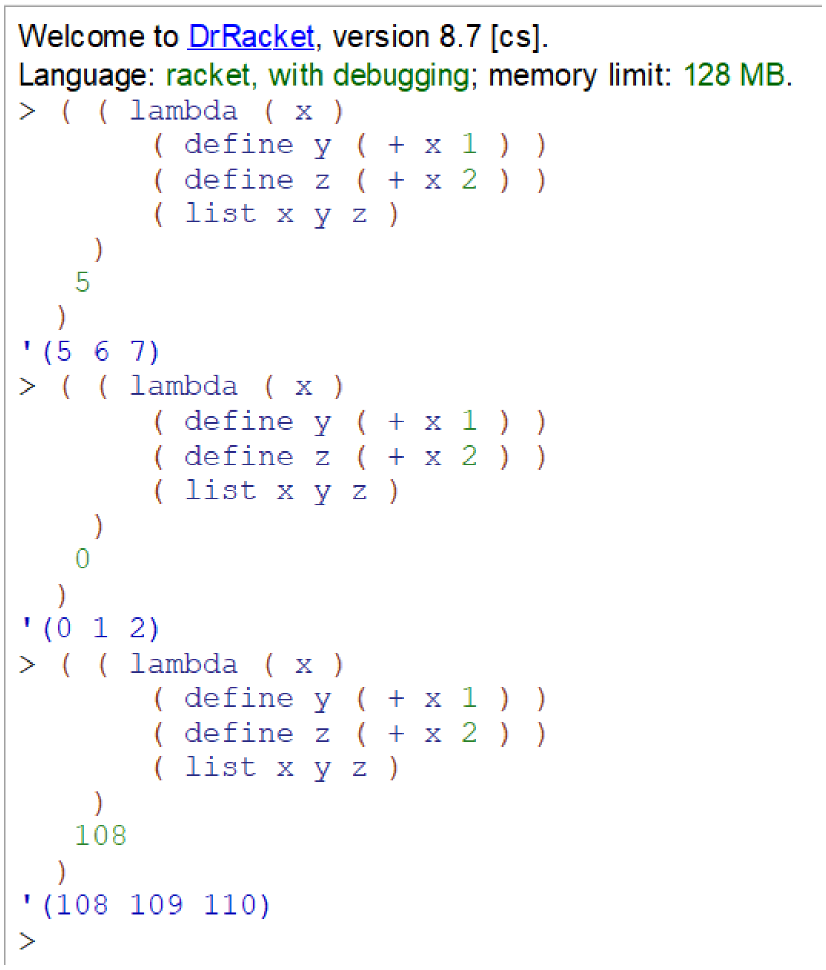
Errol Quinones CSC344 – Programming Languages

Racket Assignment #4: Lambda and Basic Lisp

ABSTRACT:

