Arrays and Lists

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Array and Lists

- The (two) types of lists we've seen
  - Arrays
  - ArrayLists

- What are the differences
- Why use one over the other

Array and Lists

- Odds are:
  - Learned Arrays
  - Learned ArrayLists were easier
  - You *always* use ArrayList now

- But why did make this abstraction in the first place

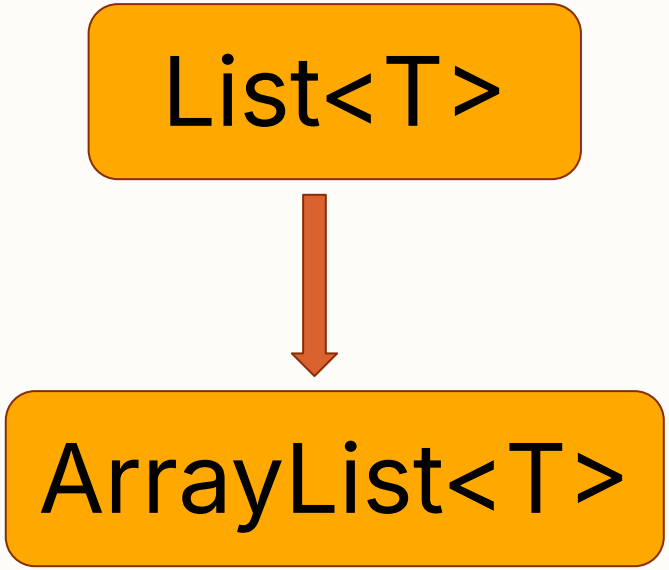
Array and Lists

- What was annoying about arrays?
  - Need index to add a value
  - Fixed size
  - Need to know the size at creation
- ArrayLists are “dynamic”
  - .add()
  - .size()

