

Worksheet: L02 – Lisp Introduction

CSCI-534: Robot Planning & Manipulation

Spring 2020

<http://www.neil.dantam.name/rpm/B02-lisp.pdf>

1. **Lisp Equality Operators:** Evaluate the following Common Lisp expressions:

- (a) `(not 0)`
- (b) `(not 1)`
- (c) `(eq t (not nil))`
- (d) `(eq t 1)`
- (e) `(eq nil (not 1))`
- (f) `(eq nil (not "a"))`
- (g) `(eq (list "a" "b") (list "a" "b"))`
- (h) `(equal (list "a" "b") (list "a" "b"))`
- (i) `(eq (list "a" "b") (list "a" "B"))`
- (j) `(equal (list "a" "b") (list "a" "B"))`
- (k) `(equalp (list "a" "b") (list "a" "B"))`

2. **Function Definition:** Write a Common Lisp function for $\text{sinc } \theta = \frac{\sin \theta}{\theta}$

3. **IF:** Write a Common Lisp function for $\text{sinc}(\theta) = \begin{cases} 1 & \text{if } \theta = 0 \\ \frac{\sin \theta}{\theta} & \text{if } \theta \neq 0 \end{cases}$

4. **COND:** Write a Common Lisp function for $\text{sinc}(\theta) = \begin{cases} 1 & \text{if } \theta = 0 \\ 1 - \frac{\theta^2}{6} + \frac{\theta^4}{120} & \text{if } 0 < \theta^2 < .00001 \\ \frac{\sin \theta}{\theta} & \text{otherwise} \end{cases}$

Name:

5. **Recursion:**

(a) Write a Common Lisp function to compute the i^{th} Fibonacci number: (1, 1, 2, 3, 5, 8, 13, 21, 34, 55, ...):

(b) Write recursive function to accumulate (sum) elements in a list

(c) Trace the execution of your accumulate function on (1 2 3).

6. **RK2:** Write a Common Lisp function to compute one step of a Runge-Kutta 2, Heun's Method, numerical integrator:

7. **RK2:** Write a Common Lisp function to compute one step of a Runge-Kutta 4 numerical integrator:

8. **Multi-method Integration:** Write a Common Lisp function to perform numerical integration using any Runge-Kutta step function passed as a parameter.

9. **Fold-Left:** Write a Common Lisp function to reverse a list, using `fold-left` / `reduce`.