Lists

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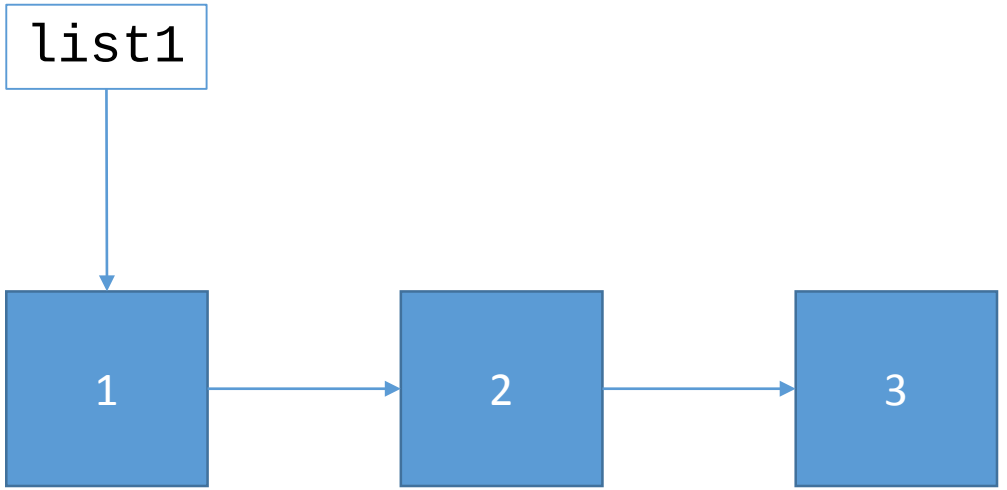
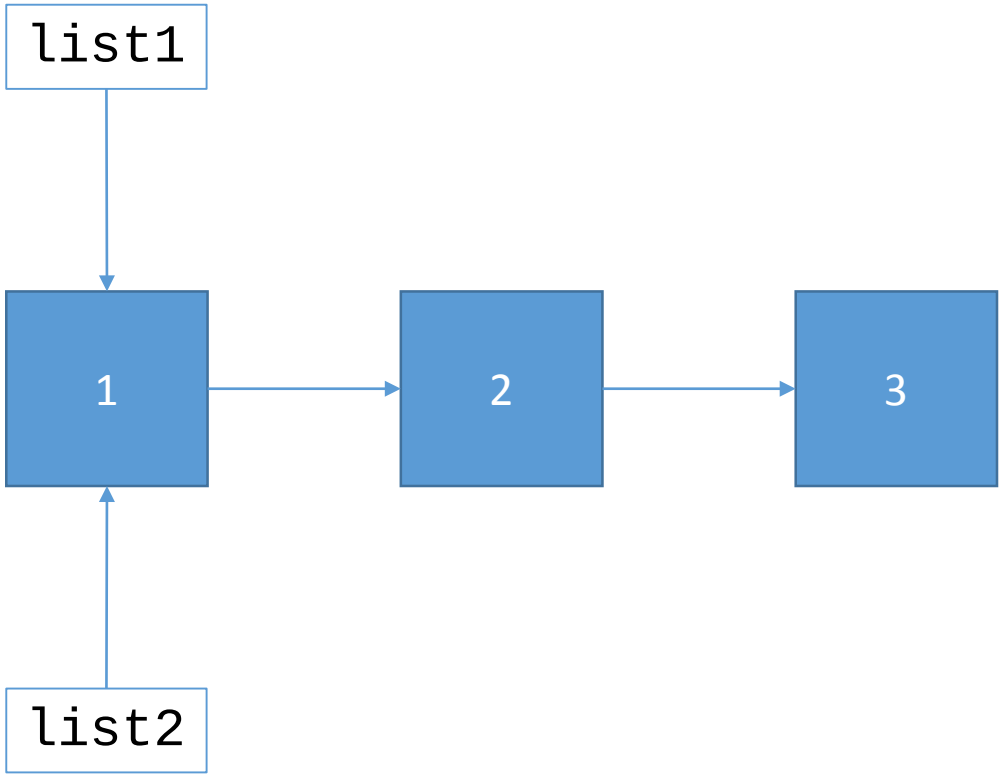
Create a List

```
val list1 = List(1, 2, 3)
```