Array and Lists

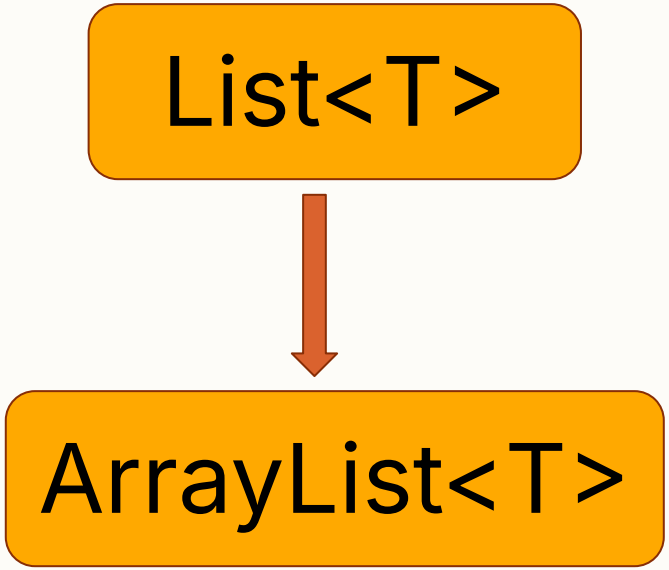
- ArrayList inherits from AbstractList

- Why differentiate these?
- ArrayList specific type of List

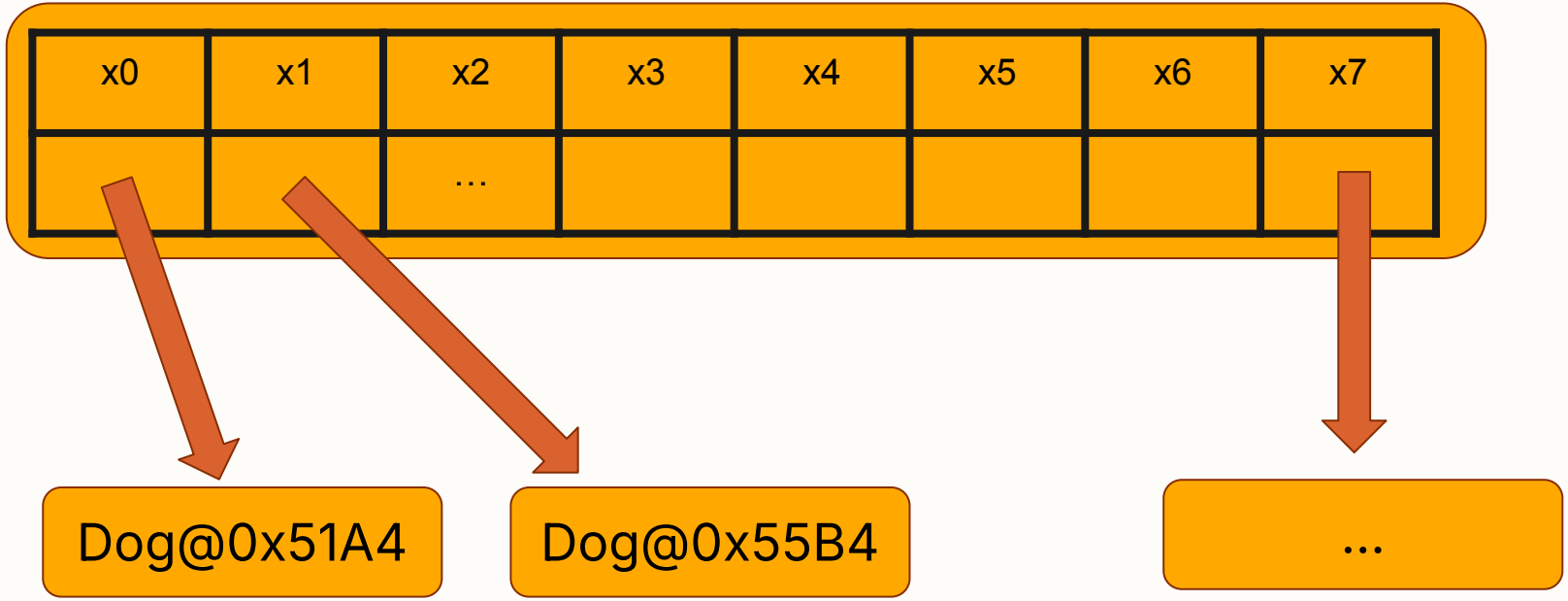


Array and Lists

- AL treats the data as an array
  - get(index)
- What does this mean in terms of memory



Array and Lists



Array and Lists

- Contiguous memory structure
  - Right next to one another

- This allows for:
  - Quick lookup
  - Jump to position immediately

Array and Lists

- ArrayList<T> L = new ArrayList<>();

Memory Location	x0	x1	x2	x3	x4	x5	x6
Data	Value1	Value2	…				

- This gets me a “pointer” to the 0th position
  - How would I get to the 4th position?

Array and Lists

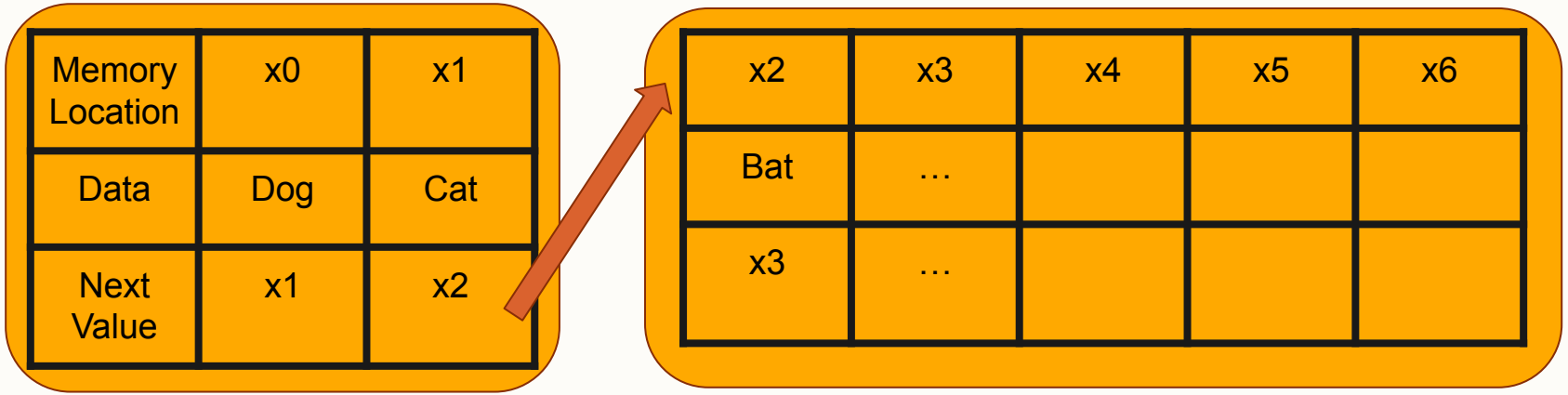
- How else could I organize my list?
- Especially if memory is just a giant array?
  - Right next door.
  - Somewhere else?

