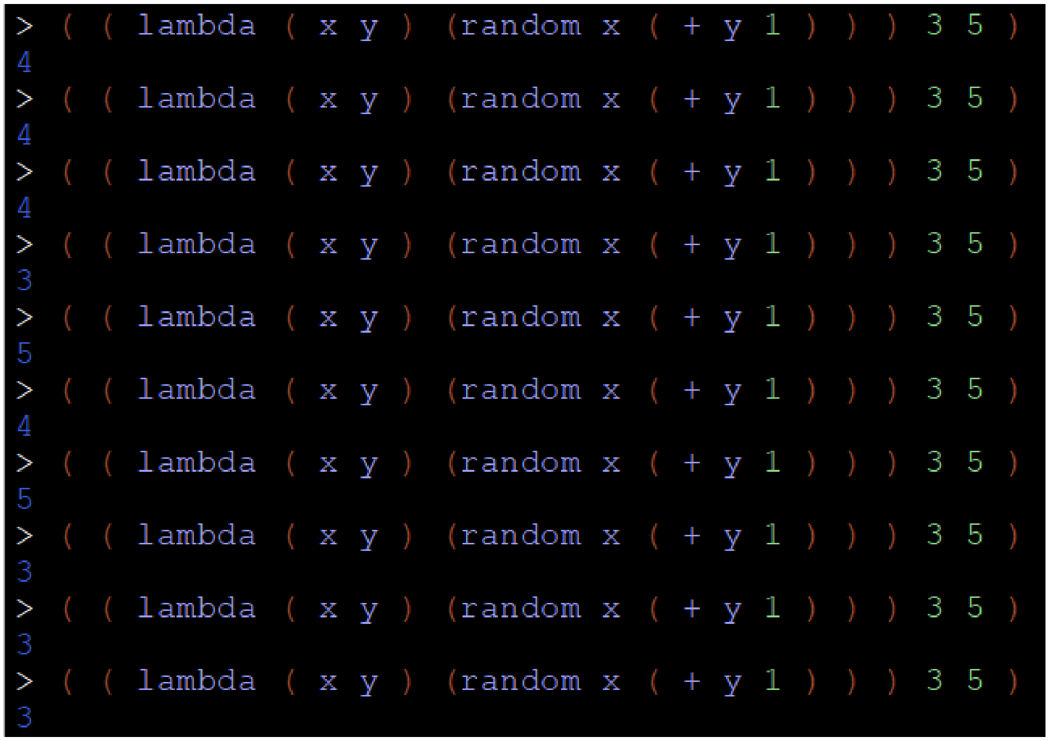
```
> ( ( lambda ( x ) (cons x ( cons ( + x 1) (cons ( + x 2 ) '() ) ) ) ) 5)
'(5 6 7)
> ( ( lambda ( x ) (cons x ( cons ( + x 1) (cons ( + x 2 ) '() ) ) ) ) 0)
'(0 1 2)
> ( ( lambda ( x ) (cons x ( cons ( + x 1) (cons ( + x 2 ) '() ) ) ) ) 108)
'(108 109 110)
```

