Data Structures

- We saw that Asteroid has built-in data structures such as lists and tuples
- Asteroid also support custom data structures via the ‘structure’ keyword

Lists

```
load system io.

let a = [1,2,3].            -- construct list a
let b = [a@2, a@1, a@0].    -- reverse list a
io @println b.
```

ln003/reverse1.ast

```
load system io.

let a = [1,2,3].     -- construct list a
let b = a@[2,1,0].   -- reverse list a using slice [2,1,0]
io @println b.
```

ln003/reverse2.ast

A slice is a list of indexes that can be used to access elements of a list.

```
load system io.

let a = [1,2,3].
let b = a @reverse (). -- reverse list using member function 'reverse'
io @println b.
```

ln003/reverse3.ast

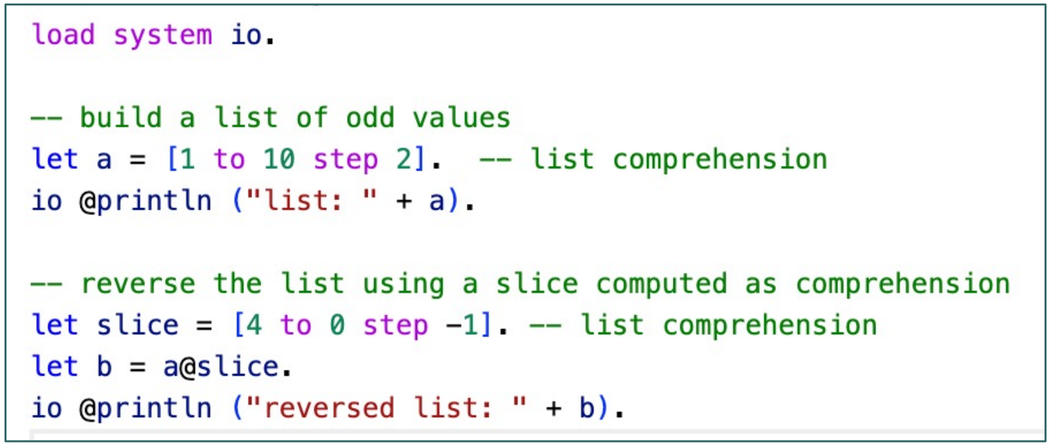
In Asteroid lists are considered objects with member functions.

The General Access Operator

- The @ operator is Asteroid's general access operator:
  - individual elements, slices, or member functions of lists.
  - members and functions of tuples and objects.
- The println function:
  - the io module is an object and println is a member function, therefore
    io @println <string>
  - In Asteroid all system modules are objects

List Comprehensions

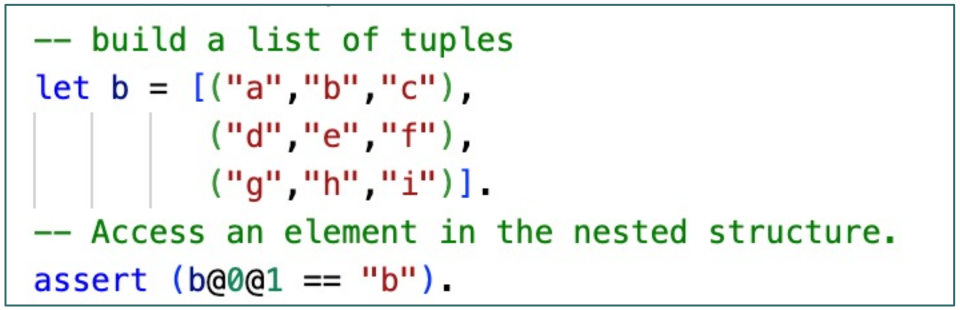
- In Asteroid a list comprehension consist of a range specifier together with an optional step specifier allowing you to generate a list of integer values within that range,
  [<start> to <end>]
  or
  [<start> to <end> step <value>]
- If a comprehension is invalid Asteroid returns an empty list, e.g.
  [0 to 4 step -1]



```
load system io.

-- build a list of odd values
let a = [1 to 10 step 2].  -- list comprehension
io @println ("list: " + a).

-- reverse the list using a slice computed as comprehension
let slice = [4 to 0 step -1]. -- list comprehension
let b = a@slice.
io @println ("reversed list: " + b).
```