Array and Lists

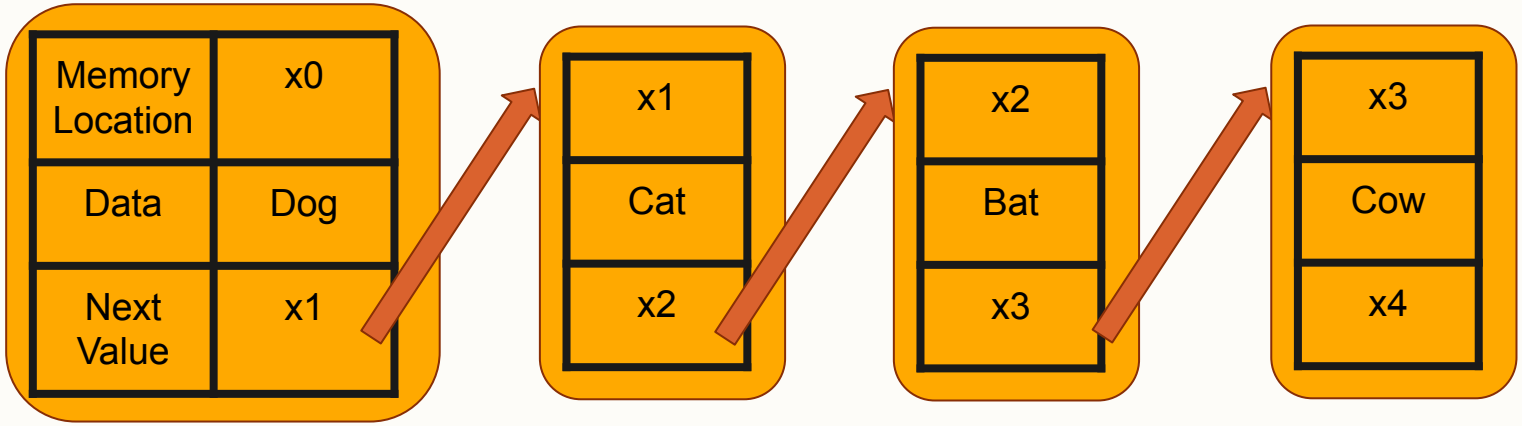
- Let’s aggregate a single piece of data
  - Data Value
  - Where the next piece of data is

