ArrayList implementation & Complexity

CS 62 - Fall 2015
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PostIt App

- See how ArrayList used in methods for PostItApplication

  - findWindowInList, moveToTop, removeWindow

  - Used in mouse-event-handling methods

ArrayList

- Not using Bailey implementation

  - see code on-line for implementation by Tomassia & Goodrich

- Standard Java libraries have lots of extra methods not in our implementation:

  - Many involve working on other collections

    - irrelevant for us at this point.

  - addAll, clear, contains, containsAll, listIterator, removeAll, replaceAll, retainAll, sort, spliterator, sublist, toArray

Back to ArrayList

- Interface is IndexList<E>

- See ArrayIndexList<E>

  - Similar to ArrayList

  - Instance variables:

    - elts: array instance variable,

    - eltsFilled: number of slots filled.

- Creating new ArrayList is weird

  - recall can't construct array of variable type!

  - Create array of Object, but coerce to believe array of E.

ArrayList Implementation

- Some operations very cheap:

  - size, isEmpty, get, set take constant time (no search)

- Others more expensive

Adding Elts in Slot i

- Easy if there is space:

  - At end, just add it

  - If before end, must move all elements at i and beyond to right before inserting

  - *Delete similar*

- What if run out of space

  - Create new array twice as big and copy old elements over before adding.

- How expensive is this?

Complexity

- Count the number of elementary operations used to perform a task (i.e., a method).

- Elementary Operations:

  - Read/Write

  - Arithmetic

Adding to ArrayList

- Suppose n elements in ArrayList and we add 1 element.

- If space:

  - Add to end is a constant number of ops

  - Add to beginning is ~n copy ops

- If not space,

  - What is cost of ensureCapacity?

  - ~n copy ops because n elements in array

Multiple Adds

- What if only increase in size by 1 each time?

  - Adding n elements one at a time to end

    - Total cost is $1+2+3+...+(n-1) = n(n-1)/2$ copy ops

- What if double in size each time?

  - Suppose add n new elements to end

    - Total cost is $1+2+4+...+n/2 = n-1$ copy operations