Errol Quinones CSC344 – Programming Languages

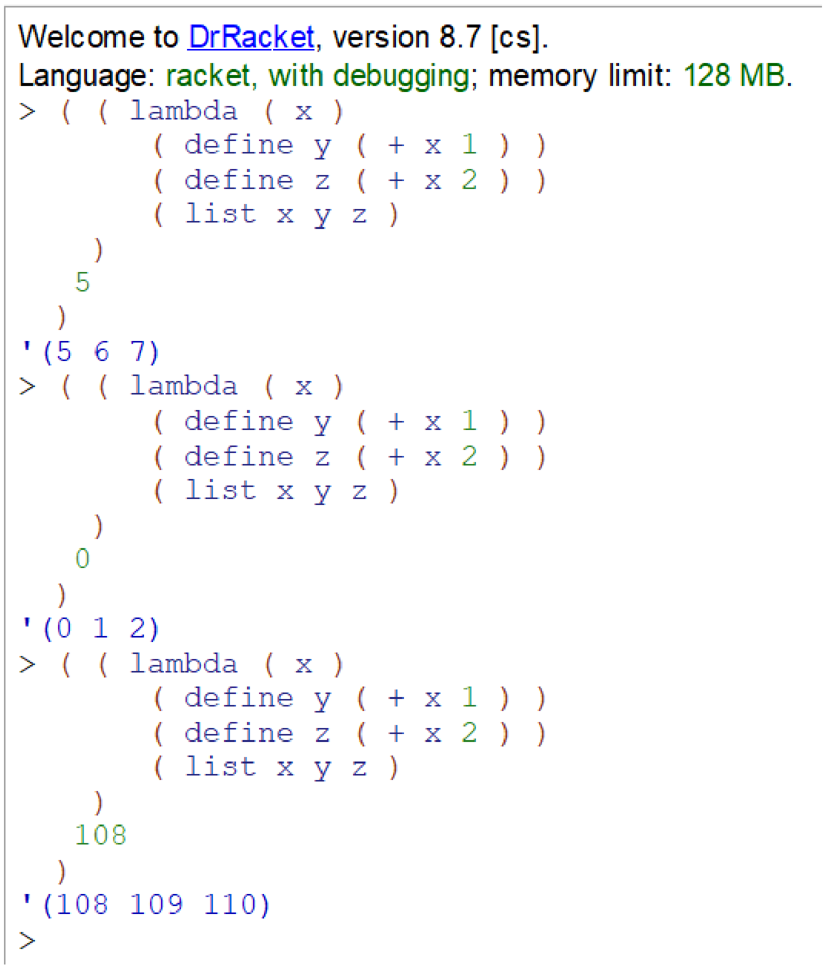
Racket Assignment #4: Lambda and Basic Lisp

ABSTRACT:

The fourth Racket Programming Assignment aims to evaluate the students' understanding of lambda functions and basic Lisp concepts. This assignment contains four tasks, the first one relating to lambda functions and the other three aim to familiarize the students with the material presented in Racket Lesson #5 on basic Lisp processing.