Memory Location	x0	x1	x2	x3	x4	x5	x6
Data	Dog	Cat	Bat	…			
Next Value	x1	x2	x3	…			

Array and Lists

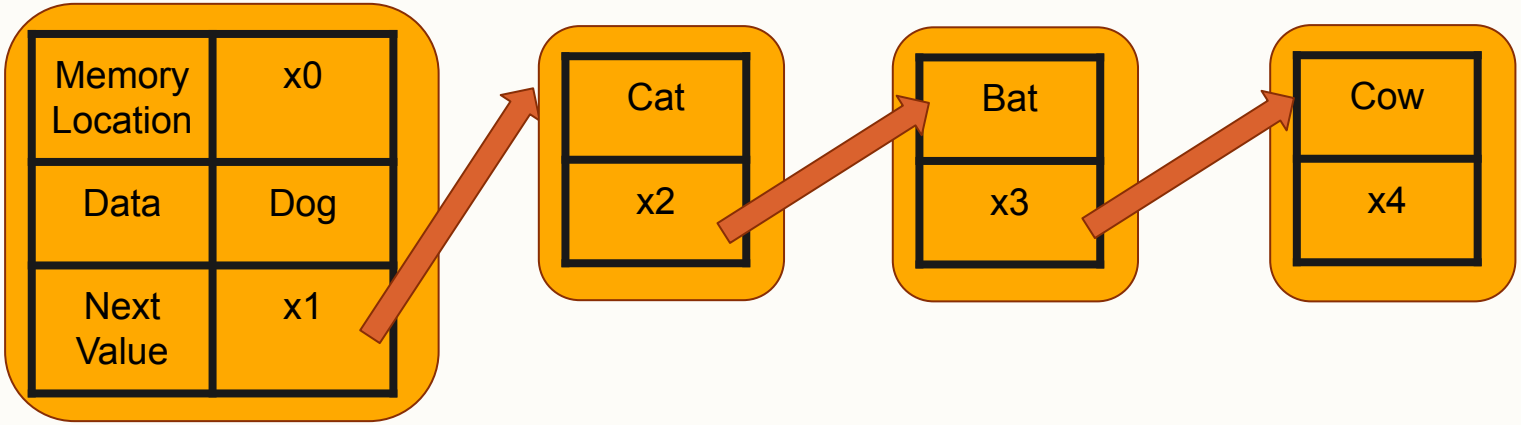


Array and Lists



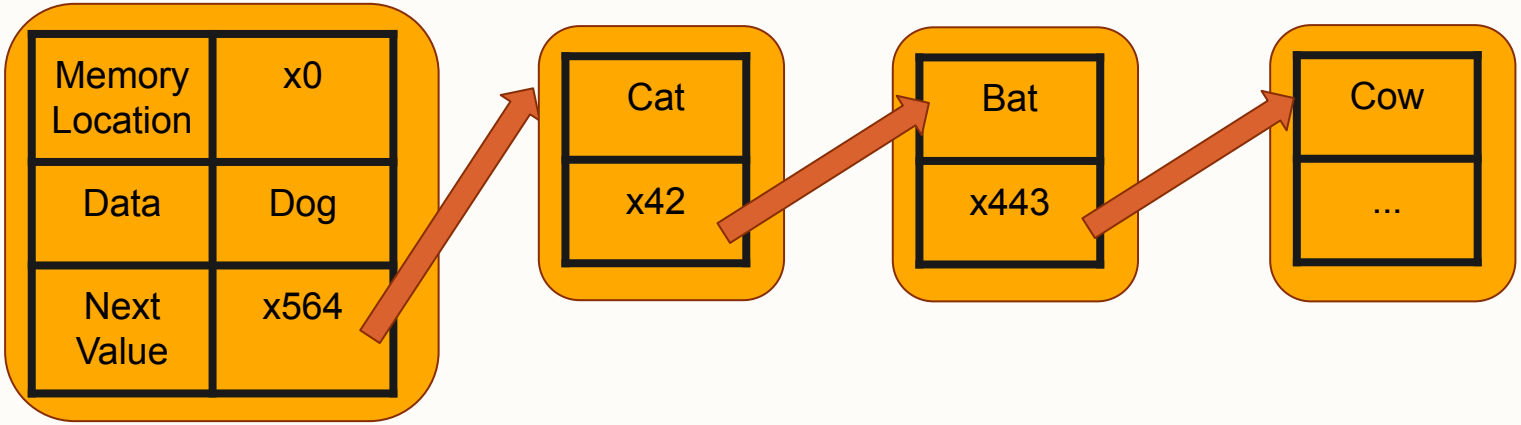
Array and Lists

- Memory locations omitted
- No longer need to be contiguous



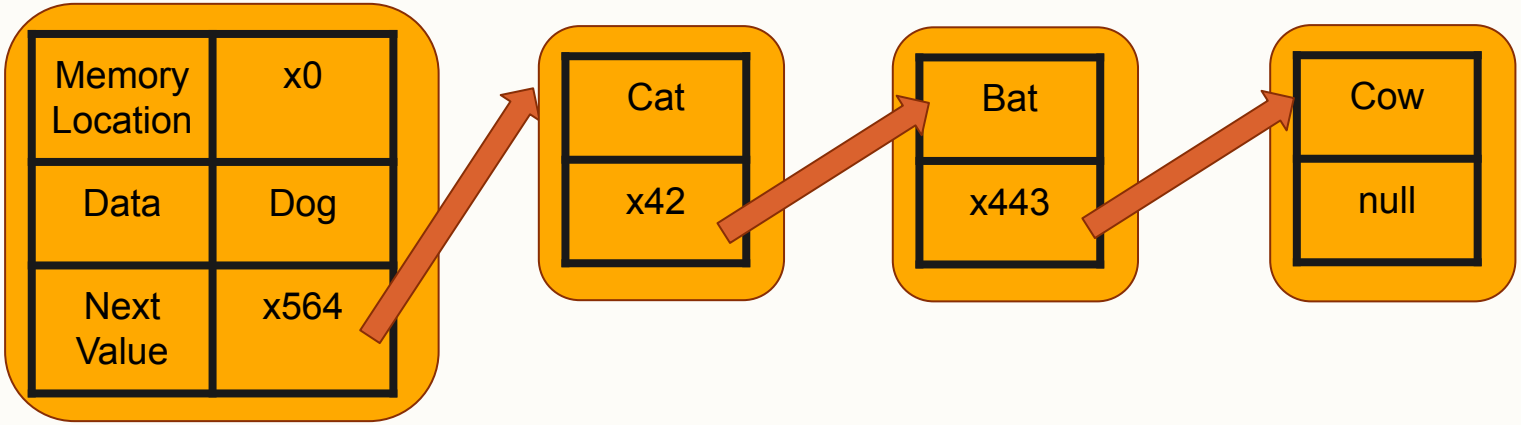