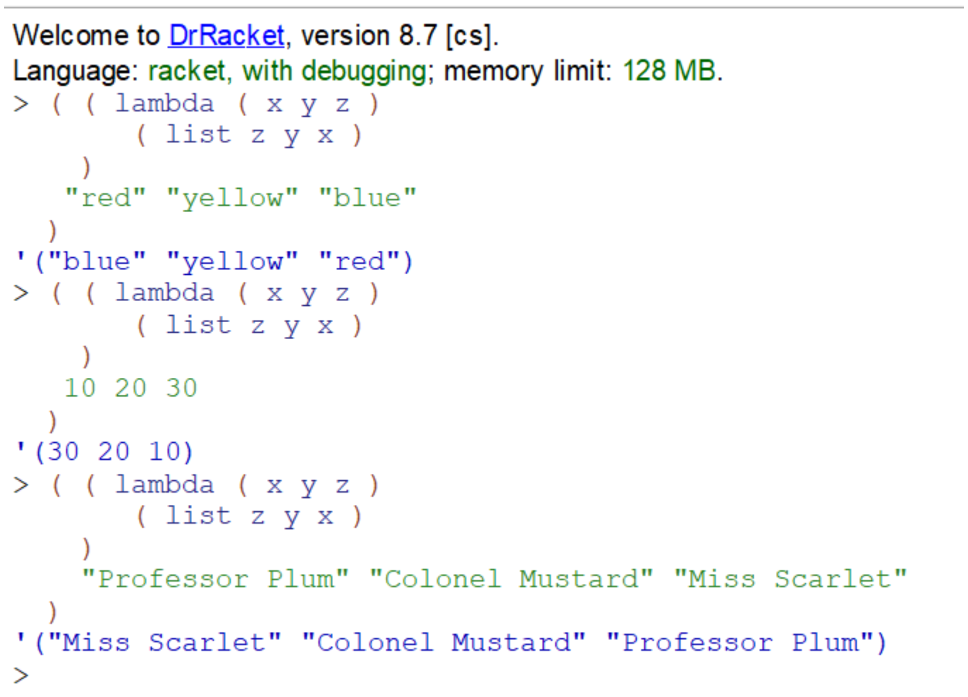
Task 1: Lambda

Demo for Task 1a - Three ascending integers:



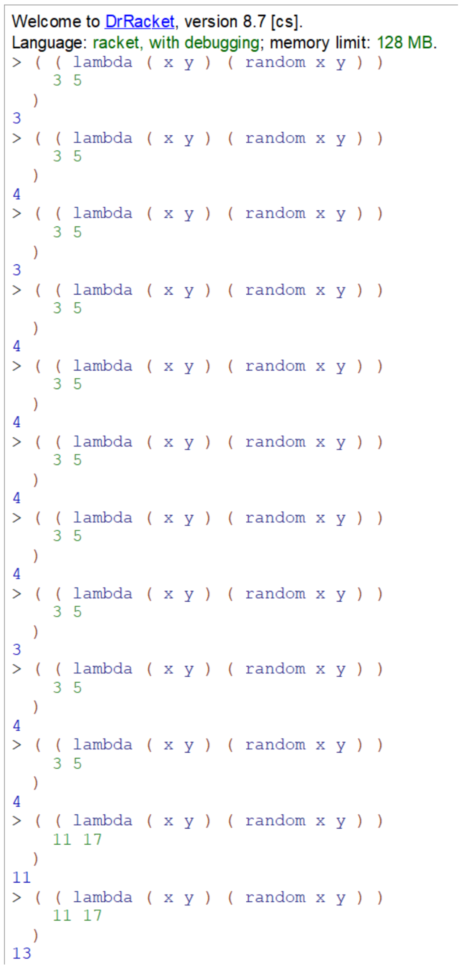
```
Welcome to DrRacket, version 8.7 [cs].
Language: racket, with debugging; memory limit: 128 MB.
> ( ( lambda ( x )
        ( define y ( + x 1 ) )
        ( define z ( + x 2 ) )
        ( list x y z )
    )
    5
  )
'(5 6 7)
> ( ( lambda ( x )
        ( define y ( + x 1 ) )
        ( define z ( + x 2 ) )
        ( list x y z )
    )
    0
  )
'(0 1 2)
> ( ( lambda ( x )
        ( define y ( + x 1 ) )
        ( define z ( + x 2 ) )
        ( list x y z )
    )
    108
  )
'(108 109 110)
>
```

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

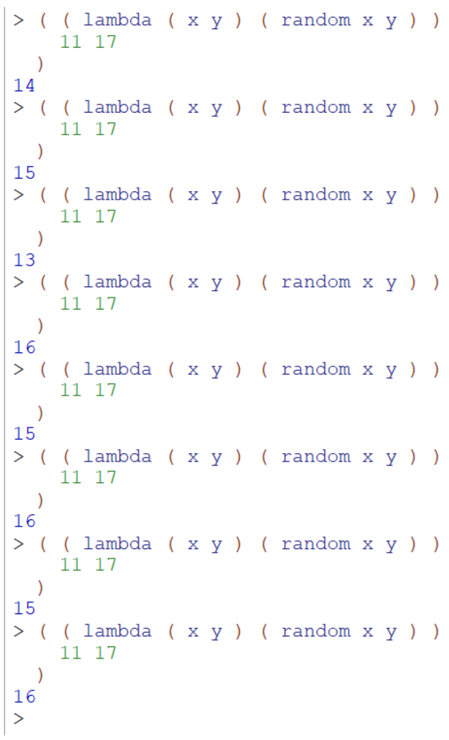


```
Welcome to DrRacket, version 8.7 [cs].
Language: racket, with debugging; memory limit: 128 MB.
> ( ( lambda ( x y z )
        ( list z y x )
    )
   "red" "yellow" "blue"
  )
'("blue" "yellow" "red")
> ( ( lambda ( x y z )
        ( list z y x )
    )
   10 20 30
  )
'(30 20 10)
> ( ( lambda ( x y z )
        ( list z y x )
    )
    "Professor Plum" "Colonel Mustard" "Miss Scarlet"
  )
'("Miss Scarlet" "Colonel Mustard" "Professor Plum")
>
```

