

Clove-lang

Clove is a Java-based, interpreted, dynamically typed, general-purpose programming language. It is primarily a procedural language, but has functional programming features, such as lambda expressions, and the programs can be composed in ways that utilise the declarative paradigm. The language allows for defining immutable primitive values, but compound structures, such as lists, can still be changed, but not reassigned; otherwise, all values are mutable.

Common statements and expressions, such as loops, if-statements, variable and function declarations/calls/invocations are conventional and similar to other languages, namely JavaScript. Variable names cannot start with a number and must be preceded by either *let*/*const* keywords or their aliases.

Many keywords included in the language can be expressed in a bunch of ways – Clove-lang contains Polish translations of commonly used keywords. The translations can easily be expanded by slightly altering the grammar. These translations enable people not knowing English to start programming and familiarise themselves with programming concepts more easily.

Data types

The following data types are supported: integers, rational numbers, strings, booleans, anonymous objects, lists, arrays, and anonymous functions. The integer and rational types are in Java's *long* and *double* ranges respectively. The list type is similar in functionality to Python's *List* and JavaScript's *Array*. Array includes all the list's features, but has a fixed size. Anonymous function is unique in that it is a container for a function definition instead of being a standalone implementation of a type.

All the types evaluate to values that are treated similarly – they can be passed around, nested, evaluated, and returned from functions. It applies to both literals and dereferenced values. Some operations, such as addition, can be performed on mixed types, but there are reasonable restrictions, e.g. it is impossible to multiply a string by a number, but it is fine to add a number to a string.

Declarations and definitions

Declarations and definitions in Clove are similar to those in JavaScript. To define an empty list or anonymous object, their empty literals must be used. Functions can be defined in two ways: standalone, with the *function* keyword, or as an anonymous *value-function*. Examples of some common declarations and definitions can be seen below¹. The variables defined at the top are accessible from every subsequent block, therefore they have a 'global' scope in this example. Variables in function invocations or any other block are defined in their corresponding scope (are inaccessible from the outside) and removed after the block is finished.

```
let foo // Variable declaration
let num = 77 // Variable definition
var str = "bar" // 'let' and 'var' are equivalent
const pi = 3.14 // Constant definition
let flag = false // Boolean definition

function sumAndDouble(param1, param2) { // Function definition
  return (param1 + param2) * 2
}
const sq1 = fn(val) {return val * val} // Value-function definition
const sq2 = (val) => {return val * val} // Arrow function

let emptyList = [] // List declaration
let list = ["foo", "bar", "baz", 2000] // List definition
let emptyObject = {} // Anonymous object declaration
let object = { // Anonymous object definition
  key: "value"
}
let emptyArray[] // Array declaration -- 0 capacity
let emptyArrayWithCap[10] // Array declaration -- explicit capacity
let array[] = {str, list, object, flag} // Array definition -- implicit capacity
let arr2[15] = {"str", ["list"], false} // Array definition -- explicit capacity
```

¹More code snippets and example programs are available in the 'demonstrations' and 'examples' directories.

Prototype functions and shorthand operators

The string, list, array and anonymous object value-types have built-in prototype functions that can be accessed using the arrow-notation. Prototype functions are invoked just like normal functions, with the parentheses after the function's name. Clove also supports a few shorthand operators for reassignment and incrementation/decrementation. Examples shown below.

```
const list = [13, "foo", ["bar", "baz"]]
const nestedBar = list[2]->shift()      // bar
const obj = { ten: 10, twenty: 20 }
obj->remove("ten")                        // { twenty: 20 }
const array[] = {77, {key: "val"}, [88]} // Array with capacity of 3
array->resize(array->cap() + 7)           // Increases the array's capacity by 7

obj.twenty /= 7                          // { twenty: 2.857142857142857 }
--obj["twenty"]                          // { twenty: 1.857142857142857 }
```

Data structures

The supported data types allow for creating compound data structures. The code below demonstrates an example usage of anonymous objects and functions to imitate a class-like structure.

```
const Car = {
  cars: [],
  get: (carInstance, index) => { return carInstance.cars[index] },
  set: (carInstance, brand, year, colour) => {
    carInstance.cars->append({
      brand: brand,
      year: year,
      colour: colour
    })
  }
}
const vehicle = Car
vehicle.set(vehicle, "Toyota", "2002", "red")
log(vehicle.get(vehicle, 0)) // {colour: red, year: 2002, brand: Toyota}
```

Built-in functions

Clove-lang has some useful built-in features, some of which interact with the outside world.

get_args() Returns a list of command-line arguments passed into the program.

random() Returns a random integer or a rational number in a given range. `random(0, 3.14)` would return a random rational number in the $0 \leq x < 3.14$ range – it recognises a floating-point number in the second argument, therefore the result will also be a float.

file() It takes three arguments: writing option, path, content. The function's behaviour depends on the first argument which specifies whether the new content should be appended to the file, or replace the old one. If the path does not exist, it will be created, although it is limited to one subdirectory.

http() This function supports four main HTTP requests: GET, POST, PUT, and DELETE, one of which has to be specified in the first argument. The second argument is the resource's URL, and the third, optional argument is the request body (only applicable to POST and PUT requests) which is a string of url-encoded pairs, or an anonymous object.

reflect() Java's Reflection API is accessible via Clove's `reflect()` method that handles one or two arguments, first being a string with the full package name (e.g. `java.lang.String`), second is a list with arguments which are used to instantiate the class. If the second argument is not supplied, the class is not instantiated. Current implementation only allows for simple tasks, such as string comparison or concatenation; see `example6` in the example programs, or `test34`.