

CS: Pod of Delight

Week 7: CS314H Midterm

First of all

First of all

- Tetris!
- How is project going?
- Pair programming?

Second of all

- Discrete Midterm!
- How did it go?
- First Turing midterm

Third of all

- Did you have a good weekend?
- Don't forget to have fun!

Fourth of all

- Data Structures Midterm

CS314H Midterm

- What to expect?
- What are you learning in class?

Things to know

- Be familiar with all the projects you've done
 - If you didn't do it, at least read the karma
 - Understand algorithms/concepts that you used

Things to know

- Data structures
 - HashMaps, HashTrees, Linked Lists, Binary trees, heaps, tries

Things to be familiar with

- Object oriented programming
 - Encapsulation, inheritance, polymorphism
 - Interfaces, abstract classes, final, private, public
 - Overloading
 - Dynamic binding
 - Autoboxing
 - Covariance
 - Generics
 - Parametrized generics

Dynamic Binding Example

- `class x; class y extends x; class z extends y;`
- `class Pub { foo(x); }`
- `class Book extends Pub { foo(x); foo(y); foo(z); }`

- `Pub p = new Book();`
- What method gets called with: `p.foo(z)`?
 - `Book.foo(x)`

Interfaces, Abstract Classes

- What is difference?
 - Interfaces are only contracts!
 - But can have default implementation (Java 8+)
 - Abstract classes can implement methods with state
 - Multiple inheritance
- Which can be instantiated?
 - Neither!

Covariance Example

- `class Shape; class Circle extends Shape; class Square extends Shape;`
- `Shape[] arr = new Circle[5];`
- Is this legal: `arr[0] = new Square();` ?
 - No! runtime error! arrays are covariant

Things to be familiar with

- Search algorithms
 - Binary search, linear searching
- Sorting algorithms
 - Quicksort, mergesort, bubble sort, insertion sort, selection sort, integer sort, radix sort
 - Their complexities

Data Structures and Complexities

Data Structure	Search	Insert/Delete
Array	n	1
Linked List	n	$1/n$
Hash table/map	1	1
Tree	$\log n$	$\log n$
BinHeap	1 (max/min) or $\log n$	$\log n$

Algorithms and Complexities

Algorithm	Best	Average	Worst
Quicksort	$n \log n$	$n \log n$	n^2
Mergesort	$n \log n$	$n \log n$	$n \log n$
Bubble sort	n	n^2	n^2
Insertion	n	n^2	n^2
Selection	n^2	n^2	n^2

Things to know

- Complexity Analysis
 - Big-Oh - upper bound (grows no faster)
 - Big-Omega - lower bound (grows no slower)
 - Big-Theta - exact bound
 - Little-Oh - stricter upper bound (strictly slower)

Most important!

- Be relaxed!
- Do not overstudy, no point in memorizing everything, stressing/eating out
- Get lots of sleep the night before
- Think of it as a fun puzzle session :)
- Ask a clarification question if something seems wrong

Good luck!