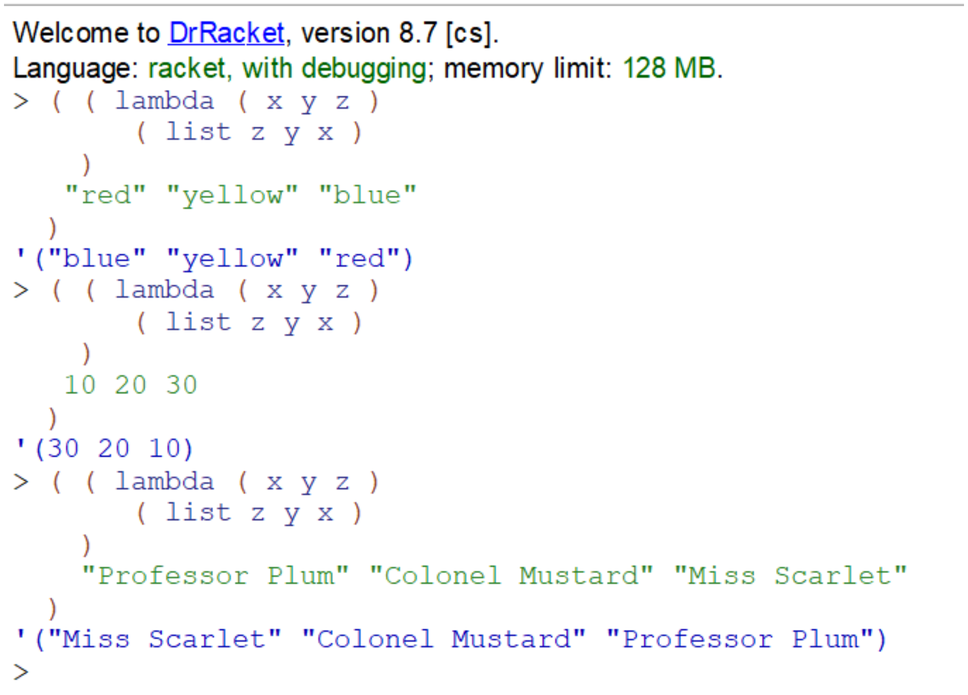
Task 1: Lambda

Demo for Task 1a - Three ascending integers:



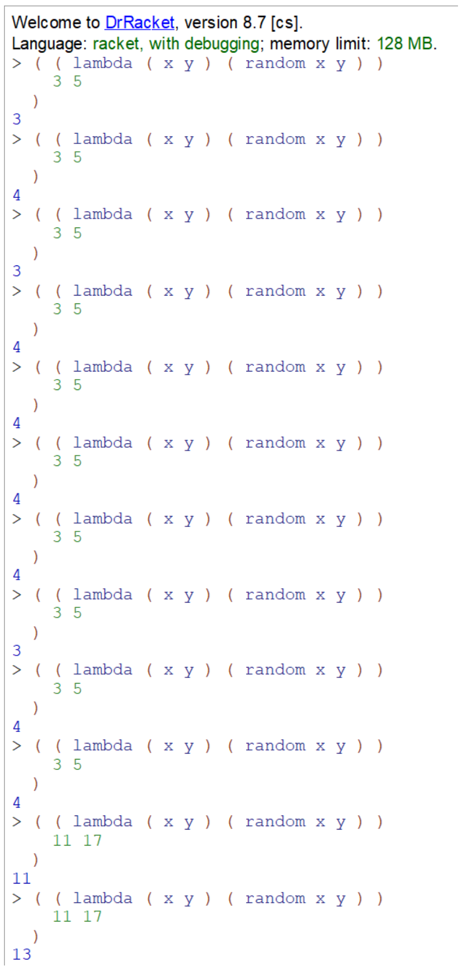
```
Welcome to DrRacket, version 8.7 [cs].
Language: racket, with debugging; memory limit: 128 MB.
> ( ( lambda ( x )
        ( define y ( + x 1 ) )
        ( define z ( + x 2 ) )
        ( list x y z )
    )
   5
  )
'(5 6 7)
> ( ( lambda ( x )
        ( define y ( + x 1 ) )
        ( define z ( + x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

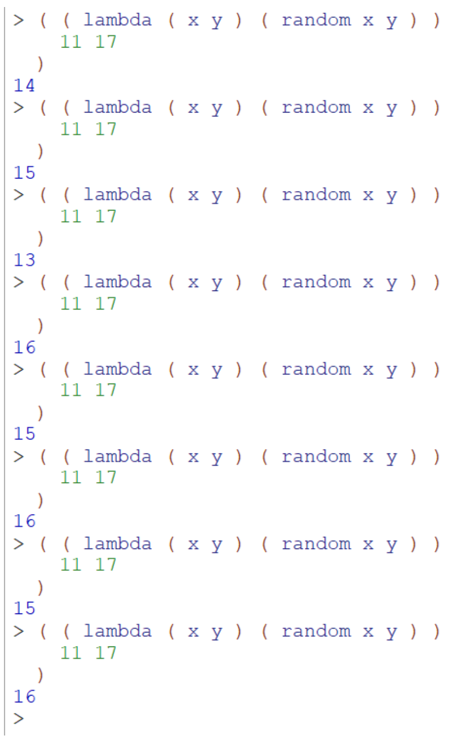


```
Welcome to DrRacket, version 8.7 [cs].
Language: racket, with debugging; memory limit: 128 MB.
> ( ( lambda ( x y z )
        ( list z y x )
    )
   "red" "yellow" "blue"
  )
'("blue" "yellow" "red")
> ( ( lambda ( x y z )
        ( list z y x )
    )
   10 20 30
  )
'(30 20 10)
> ( ( lambda ( x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