### Demo for Task 1b - Make list in reverse order

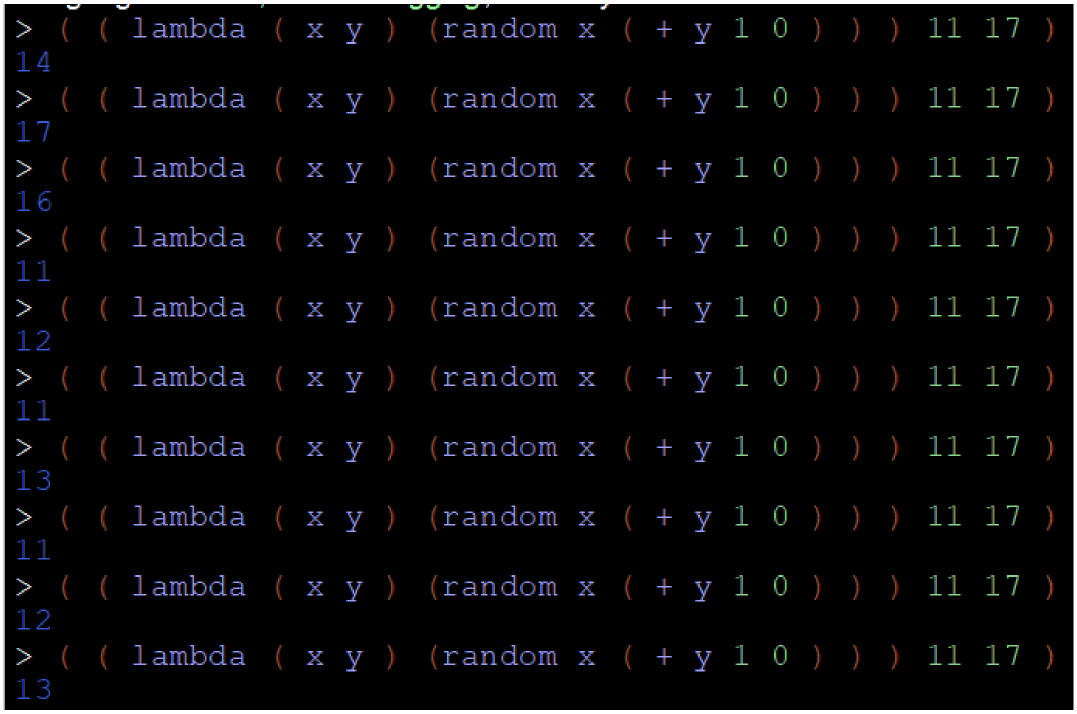


```
> ( ( lambda ( first second third ) ( list third second first) ) 'red 'yellow 'blue)
'(blue yellow red)
> ( ( lambda ( first second third ) ( list third second first) ) 10 20 30)
'(30 20 10)
> ( ( lambda ( first second third) (list third second first) ) "Professor Plum" "Colonel Mustard" "Miss Scarlet"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

### Demo for Task 1c: Random number generator



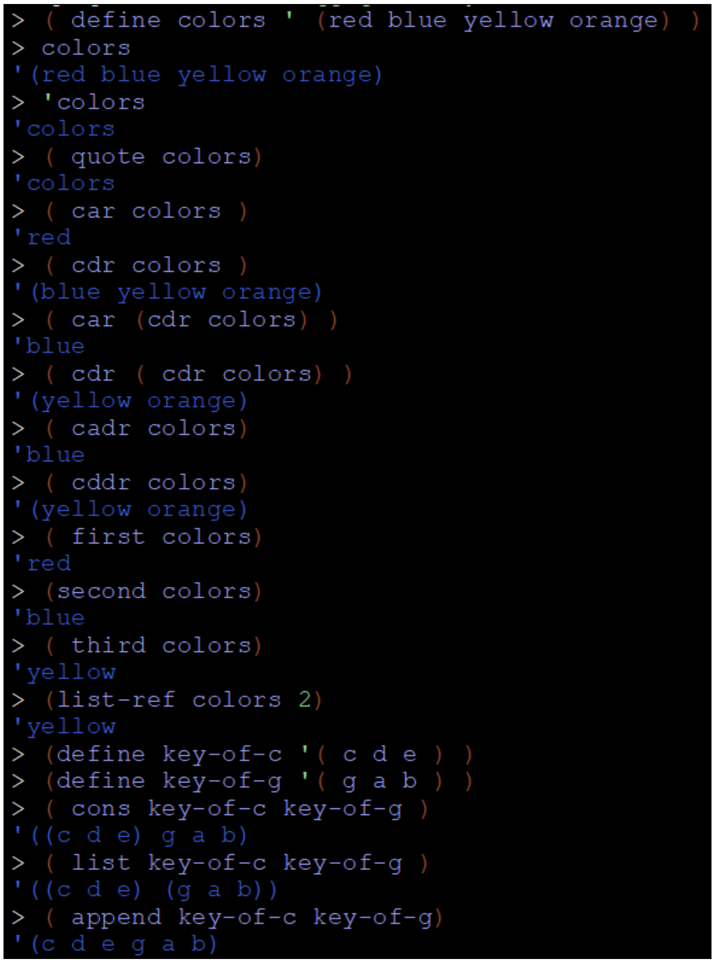
```
> ( ( lambda ( x y ) (random x ( + y 1 ) ) ) 3 5 )
4
> ( ( lambda ( x y ) (random x ( + y 1 ) ) ) 3 5 )
4
> ( ( lambda ( x y ) (random x ( + y 1 ) ) ) 3 5 )
4
> ( ( lambda ( x y ) (random x ( + y 1 ) ) ) 3 5 )
3
> ( ( lambda ( x y ) (random x ( + y 1 ) ) ) 3 5 )
5
> ( ( lambda ( x y ) (random x (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



