ICS 240
Introduction to Data Structures

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Ordered Lists

versus unordered lists

Book Shelf Example

- How to organize books on your book shelf?
  - **Solution 1:**
    - Put the books in a random order
    - Whenever you get a new book place it as the last book on the shelf
    - What are the pros and cons of this solution?
      - **Good:** needs a short time to insert a book
      - **Bad:** takes a long time to find a specific book by title
  - **Solution 2:**
    - Sort the books alphabetically by book title
    - What are the pros and cons of this solution?
      - **Good:** finding a specific title is very fast
      - **Bad:** inserting a new book requires more time in order to shift the books to make a space for the new book.

Tradeoffs – Which Operation is Done Most Often?

Unordered Lists

- Adding an element is fast
- Finding an element is slow
- Removing an element is fast

Ordered Lists

- Adding an element is slow
- Finding an element is faster
- Removing an element is slow

Invariants

Something that is always true

Invariants

- An invariant is an explicit statement of the rules dictating how instance variables are to be used
- All methods may assume that the invariant is valid when they are called
- Each method is responsible for ensuring continuing validity of the invariant when the method returns

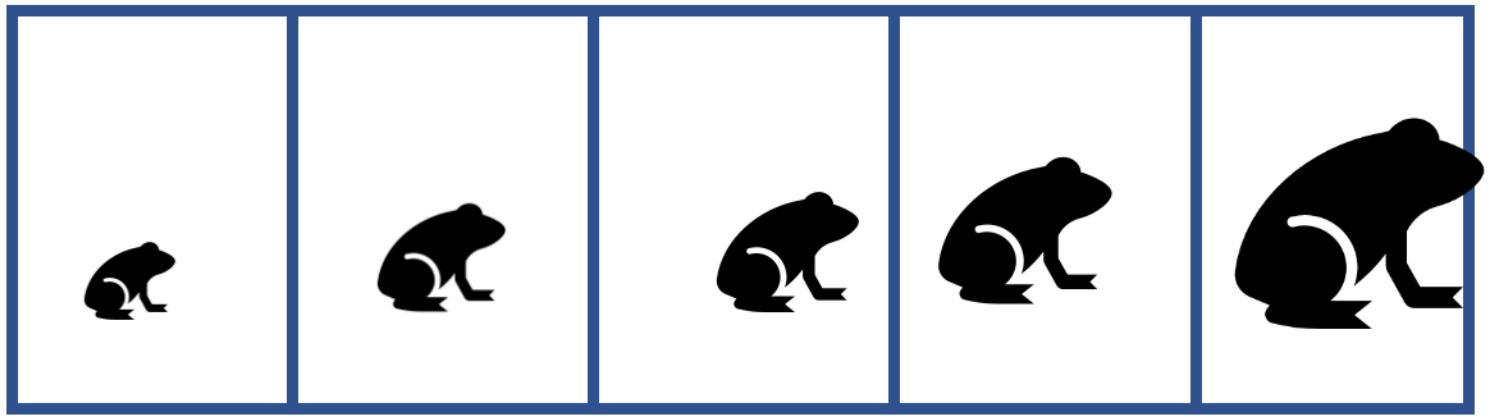
Invariants of `Sorted Array`

- The number of items contained in the collection is stored in an instance variable conventionally called manyItems
- The ordered list entries are stored in an instance array variable conventionally called `data`, from position `data[0]` to position `data[manyItems-1]`
- Items are stored in order

Add an item to a sorted array

DO NOT USE A SORTER – Learning how those are implemented

Adding to array



Pseudocode for Inserting in Order

Make sure there is room to add it

Starting with the last item in the collection, repeat until not moving over

    If item to add is less than that item, move that item over

Add item to “empty” spot

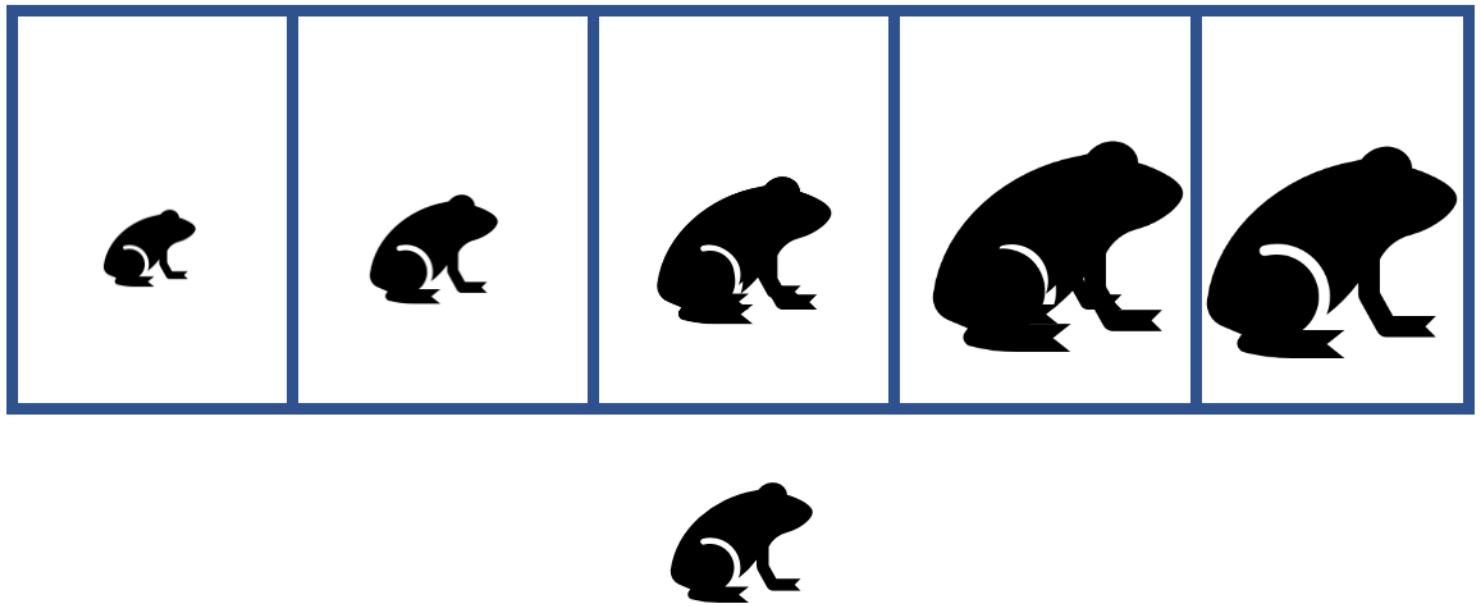
Increase the instance variable manyItems by one

***Make sure will work for border cases (first thing added, last thing added)

Remove an item from a sorted array

DO NOT USE A SORTER!

Deleting from array



Pseudocode for Removing an Item from an Ordered List

Find the item

Starting at that position until the last item in the array

    Move the item at the next slot over to the current slot

Decrease manyItems

Try it!

- Update the add methods to the AnimalShelter class in the Animal Shelter project to maintain a sorted collection.
- Create a remove method in the AnimalShelter class that accepts an Animal to remove. This method should return true if the animal was in the collection and has been removed, and false if the animal was not in the collection.

- Test the new methods from the driver. Does the collection stay sorted?