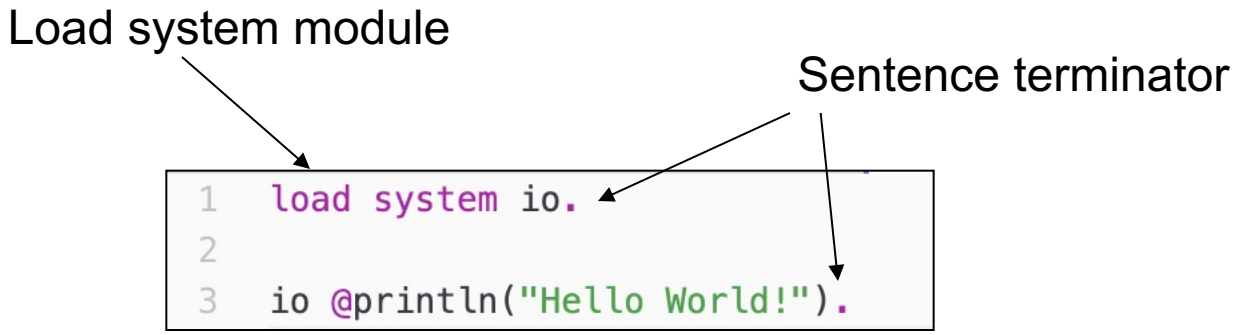
Asteroid Basics

https://asteroid-lang.readthedocs.io/

Imperative Asteroid

- The “Hello World” program…



Iteration

- ‘while’, ‘for’, ‘loop’ constructs are all supported

```
1   -- compute the factorial
2
3   load system io.
4   load system type.
5
6   function fact with n do
7     let val = 1.
8     while n > 1 do
9       let val = val*n.
10      let n = n-1.
11    end
12    return val.
13  end
14
15  let x = type @tointeger(io @input("Enter a positive integer: ")).
16  io @println ("The factorial of "+x+" is "+(fact x)).
```

Function argument

Iteration

Assignment

Type conversion

Function Call

Function Calls

- In Asteroid function calls are constructed by juxta positioning a function with a value, e.g.

  fact 3.

  no parentheses necessary! But the traditional

  fact(3).

  also works.

Data Structures

- Built-in lists
  - [1,2,3]
- Built-in tuples
  - (x,y)
- Element access
  - a@i

```
1  -- the bubble sort
2  load system io.
3
4  function bubblesort with l do
5
6    loop
7      let swapped = false.
8      for i in 0 to len(l)-2 do
9        if l@(i+1) <= l@i do
10         let (l@i,l@(i+1)) = (l@(i+1),l@i).
11         let swapped = true.
12       end
13     end
14     if not swapped do
15       break.
16     end
17   end
18
19   return l.
20 end
21
22 let k = [6,5,3,1,8,7,2,4].
23 io @println("unsorted array: "+k).
24 io @println("sorted array: "+(bubblesort k)).
```

Structures & Objects

- Asteroid is object-based
- Bundle operations with data
- No inheritance
  - Construct new objects from other objects via object composition
- New languages with a full object-oriented type system are waning
  - Of the three “big” new languages (Rust, Go, Swift) only Swift supports OO with inheritance, the others are object-based.

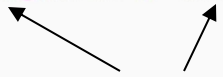
Structures

```
1  -- rectangle structure
2  load system "io".
3
4  structure Rectangle with
5    data xdim.
6    data ydim.
7  end
8
9  let r = Rectangle(4,2). -- default constructor
10 println ("Rectangle with x="+r@xdim+" and y="+r@ydim).
```

- Structures consist of ‘data’ fields and are associated with a default constructor
- Member access is via the ‘@’ operator

Structures

```
1  -- rectangle structure
2  load system io.
3  load system type.
4
5  structure Rectangle with
6    data xdim.
7    data ydim.
8
9    -- member function
10   function area with () do
11     return this@xdim * this@ydim.
12   end
13 end
14
15 let r = Rectangle(4,2).
16 io @println ("The area of Rectangle ("+r@xdim+","+r@ydim+") is "+r@area()).
```



- Member functions
- Object identity is given with the ‘this’ keyword
- Member functions are called on objects with the ‘@’ operator
  - E.g., r@area()

Structures: Rust & Go

```rust
#[derive(Debug)]
struct Rectangle {
    width: u32,
    height: u32,
}

impl Rectangle {
    fn area(&self) -> u32 {
        self.width * self.height
    }
}
```

Rust

```go
type rect struct {
    width int
    height int
}

func (r *rect) area() int {
    return r.width * r.height
}
```

Go

Asteroid Exercises

- Ex1: Write an Asteroid program that prints out the integers 10 through 1.
- Ex2: Write an Asteroid program that has a structure for the type ‘Circle’ that holds the coordinates of the center of a circle and its radius.
  1. Your program should instantiate a number of different circle objects and print them out using the ‘io @println’ statement.
  2. Add a member function to your Circle structure that computes the circumference of the given circle using 2*pi*r. Your program should instantiate a number of circles and print out their circumference.

Types in Asteroid

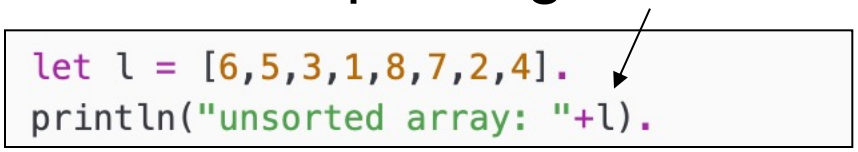
- Asteroid has a set of **primitive data types**:
  - integer
  - real
  - string
  - boolean
- Asteroid arranges these data types in a **type hierarchy** in order to facilitate automatic type promotion:

  boolean < integer < real < string

  (more on type hierarchies later)

Types in Asteroid

- Asteroid has two more built-in data types:
  - list
  - tuple
- These are **structured data types** in that they can contain entities of other data types.
- Lists and tuples themselves are also embedded in type hierarchies, although very simple ones:
  - list < string
  - tuple < string
- That is, any list or tuple can be viewed as a string. This is very convenient for printing lists and tuples.



Types in Asteroid

- Using the ‘structure’ keyword Asteroid also supports user defined types.
  - The name of the structure becomes a new type available in the program.

```
1  -- user defined types
2  structure Person with
3  ··data name.
4  ··data profession.
5  end
6
7  let p:%Person = Person("Fred","Carpenter").
```

Type Constraint Pattern

Types in Asteroid

- Finally, Asteroid supports one more type, namely the **none** type.
  - The none type has a constant named conveniently ’none’.
  - The empty pair of parentheses () can be used as a short-hand for the constant none.
  - The none data type does not belong to any type hierarchy.

Running Asteroid

- Install the interpreter on your machine
  - See https://asteroid-lang.org
- Run Asteroid in the cloud
  - https://replit.com/@lutzhamel/asteroid

Assignments

- Reading: MPL Chap 6
- Do Assignment #1 – see BrightSpace