Demo for Task 1c - Random number generator:



```
Welcome to DrRacket, version 8.7 [cs].
Language: racket, with debugging; memory limit: 128 MB.
> ( ( lambda ( x y ) ( random x y ) )
    3 5
  )
3
> ( ( lambda ( x y ) ( random x y ) )
    3 5
  )
4
> ( ( lambda ( x y ) ( random x y ) )
    3 5
  )
3
> ( ( lambda ( x y ) ( random x y ) )
    3 5
  )
4
> ( ( lambda ( x y ) ( random x y ) )
    3 5
  )
4
> ( ( lambda ( x y ) ( random x y ) )
    3 5
  )
4
> ( ( lambda ( x y ) ( random x y ) )
    3 5
  )
4
> ( ( lambda ( x y ) ( random x y ) )
    3 5
  )
3
> ( ( lambda ( x y ) ( random x y ) )
    3 5
  )
4
> ( ( lambda ( x y ) ( random x y ) )
    3 5
  )
4
> ( ( lambda ( x y ) ( random x y ) )
    11 17
  )
11
> ( ( lambda ( x y ) ( random x y ) )
    11 17
  )
13
```



```
> ( ( lambda ( x y ) ( random x y ) )
    11 17
  )
14
> ( ( lambda ( x y ) ( random x y ) )
    11 17
  )
15
> ( ( lambda ( x y ) ( random x y ) )
    11 17
  )
13
> ( ( lambda ( x y ) ( random x y ) )
    11 17
  )
16
> ( ( lambda ( x y ) ( random x y ) )
    11 17
  )
15
> ( ( lambda ( x y ) ( random x y ) )
    11 17
  )
16
> ( ( lambda ( x y ) ( random x y ) )
    11 17
  )
15
> ( ( lambda ( x y ) ( random x y ) )
    11 17
  )
16
>
```

Task 2: List Processing References and Constructors

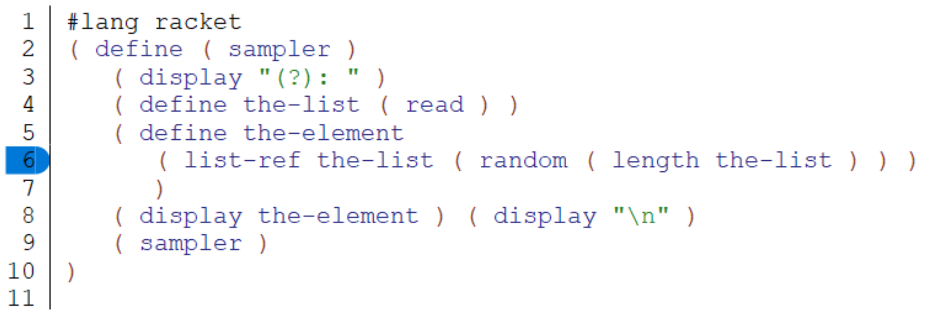
Demo:

```
Welcome to DrRacket, version 8.7 [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: bad syntax (multiple expressions after identifier) in: (define x ’ (1 one))
> ( 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)
>
```

