CSE 373: Tradeoffs and Abstractions

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Warmup questions:

Instructions:

- Recall: What's an ADT? What's a data structure? An implementation of a data structure?
- Skim the Queue ADT on your handout.
- Discuss: How would you implement a queue?

Possible queue implementations

Announcements

Course overload link: [Given in lecture only]

Other announcements:

- Overloading + looking for a partner? Talk to me after class.
- Project 1 out
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Setup tips and tricks:

- Suspect the spec is out-of-date? Shift-refresh in your browser
- Use Java 8, not 9
- When running into weird Eclipse issues, try restarting it

Reviewing CSE 143 material

Places to get practice

- Section 1 handouts
- Practice-it: https://practiceit.cs.washington.edu
- CSE 143 class website (17au or older)
- Project 1

Need help? Visit office hours!

ADTs

ADTs are just a tool for *communicating* with other programmers

This course focuses on *implementing* ADTs: implementing data structures

Why?

Why can't we just use `java.util.*`?

Why?

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The reality: nothing's perfect

But we can work around many *tradeoffs* by carefully *adapting* data structures and *abstracting* algorithms!

Tradeoffs

There are (often highly *non-obvious*) ways to organize information to enable *efficient* computations over data.

However, no method is perfect: there exists unavoidable **tradeoffs**.

Tradeoffs

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Core questions:

- What operations do I really need?
- What assumptions am I making about how my software will be used? (e.g. more lookups or inserts)

Case study: The List ADT

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- **get**: returns the item at the i-th index
- **set**: sets the item at the i-th index to a given value
- **append**: add an item to the end of the list
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- **size**: return the number of elements in the stack

Tradeoffs

Goal: implement the List ADT

Compare and contrast: array list vs linked list

- Time needed to access i-th element
- Time needed to insert at i-th element
- Amount of space used overall:
- Amount of space used per element:

Tradeoffs

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- Amount of space used per element:
  - Array list: No wasted space
  - Linked list: Slightly more space per element

A question:

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One idea:

```
for (int i = 0; i < myList.size(); i++) {
    System.out.println(myList.get(i));
}
```

How efficient is this if `myList` is an array list? A linked list?

A problem:

We want to make linked list iteration fast. How?

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Idea!

- **Adapt** the list ADT
- **Abstract** the idea of iteration

A solution?

```
Iterator<String> iter = myList.iterator();
while (iter.hasNext()) {
    String item = iter.next();
    System.out.println(item);
}
```

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- **delete**: delete the item at the i-th index
- **size**: return the number of elements in the stack
- **iterator**: returns an iterator over the list

The Iterator ADT

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Supported operations:

- **hasNext**: returns 'true' if there's another element left to yield and false otherwise
- **next**: returns the next element (if there is one)

Implementing an iterator: A plan of attack

Next time...

What is this ‘efficiency’ thing anyways?

Parting thoughts

Reminder: Overloading/partner concerns, talk to me after class

Supplemental resources: see resources page on class website for...

- Strategies on effectively testing code
- Info on JUnit
- Math review (logs, exponents, summations)

Have suggestions for more resources docs we should write?
Use feedback form.