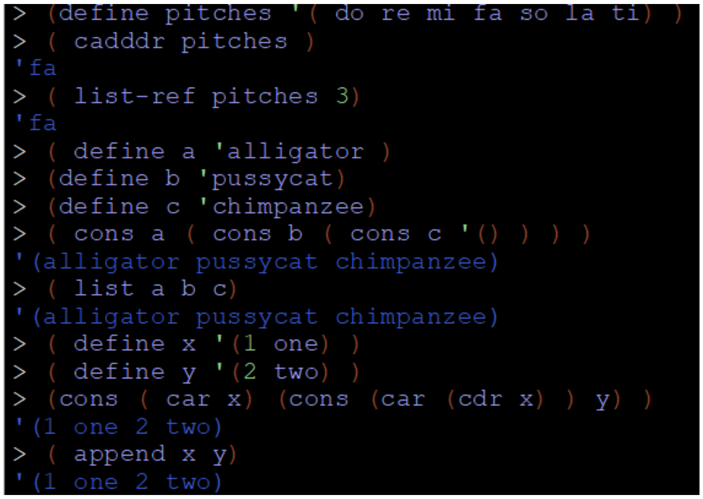
```
> ( ( lambda ( x y ) (random x ( + y 1 0 ) ) ) 11 17 )
14
> ( ( lambda ( x y ) (random x ( + y 1 0 ) ) ) 11 17 )
17
> ( ( lambda ( x y ) (random x ( + y 1 0 ) ) ) 11 17 )
16
> ( ( lambda ( x y ) (random x ( + y 1 0 ) ) ) 11 17 )
11
> ( ( lambda ( x y ) (random x ( + y 1 0 ) ) ) 11 17 )
12
> ( ( lambda ( x y ) (random x ( + y 1 0 ) ) ) 11 17 )
11
> ( ( lambda ( x y ) (random x ( + y 1 0 ) ) ) 11 17 )
13
> ( ( lambda ( x y ) (random x ( + y 1 0 ) ) ) 11 17 )
11
> ( ( lambda ( x y ) (random x ( + y 1 0 ) ) ) 11 17 )
12
> ( ( lambda ( x y ) (random x ( + y 1 0 ) ) ) 11 17 )
13
```

## Task 2 : List Processing Referencers and Constructors

## Demo



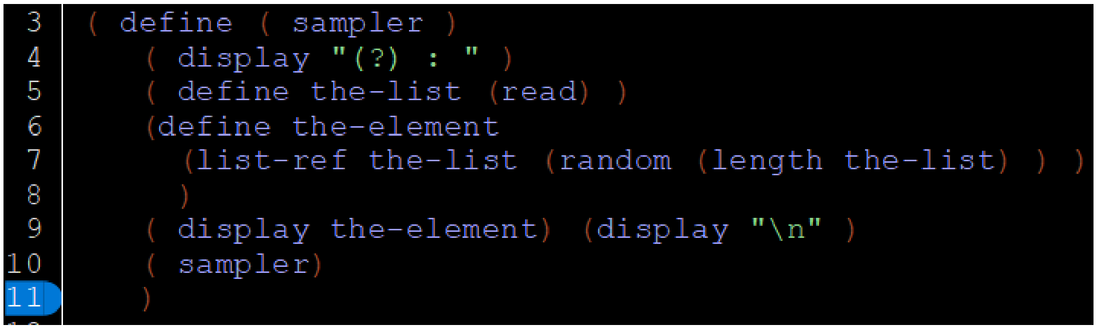
```
> ( define colors ' (red blue yellow orange) )
> colors
'(red blue yellow orange)
> 'colors
'colors
> ( quote colors)
'colors
> ( car colors )
'red
> ( cdr colors )
'(blue yellow orange)
> ( car (cdr colors) )
'blue
> ( cdr ( cdr colors) )
'(yellow orange)
> ( cadr colors)
'blue
> ( cddr colors)
'(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) )
> ( 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)
```

