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**CS 250**

**Lab 15**

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**Assignment 15: Racket Expressions**

**Use *ONLY* first, rest, and cons.**

**Section A.** Given the following definitions:

|  |  |  |
| --- | --- | --- |
| **Variable** | **Definition** | **Note:**  You are defining **Jane** as an **atom**;  therefore **e** will be equal to **Jane**, *not* **(Jane)** |
| **a** | ‘( ) |
| **b** | ‘( ( ) ( ) ( ) ) |
| **c** | ‘(Bob (Jane) ) |
| **d** | ‘( ( (Bob) (Jane) ) ) |
| **e** | ‘Jane |
| **f** | ‘( (Bob) Jane) |

Evaluate the following expressions and write your answer in the appropriate space. If the expression cannot be evaluated, write “Cannot be evaluated”.

|  |  |
| --- | --- |
| (first a) | Cannot be evaluated. |
| (first b) | '( ) |
| (first c) | 'Bob |
| (first d) | '( (Bob) (Jane) ) |
| (first e) | Cannot be evaluated. |
| (rest f) | '(Jane) |
| (rest c) | '( (Jane) ) |
| (rest d) | '( ) |
| (rest e) | Cannot be evaluated. |
| (cons a c) | '( ( ) Bob (Jane) ) |
| (cons a d) | '( ( ) ( (Bob) (Jane) ) ) |
| (cons a e) | '( ( ) . Jane) |
| (cons f c) | '( ( (Bob) Jane) Bob (Jane) ) |
| (cons e d) | '( Jane ( (Bob) (Jane) ) ) |
| (cons a (rest c)) | '( ( ) (Jane) ) |
| (cons e (rest f)) | '(Jane Jane) |
| (cons f (rest a)) | Cannot be evaluated. |
| (cons a (rest b)) | '( ( ) ( ) ( ) ) |
| (first (rest f)) | 'Jane |
| (first (rest (first d))) | '(Jane) |
| (first (rest (cons a f))) | '(Bob) |
| (rest (rest d)) | Cannot be evaluated. |
| (first (rest f)) | 'Jane |

**Section B.** Given the following definitions:

|  |  |
| --- | --- |
| **Variable** | **Definition** |
| **a** | ‘(5 4 3 2 1) |
| **b** | ‘( (5) ( (4) (3) 3 ( (2) ) ) ) |
| **c** | ‘(5 (4 (3 (2 (1) ) ) ) ) |
| **x** | ‘(a b c (d) e f) |
| **y** | ‘((5) ((4 3) 2 (1))) |

Write an expression that will output the following:

|  |  |  |
| --- | --- | --- |
| **Using…** | **Output should be…** | **What is the expression?** |
| List **a** | '(4 3 2 1) | (rest a) |
| '(3 2 1) | (rest (rest a)) |
| 4 | (first (rest a)) |
| List **b** | '((4) (3) 3 ((2))) | (first(rest b)) |
| '((3) 3 ((2))) | (rest(first(rest b))) |
| '() | (rest (rest b)) |
| List **c** | '(4 (3 (2 (1)))) | (first (rest c)) |
| 5 | (first c) |
| '((3 (2 (1)))) | Cannot be evaluated. |
| List **x** and **y** | '(a 5) | (cons (first x) (first y)) |
| '(b ((4 3) 2 (1))) | (cons (first(rest x) ) (rest y)) |
| '((5) a b c (d) e f) | (cons (first y) x) |

**Section C.** Given the following infix expressions, change them to prefix notation and compute the result.

|  |  |  |
| --- | --- | --- |
| **Infix expression** | **Prefix expression** | **Result** |
| (8 + 6) \* ((1 + 2) - 3) | (\* (+ 8 6) (- (+ 1 2) 3)) | 0 |
| 9 \* 3 – 2 + 4 \* 6 / 2 | (+(-(\* 9 3) 2) (/(\* 4 6) 2)) | 37 |

**Section D.** Given the following prefix expressions, change them to infix notation and compute the result.

|  |  |  |
| --- | --- | --- |
| **Prefix expression** | **Infix expression** | **Result** |
| (+ (\* 4 5) (/ 9 3)) | 4 \* 5 + 9 / 3 | 23 |
| (\* 3 (+ 2 (/ 8 4) ) ) | 3 \* (2 + 8 / 4) | 12 |