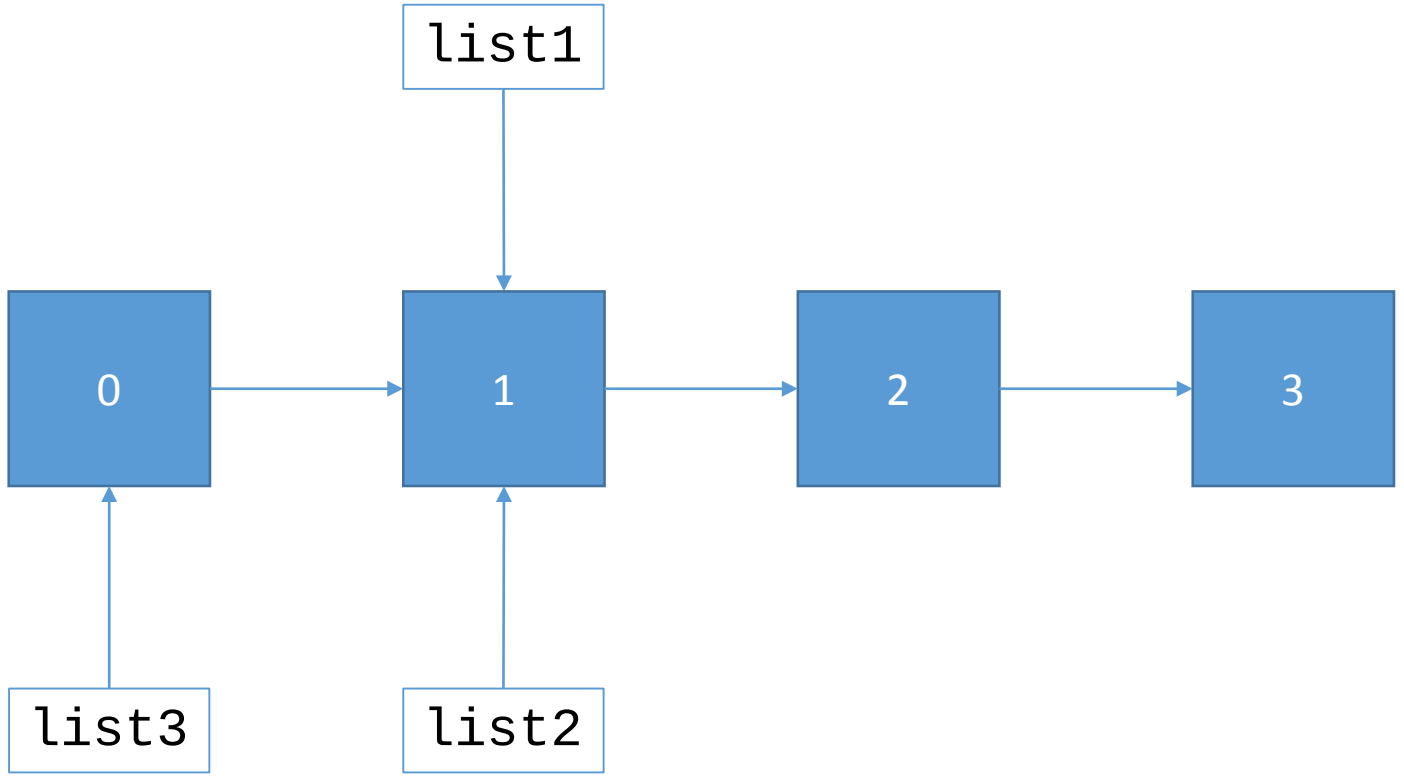
Create a “Second” List

```
val list2 = list1
```