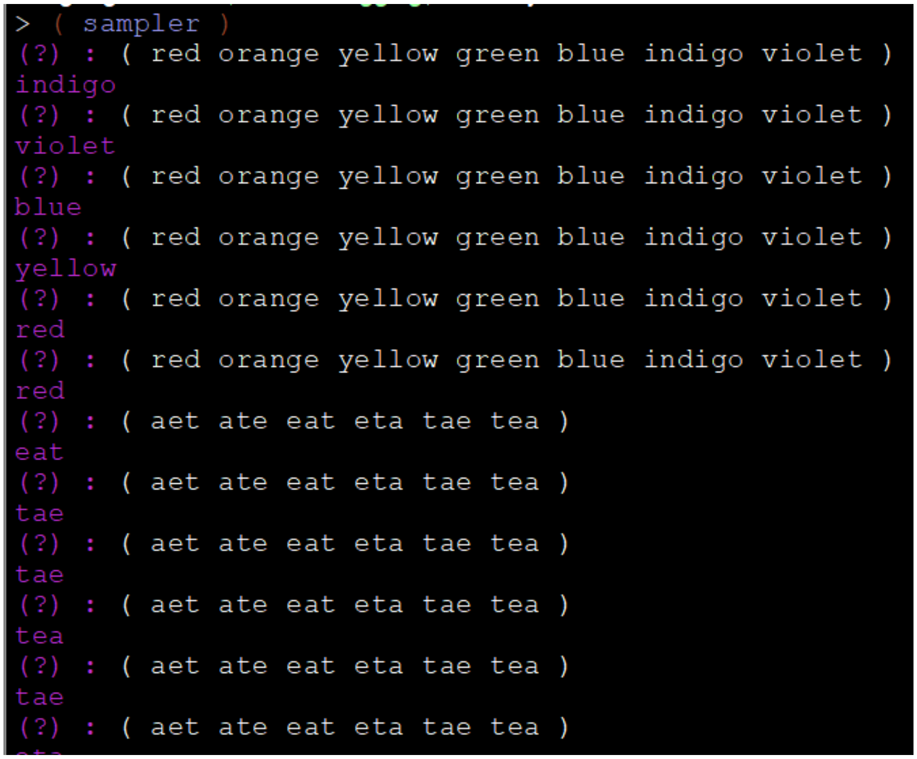
## Task 3: The Sampler Program

## Code:

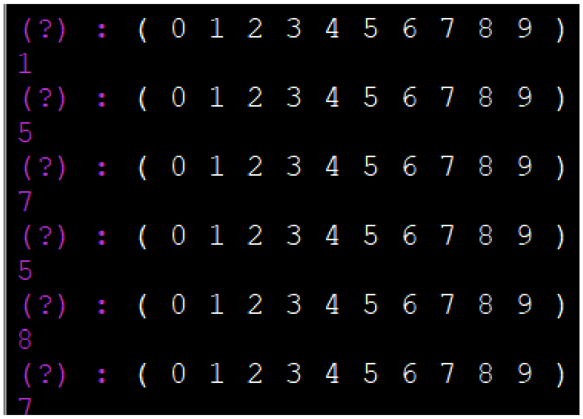


```
( define ( sampler )
    ( display "(?) : " )
    ( define the-list (read) )
    (define the-element
      (list-ref the-list (random (length the-list) ) )
      )
    ( display the-element) (display "\n" )
    ( sampler)
    )
```

## Demo:



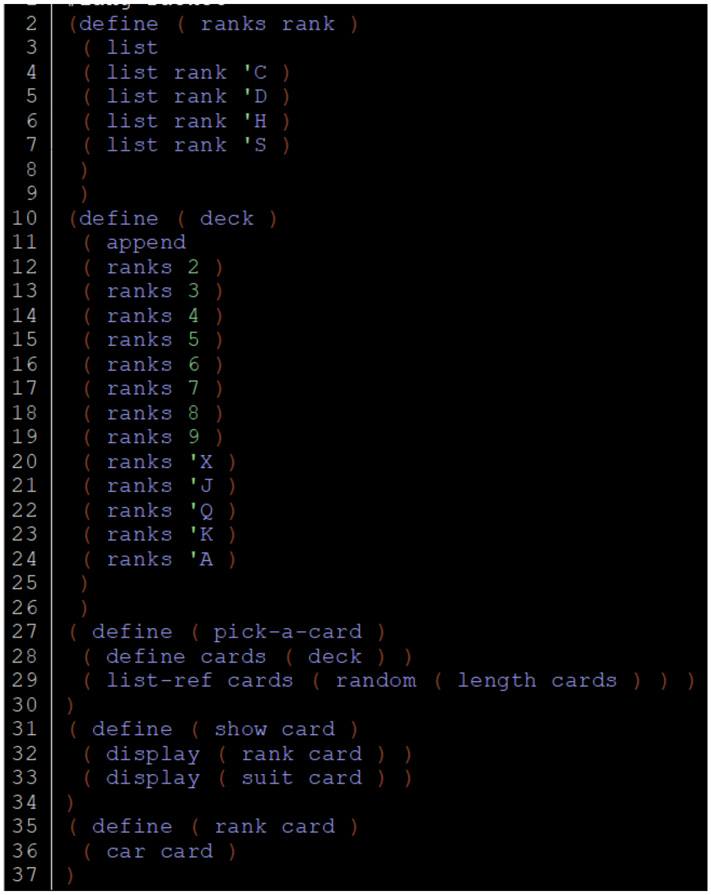
```
> ( sampler )
(?) : ( red orange yellow green blue indigo violet )
indigo
(?) : ( red orange yellow green blue indigo violet )
violet
(?) : ( red orange yellow green blue indigo violet )
blue
(?) : ( red orange yellow green blue indigo violet )
yellow
(?) : ( red orange yellow green blue indigo violet )
red
(?) : ( red orange yellow green blue indigo violet )
red
(?) : ( aet ate eat eta tae tea )
eat
(?) : ( aet ate eat eta tae tea )
tae
(?) : ( aet ate eat eta tae tea )
tae
(?) : ( aet ate eat eta tae tea )
tea
(?) : ( aet ate eat eta tae tea )
tae
(?) : ( aet ate eat eta tae tea )
eta
```