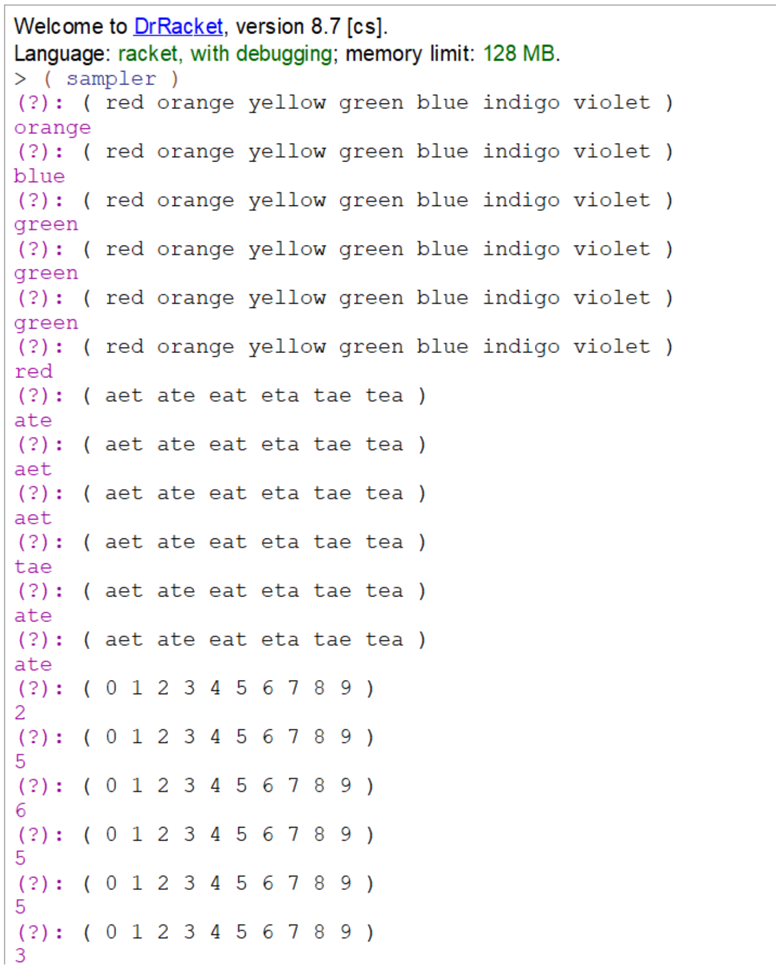
Task 3: The Sampler Program

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 )
)

```

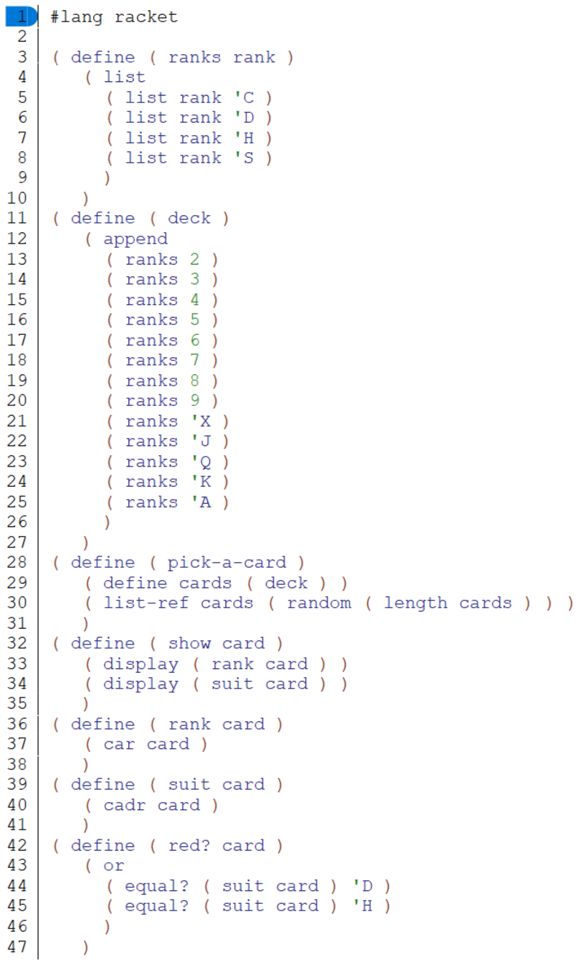
Demo:



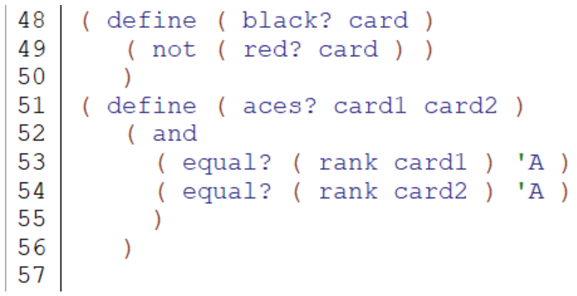
```
Welcome to DrRacket, version 8.7 [cs].
Language: racket, with debugging; memory limit: 128 MB.
> ( sampler )
(?): ( red orange yellow green blue indigo violet )
orange
(?): ( red orange yellow green blue indigo violet )
blue
(?): ( red orange yellow green blue indigo violet )
green
(?): ( red orange yellow green blue indigo violet )
green
(?): ( red orange yellow green blue indigo violet )
green
(?): ( red orange yellow green blue indigo violet )
red
(?): ( aet ate eat eta tae tea )
ate
(?): ( aet ate eat eta tae tea )
aet