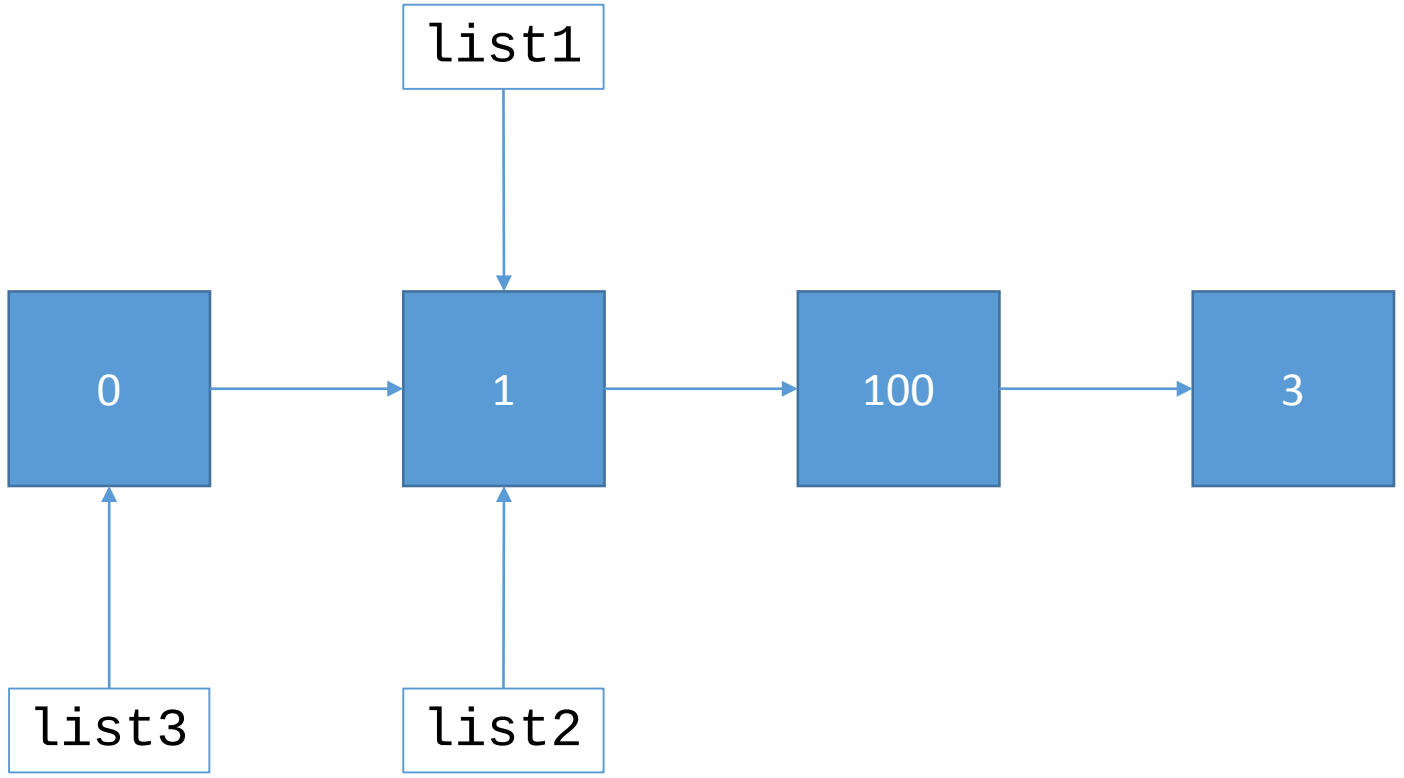
“Cons” an Element

```
val list3 = 0 :: list2
```