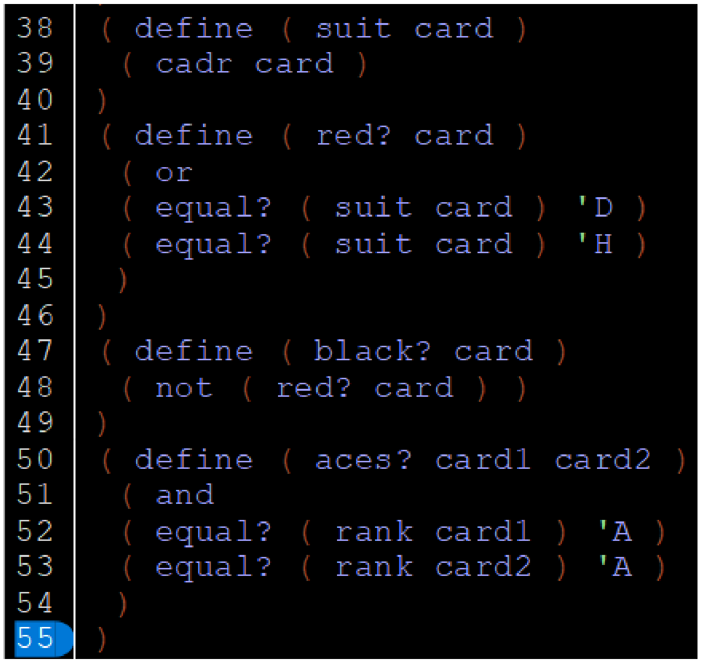
```
(?) : ( 0 1 2 3 4 5 6 7 8 9 )
1
(?) : ( 0 1 2 3 4 5 6 7 8 9 )
5
(?) : ( 0 1 2 3 4 5 6 7 8 9 )
7
(?) : ( 0 1 2 3 4 5 6 7 8 9 )
5
(?) : ( 0 1 2 3 4 5 6 7 8 9 )
8
(?) : ( 0 1 2 3 4 5 6 7 8 9 )
7
```

# Task 4: Playing Cards

## Code:

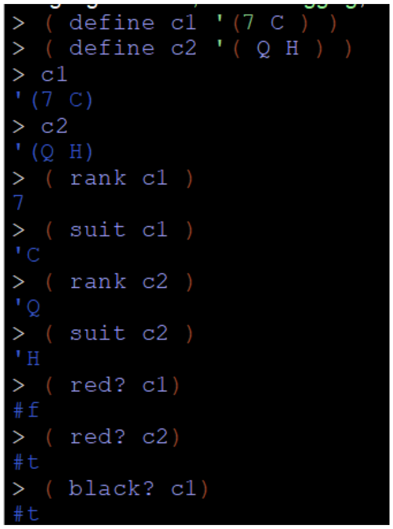


```
(define ( ranks rank )
 ( list
 ( list rank 'C )
 ( list rank 'D )
 ( list rank 'H )
 ( list rank 'S )
 )
 )
(define ( deck )
 ( append
 ( ranks 2 )
 ( ranks 3 )
 ( ranks 4 )
 ( ranks 5 )
 ( ranks 6 )
 ( ranks 7 )
 ( ranks 8 )
 ( ranks 9 )
 ( ranks 'X )
 ( ranks 'J )
 ( ranks 'Q )
 ( ranks 'K )
 ( 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 )
)
```