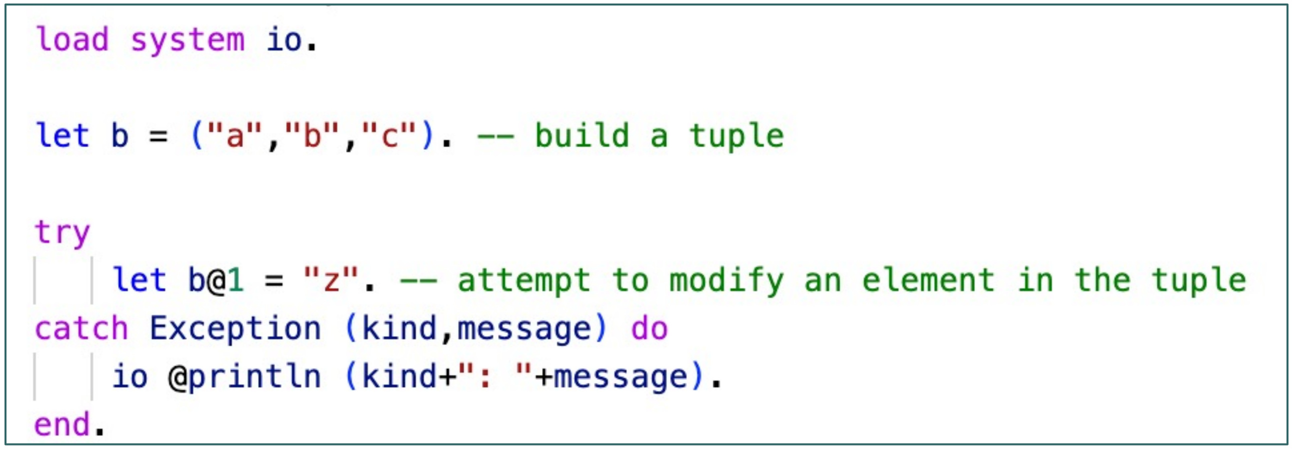
ln003/comprehension.ast

Tuples



```
-- build a list of tuples
let b = [("a","b","c"),
         ("d","e","f"),
         ("g","h","i")].
-- Access an element in the nested structure.
assert (b@0@1 == "b").
```

In003/tuples1.ast

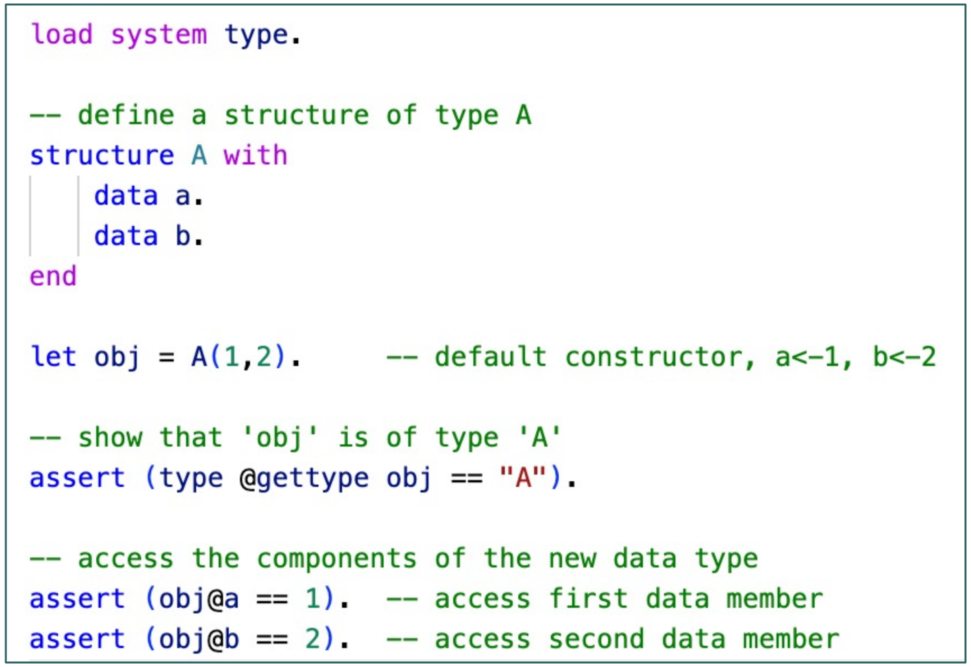


```
load system io.

let b = ("a","b","c"). -- build a tuple

try
    let b@1 = "z". -- attempt to modify an element in the tuple
catch Exception (kind,message) do
    io @println (kind+": "+message).
end.
```

In003/tuples2.ast

Tuples are immutable objects!

Structures & Objects



```
load system type.

-- define a structure of type A
structure A with
    data a.
    data b.
end

let obj = A(1,2).      -- default constructor, a<-1, b<-2

-- show that 'obj' is of type 'A'
assert (type @gettype obj == "A").

-- access the components of the new data type
assert (obj@a == 1).   -- access first data member
assert (obj@b == 2).   -- access second data member
```

- Structures in Asteroid are similar to classes in Python and almost identical to structures in Rust.
- A structure introduces a data structure as a new type
- For each structure Asteroid creates a default constructor

Reading

- Data Structures
  - asteroid-lang.readthedocs.io/en/latest/User%20Guide.html#data-structures