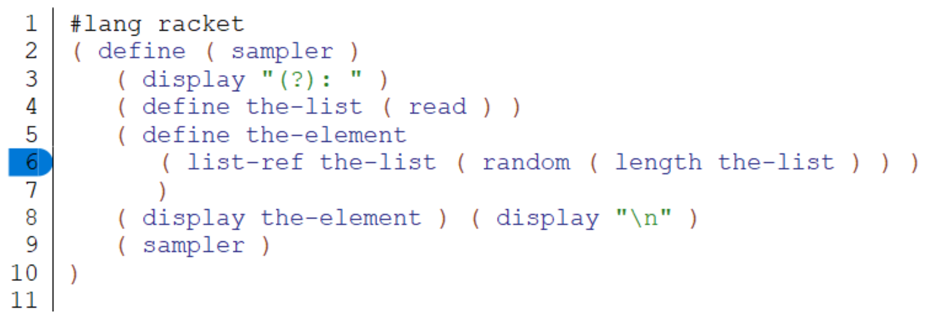
Demo:

```
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)
>
```

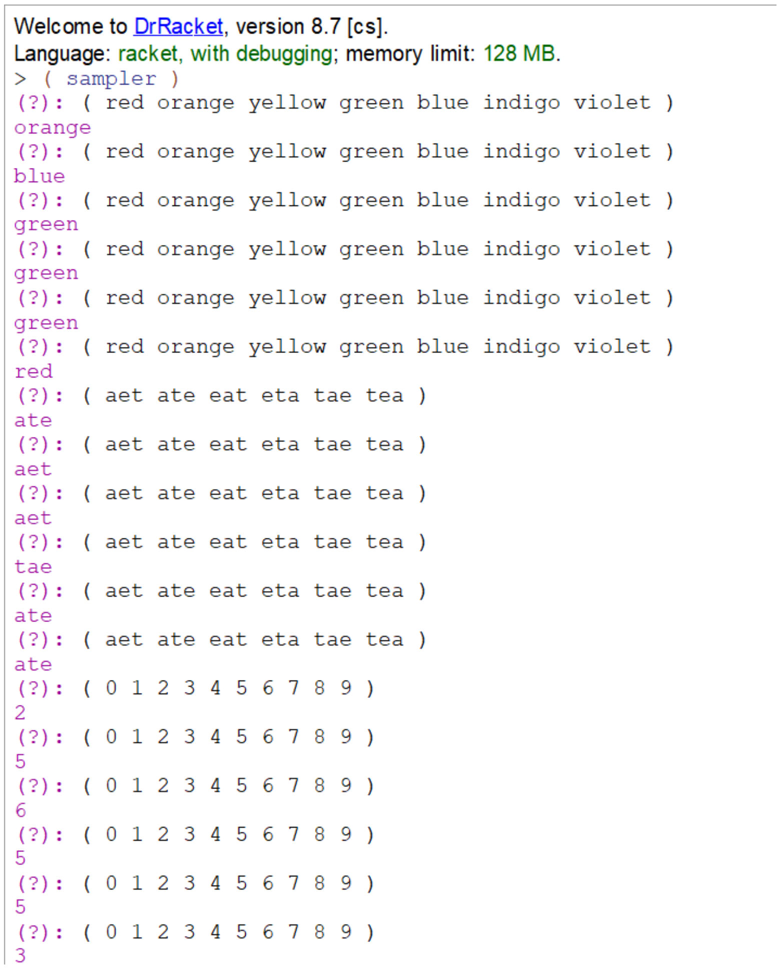
Task 3: The Sampler Program

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:

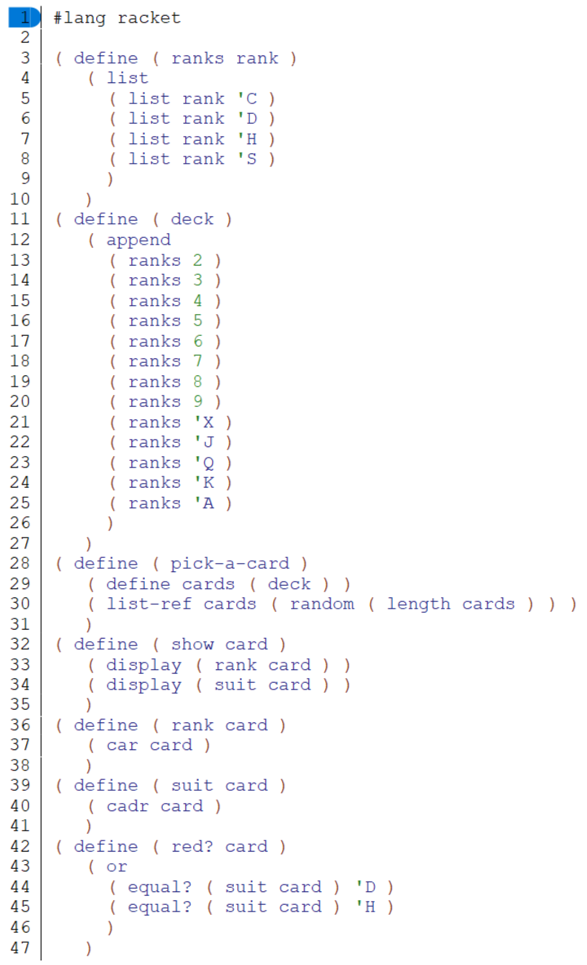


```
Welcome to DrRacket, version 8.7 [cs].
Language: racket, with debugging; memory limit: 128 MB.
> ( sampler )
(?): ( red orange yellow green blue indigo violet )
orange
(?): ( red orange yellow green blue indigo violet )
blue
(?): ( red orange yellow green blue indigo violet )
green
(?): ( red orange 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
```

