

Scheme

CS 152

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## 1. Basic Arithmetic

+, -, \*, and / represent addition, subtraction, multiplication, and division respectively.

### 1.1. Example(s)

( + 1 2 )

## 2. Other Arithmetic Operation

- quotient
- remainder
- modulo
- sqrt
- exp
- log
- trigonometry
  - sin
  - cos
  - tan
  - asin
  - acos
  - atan

## 3. Lists

### 3.1. Cons Cells

- Memory spaces which stores two addresses.
  - **car** The part storing the address to 1
  - **cdr** The part storing the address to 2
- Made by function cons.

#### 3.1.1. Lists

- Lists are beaded cons cells with the cr part of the last cons cell being ' ()
- ' () is called the empty List

## 4. atoms

- Data structures that do not use cons cells
- Numbers, characters, strings, vectors, and ' () are atom
- ' () is an atom and a list

## 5. quotient

- A special form named quote is used to prevent tokens from evaluation
- symbol '

### 5.1. Special forms

## 6. Functions car and cdr

- If the value of car is a beaded cons cell, it returns the address of the first element of the list.

## 7. Function List

## 8. Defining Functions

### 8.1. Hello World

```
; Hello world as a variable
(define vhello "Hello World")

(cd "C:\\doc\\scheme")
(load "hello.scm")
```

### 8.2. With parameters

```
; farg.scm
(define hello
  (lambda (name)
    (string-append "Hello " name)))

; main.scm
(load "farg.scm")
(hello "World")
```

#### 8.2.1. Another form

```
(define (hello name)
  (string-append "Hello " name "!"))
```

## 9. Branching

### 9.1. The if expression

```
(if predicate then_value else_value)
```

## 10. and and or

### 10.1. and

```
(and 1 2 3) returns 3
```

- Return #f if any argument is #f

### 10.2. or

```
(or 1 2 3) returns 1
```

- Returns value of first argument which is not #f

## 11. cond expression

```
(cond
  (predicate_1 clauses_1)
  (predicate_2 clauses_2)
  ...
  (predicate_n clauses_n)
  (else clauses_else))
```

## 12. Functions that make predicates

### 12.1. eq?

- Compares addresses of two objects and returns #t if they are the same

### 12.2. eqv?

### 12.3. equal?

## 13. Functions that check data type

## 14. Local Variables

### 14.1. let expression

(let binds body)

- You can use let\* as syntactic sugar that doesn't need nesting for let to bind variables with nesting

#### 14.1.1. Example(s)

```
(let ((i 1) (j 2))
  (+ i j))
```

## 15. Repetition

### 15.1. Recursion

```
(define (fact n)
  (if (= n 1)
      1
      (* n (fact (- n 1)))))
```

### 15.2. Tail Recursion

```
(define (fact-tail n)
  (fact-rec n n))
```

```
(define (fact-rec n p)
  (if (= n 1)
      p
      (let ((m (- n 1)))
        (fact-rec m (* p m)))))
```

### 15.3. Named let

- Available to express a loop