More Practice with Racket

Computer Science 61AS

The Basics of Racket

1. What notation does Racket use and what are the benefits of using it?

Solution: Racket uses prefix notation which means that the operator is put at the beginning of the expression and followed by its arguments. For example: (+ 3 4)

This allows the user to nest expressions within each other and for mathematics operations that can take more than one argument to do so without needing another sign. For example:

(+ (* 4 3) (- 4 2)) -> 14
(+ 3 4 5 6) -> 18

2. What do we mean by ‘functional programing’?

Solution: Functional programming is the idea that we can express a variety of computational algorithms by using the value returned by one function as an argument to another function.

Words and Sentences with Racket

What will the following expressions return?

1. (first '(hello there))

Solution: hello

2. (bf '(hello there))
Solution: (there) Note how the word (there) is in parentheses. This means that it is a sentence even if it is a one word sentence.

3. (define (polite sentence) (sentence ’please sentence))
   (polite ’(go to the mall))

Solution: error

Booleans, Predicates and Special Forms

1. What are booleans?

Solution: Booleans are a data type with only two possible values true or false denoted by #t and #f, respectively.

2. What are predicates?

Solution: Predicates are functions that return a true or false value.

3. Why does new-if not work exactly the same as if?

(define (new-if predicate if-true if-false)
  (if predicate if-true if-false))

Solution: new-if doesn’t work because it is not a special form. Unlike the normal if, new-if will evaluate all of the arguments you present it with; therefore, it will evaluate both the if-true and if-false value which is not what you want.

4. What do the following expressions evaluate to?

a. (= (+ 2 2) 5)

Solution: #f

b. (if ’happy
   ’(i am happy)
   (/ 1 0))
Solution: ‘(i am happy)

c. (equal? ‘there (bf '(hello there)))

Solution: #f. Remember, bf returns a sentence with everything but the first word. This means that (bf '(hello there)) returns a one word sentence (there). This is not equal to the word ‘there.

5. Write a procedure num-name that takes in single digit numbers and outputs the word equivalent. Example: (num-name 3) Returns: three

Solution:

(define (num-name number)
  (cond ((= number 0) ’zero)
        ((= number 1) ’one)
        ((= number 2) ’two)
        ((= number 3) ’three)
        ((= number 4) ’four)
        ((= number 5) ’five)
        ((= number 6) ’six)
        ((= number 7) ’seven)
        ((= number 8) ’eight)
        ((= number 9) ’nine)))

Domain and Range

Domain and range in CS are just like domain and range from math. The domain of a procedure is the type(s) of arguments that it can accept and the range of a procedure is the type of the output.

1. What is the domain and range of last?

Solution: domain - word or sentence; range - word

2. What is the domain and range of +?

Solution: domain - number, number, number...; range - number
3. Find and fix the bugs in the following code which finds the color of a card. Cards are represented as a sentence with their value as the first word and the suit as the second word. For example, the Jack of Hearts is '(jack hearts) and 9 of Spades is '(nine spades)

(define (card-color sent)
  (if (or (= (last sent) 'hearts)
         (= (last sent) 'diamonds))
      'red
      'black))

Solution: The domain of = is a number. Because the (last sent) is a word and not a number, the above code is not correct. The = should be replaced with equal?.