Array and Lists

- Points to random locations
- Where is convenient to allocate



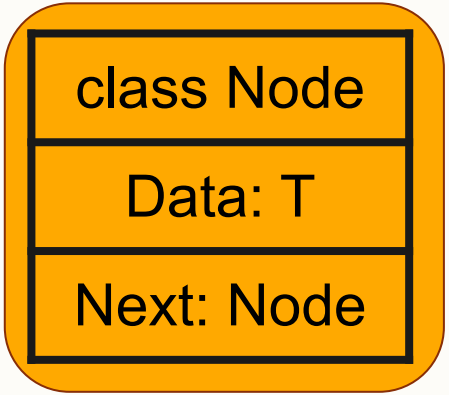
Array and Lists

- Usually “null” terminated
- What does that mean?



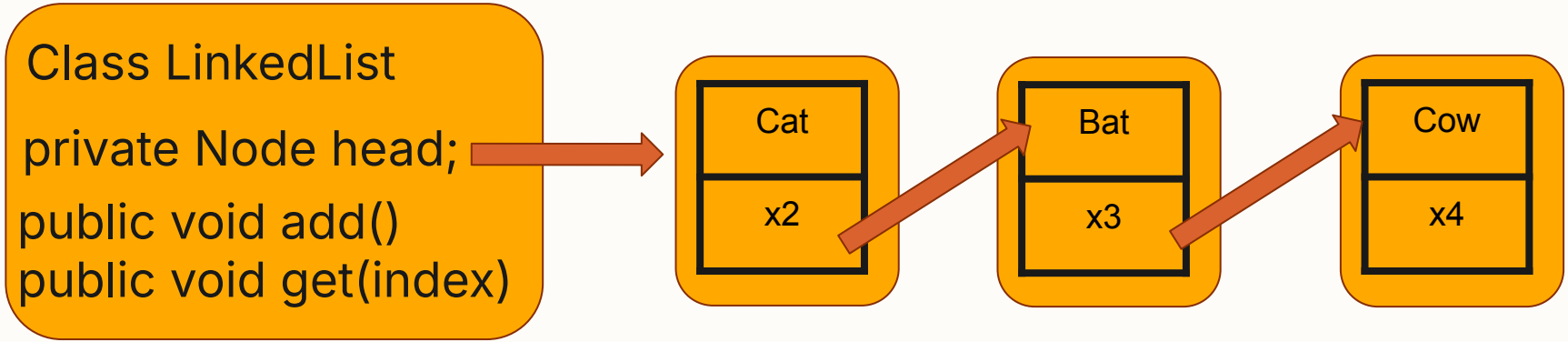
Array and Lists

- Wrap data in a Node class
- Pay attention to the types
  - Generic
  - Node (itself)



