CSC 212
Data Structures and Abstractions
Spring 2016

Announcements
PA #1 is out
submissions must be through Autolab
start early and ask questions
office hours and Piazza

Previously ...
Recurrences
used to determine running time of recursive
algorithms

Today ...
Pointers and Arrays
Example with Dynamic Arrays

int a[] = \{3, 4, 7, 1, 6, 9\};

Dynamic Arrays
Not dynamically allocated arrays
Dynamic arrays can grow/shrink over time
need to remember size and capacity

How to append more data?
How to append more data?

append
Insert at end

Let's analyze the number of ‘writes’
Grow by 1

If array is full, increase the capacity by 1
Cost of adding first $N$ elements?
ignore cost of memory allocation

\[ N + [1 + 2 + 3 + \cdots + (N - 1)] = \frac{N(N + 1)}{2} = O(N^2) \]

$N$ appends $N$ copy operations

Repeated Doubling

If full, create a new array of **twice** the size
Cost of adding first $N=2^k$ elements?

\[ N + [2^0 + 2^1 + 2^2 + \cdots + 2^{k-1}] = N + \sum_{i=0}^{k-1} 2^i = N + 2^k - 1 = 2N - 1 = O(N) \]

$N$ appends $N$ copy operations

How to Shrink arrays?

halve the array when array is **one-half** full?
or
halve the array when array is **one-quarter** full?