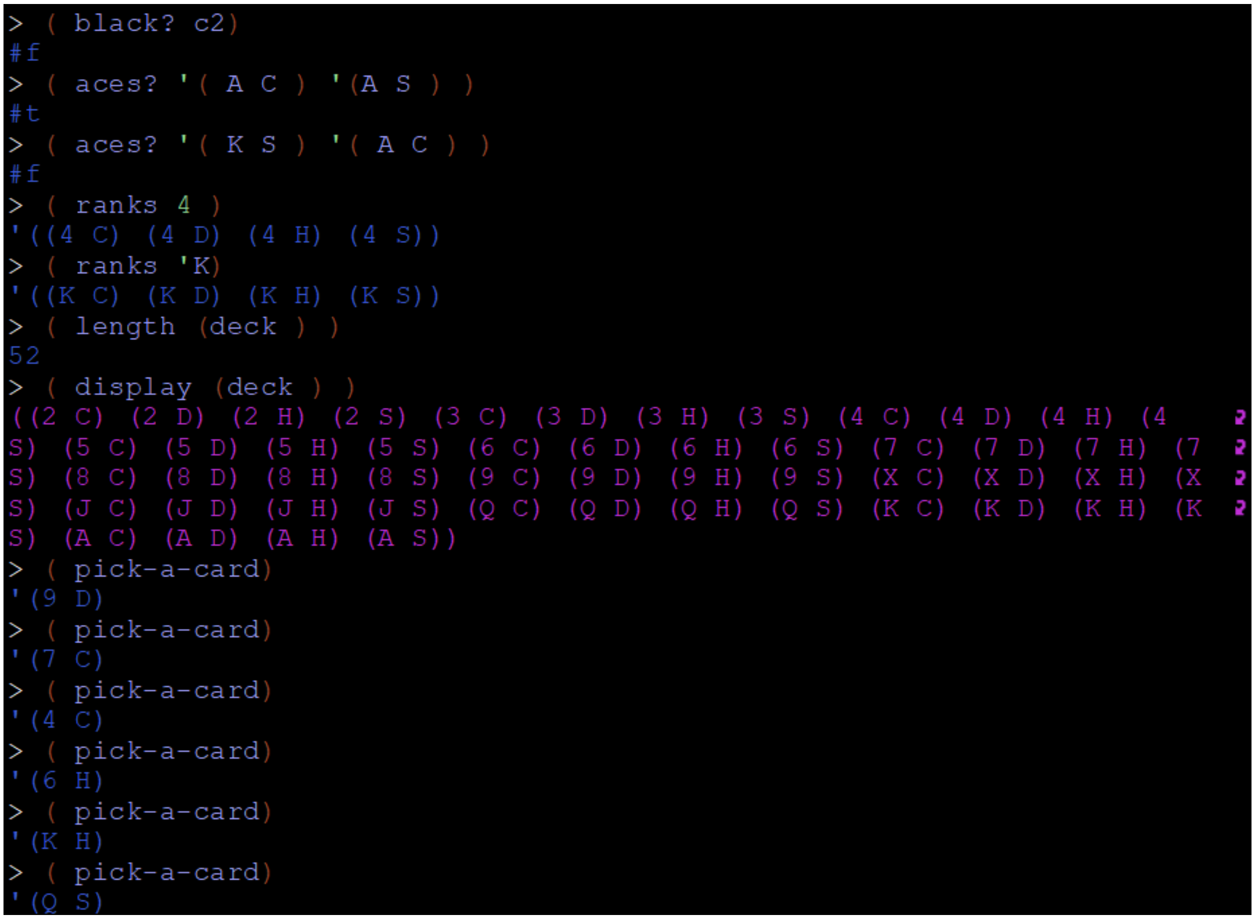


```
( define ( suit card )
 ( cadr card )
)
( define ( red? card )
 ( or
 ( equal? ( suit card ) 'D )
 ( equal? ( suit card ) 'H )
 )
)
( define ( black? card )
 ( not ( red? card ) )
)
( define ( aces? card1 card2 )
 ( and
 ( equal? ( rank card1 ) 'A )
 ( equal? ( rank card2 ) 'A )
 )
)
```

# 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
> ( 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)
'(9 D)
> ( pick-a-card)
'(7 C)
> ( pick-a-card)
'(4 C)
> ( pick-a-card)
'(6 H)
> ( pick-a-card)
'(K H)
> ( pick-a-card)
'(Q S)
```