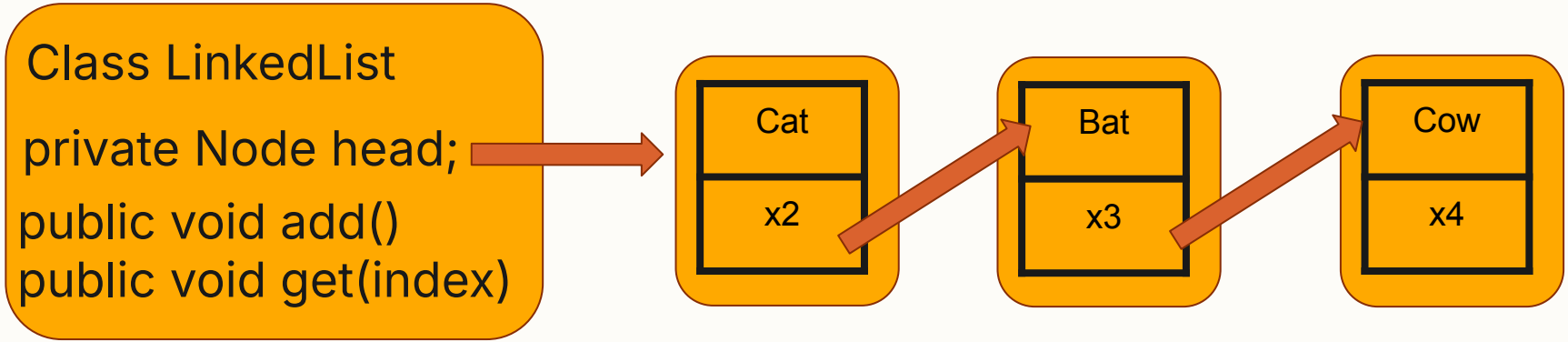
Array and Lists

- Wrap this in a class
  - Only knows about the “head”
- Call it a LinkedList



Array and Lists

- Java provides a LinkedList class
  - Extends from List
- Let’s make our own



Array and Lists

- Why did we do all of that ;-;
  - This is more annoying than arrays to start with
- Let’s look at the time it takes to perform some operations
  - get()
  - add()
  - insert() ?

Array and Lists

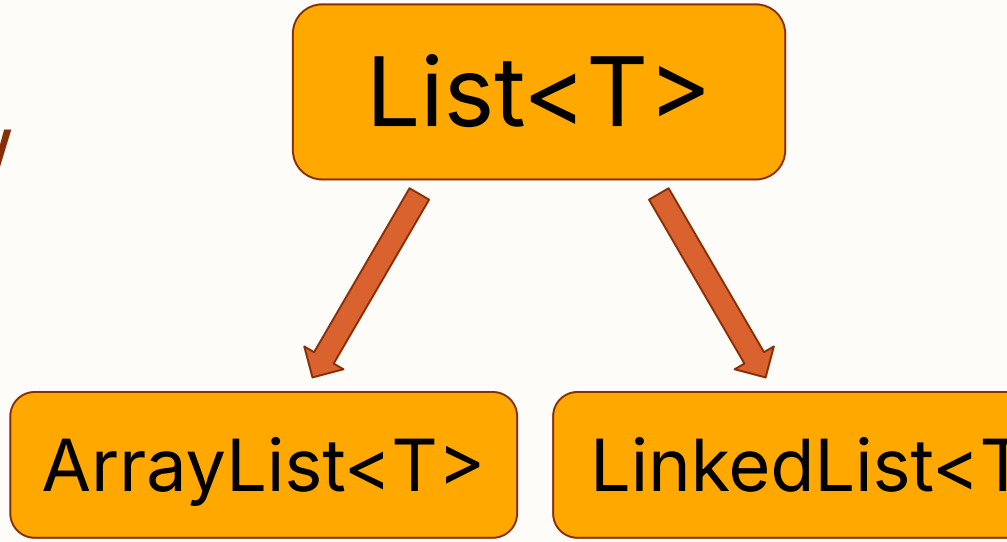
- Let’s program insert() method
- And we can test to see if its faster!
- Next class if time permits
  - I’ll write the benchmark most likely
  - Demo that Thursday

List types

- We've seen two types of lists now

- ArrayList
- LinkedList

- Both implement List<E> interface



Array and Lists

- Trade-offs associated with different operations
- Formalized with Big O notation

- O(1) → Constant
  - Fast
- O(n) → Linear
  - Slower

Operation	LinkedList	ArrayList
get()	O(n)	O(1)
prepend()	O(1)	O(n)
contains()	O(n)	O(n)