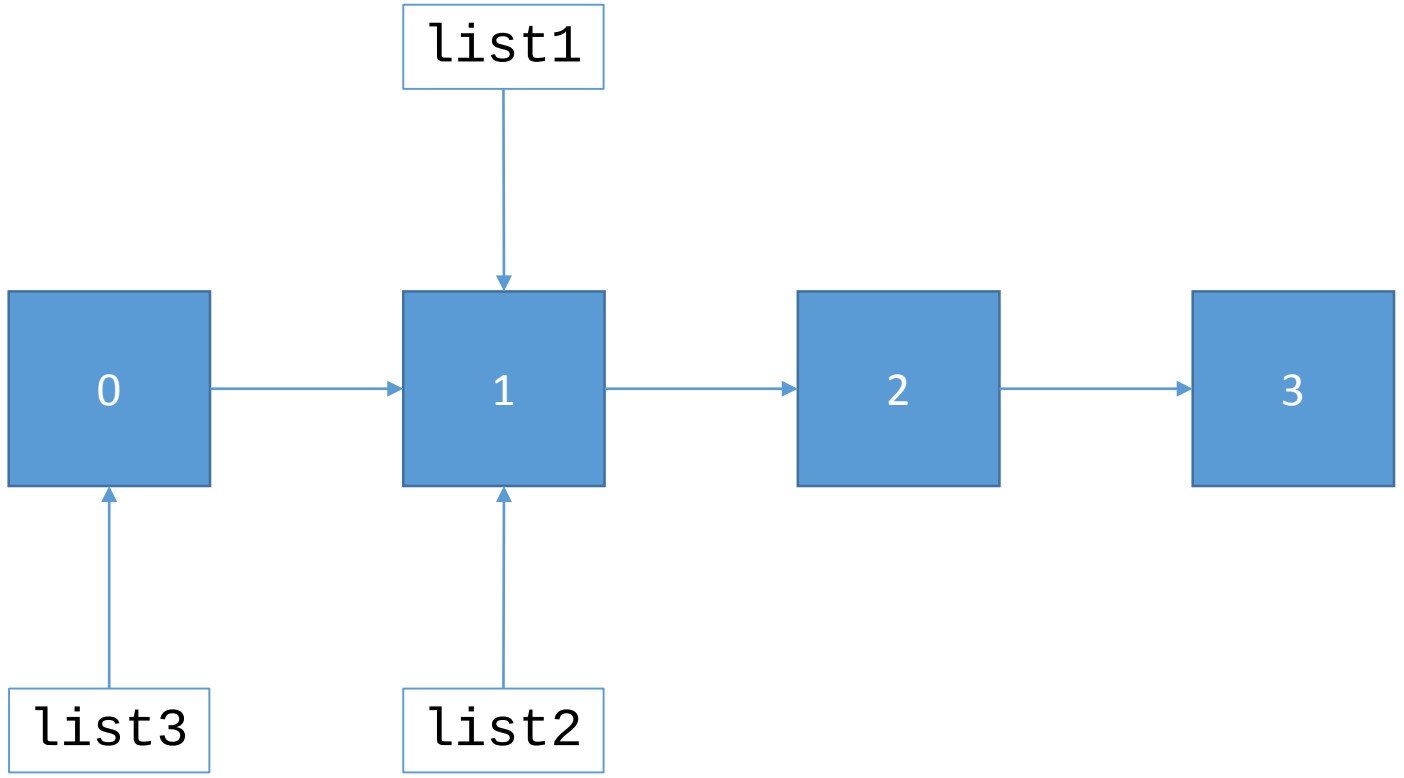
Modifying List3 Changes List1 and List2?

```
list3(2) = 100
```



No! Lists are Immutable

```
list3(2) = 100    error: value update is not a member of List[Int]
```



Summary

- Because of List immutability different List objects can share nodes
  - Nobody can tell because nodes can never be modified†
  - Thus creating a “new” list after each list operation is not always expensive.
  - `1 :: superLongList` does *not* entail making a copy of `superLongList`.
- Functional data structures try to share representation
  - You can reason as if all objects are distinct
  - … without paying the price of actually making zillions of copies
  - We will see how this helps later with more complex examples
- *Immutability is the key!*

† This is not entirely true; there are ways to tell

Arrays

- In Scala arrays are mutable; their elements can be modified
  - ```
    val array1 = Array(1, 2, 3)
    val array2 = array1
    array2(1) = 100
    ```
  - Now `array1` is `Array(1, 100, 3)`
  - There is only one Array object; both vals reference it
  - … and the object can be modified “out from underneath” one of the vals
  - This behavior is compatible with Java (Scala arrays are the same as Java arrays)
- Mutability makes reasoning about program behavior harder
    ```

Aren’t Vals Immutable?

- Yes! Once a val has been bound it can never refer to a different object
  - … but the mutability of that object is a separate matter!
  - ```
    val myArray = Array(1, 2, 3)
    myArray = Array(4, 5, 6)  // Error! Can’t reassign a val
    myArray(1) = 100          // Fine. The Arrays are mutable
    ```
- Vars can be bound to a different object
  - … even if that object is immutable
  - ```
    var myList = List(1, 2, 3)
    myList = List(4, 5, 6)  // Fine. Vars can be reassigned
    myList(1) = 100         // Error! Lists are immutable
    ```
- *Use vals by default; vars only when necessary!*