(?): ( aet ate eat eta tae tea )
aet
(?): ( aet ate eat eta tae tea )
tae
(?): ( aet ate eat eta tae tea )
ate
(?): ( aet ate eat eta tae tea )
ate
(?): ( 0 1 2 3 4 5 6 7 8 9 )
2
(?): ( 0 1 2 3 4 5 6 7 8 9 )
5
(?): ( 0 1 2 3 4 5 6 7 8 9 )
6
(?): ( 0 1 2 3 4 5 6 7 8 9 )
5
(?): ( 0 1 2 3 4 5 6 7 8 9 )
5
(?): ( 0 1 2 3 4 5 6 7 8 9 )
3
```

Task 4: Playing Cards

<u>Code:</u>

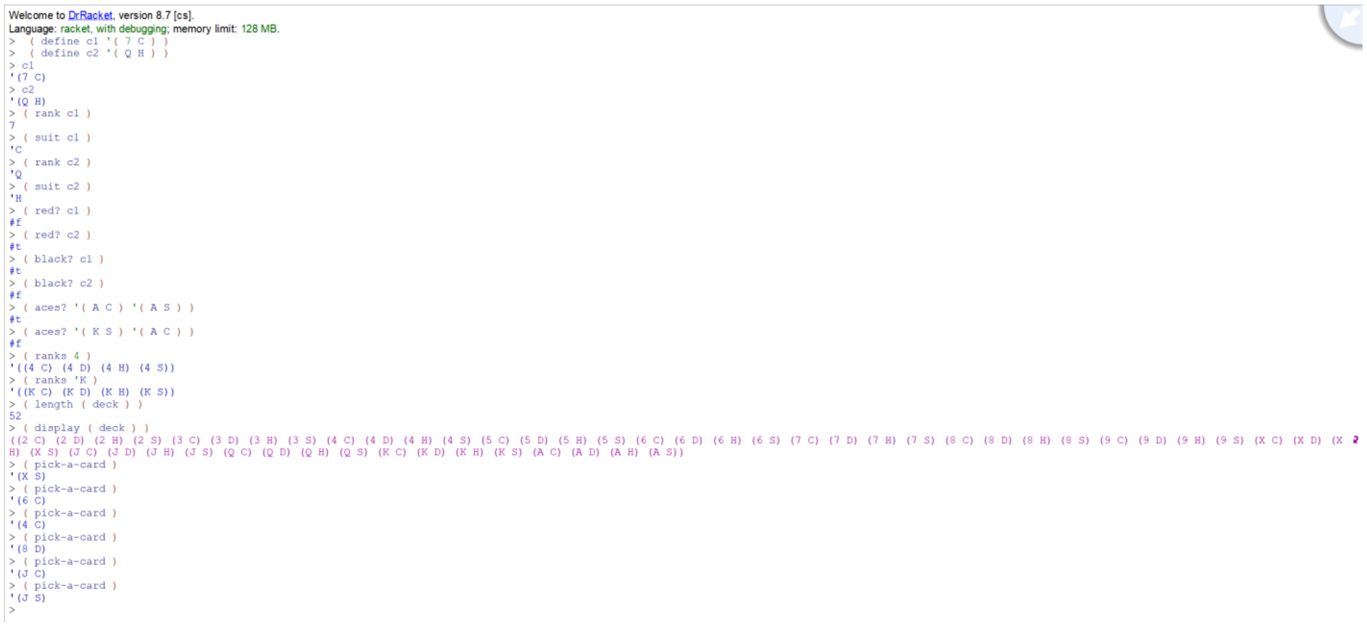


```
#lang racket

( 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 )
     )
   )

```

<u>Demo:</u>



```
Welcome to DrRacket, version 8.7 [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 )
'(X S)
> ( pick-a-card )
'(6 C)
> ( pick-a-card )
'(4 C)
> ( pick-a-card )
'(8 D)
> ( pick-a-card )
'(J C)
> ( pick-a-card )
'(J S)
>
```