



sit with your clan
if you can

CMPS 12B/M

Introduction to Data Structures

▼ Instructor: Nathan Whitehead

Vote for Lab Times

Piazza poll for potential new lab:

Monday, 6pm-8pm

Tuesday, 8am-10am

Wednesday, 6pm-8pm

Thursday, 8am-10am

Friday, 5pm-7pm

How many people are signed up for a lab but actually have a conflict?

Data Structures

- ▼ What do they do?

Data as Cards

- ▼ Data can represent things
 - ▼ external to computer
 - ▼ meaningful to people
- ▼ Like a stack of cards
- ▼ What can you do?
 - ▼ Write things on a card
 - ▼ Find desired cards
 - ▼ Insert new cards
 - ▼ Delete existing cards
 - ▼ Organize cards using different systems



Data Structures

- ▼ Think of data structures as ways of dealing with data cards
- ▼ Array
 - ▼ Fixed size numbered plastic slots
- ▼ Ordered Array
 - ▼ Keep them organized in order
- ▼ Stack
 - ▼ LIFO
- ▼ Queue
 - ▼ FIFO



More Data Structures

- ▼ Linked list
- ▼ Binary tree
- ▼ Red-black tree
- ▼ Hash table
- ▼ Heap
- ▼ Graph

each data structure has advantages and disadvantages

Some Definitions

- ▼ *Database*
 - ▼ All the data needed in a particular situation
- ▼ *Record*
 - ▼ One card
- ▼ *Field*
 - ▼ One part of a card
- ▼ *Key*
 - ▼ Designated field for searching and sorting

Example

- ▼ *Database*
 - ▼ All businesses in USA, names and phone numbers
- ▼ *Record*
 - ▼ One business
- ▼ *Fields*
 - ▼ Business name
 - ▼ Phone number
- ▼ *Key*
 - ▼ Business name

Unordered Array Example

Unordered Array	Operation																																				
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<http://cs.brynmawr.edu/Courses/cs206/spring2004/lafore.html>

Java code for arrays

- ▼ Array
- ▼ LowArray
- ▼ HighArray

Ordered Array

Ordered Array	Operation																																																
<div data-bbox="400 518 1223 630"><div>New Fill Ins Find Del</div><div><input checked="" type="radio"/> Linear <input type="radio"/> Binary</div><div>Number: <input type="text"/></div></div> <p data-bbox="400 635 621 662">Press any button</p> <table border="1" data-bbox="400 678 680 1093"><tbody><tr><td>0</td><td>209</td><td>12</td><td></td></tr><tr><td>1</td><td>274</td><td>13</td><td></td></tr><tr><td>2</td><td>459</td><td>14</td><td></td></tr><tr><td>3</td><td>548</td><td>15</td><td></td></tr><tr><td>4</td><td>625</td><td>16</td><td></td></tr><tr><td>5</td><td>680</td><td>17</td><td></td></tr><tr><td>6</td><td>703</td><td>18</td><td></td></tr><tr><td>7</td><td>720</td><td>19</td><td></td></tr><tr><td>8</td><td>756</td><td></td><td></td></tr><tr><td>9</td><td>817</td><td></td><td></td></tr><tr><td>10</td><td></td><td></td><td></td></tr><tr><td>11</td><td></td><td></td><td></td></tr></tbody></table>	0	209	12		1	274	13		2	459	14		3	548	15		4	625	16		5	680	17		6	703	18		7	720	19		8	756			9	817			10				11				<p data-bbox="1287 678 1719 705">New creates array with N cells (60 max)</p> <p data-bbox="1287 742 1613 769">Fill inserts N items into array.</p> <p data-bbox="1287 805 1655 833">Ins inserts new item with value N.</p> <p data-bbox="1287 869 1606 896">Find finds item with value N.</p> <p data-bbox="1287 933 1617 960">Del deletes item with value N.</p> <p data-bbox="1287 997 1664 1024">(Type N into "Enter number" box.)</p>
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Java code for ordered arrays

▼ OrderedArray

How fast is HighArray?

- ▼ How many steps does it take on average to do these operations for HighArray?
 - ▼ (Assume no duplicates allowed)
 - ▼ Let n be number of elements in array.
 - ▼ Insert
 - ▼ Delete
 - ▼ Find



The End