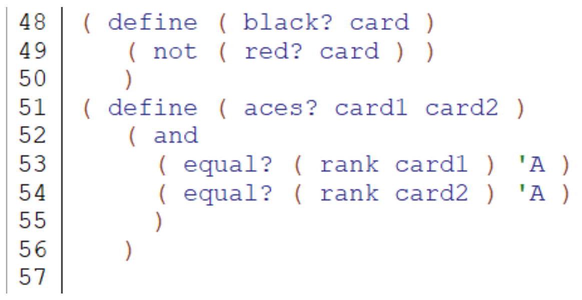
Task 4: Playing Cards

___

Code:

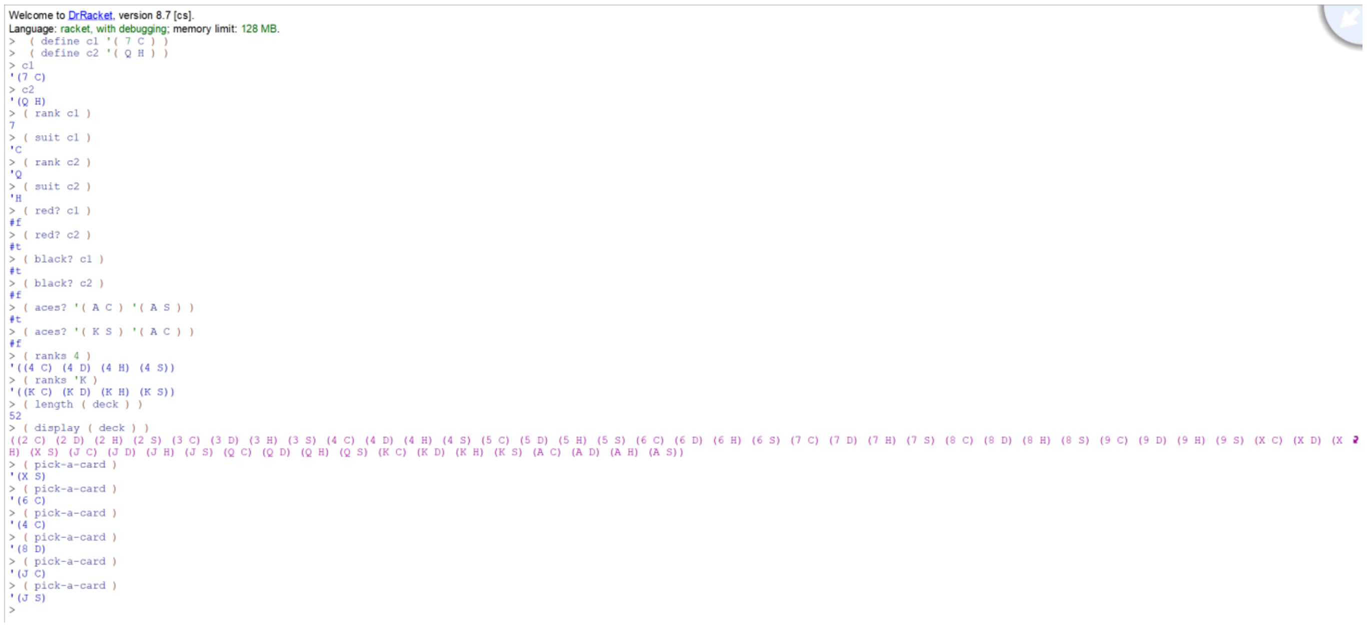


```
#lang racket

( 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 8.7 [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)
>
```