CS240: Data Structures And Algorithms

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LinkedList or ArrayList?

```java
import java.util.ArrayList;
import java.util.LinkedList;

public class ListDemo {

  public static void main(String[] args) {

    LinkedList<String> list = new LinkedList<String>();

    for (int i = 0; i < 500000; i++) {
      list.add(0, "A");
    }

    for (int i = 0; i < 500000; i++) {
      list.remove(0);
    }

  }
}
```

- What is the result of changing the code snippet to use an ArrayList instead of a LinkedList?

```
for (int i = 0; i < 500000; i++) {
     list.add(0, "A");
}
for (int i = 0; i < 500000; i++) {
     list.remove(0);
}
```

A) No change in correctness or execution time. No one notices you made the change.

B) An ArrayList will not work correctly in this case. You've broken the code! You're Fired!

C) The new implementation is slightly slower than the original implementation.

D) The new implementation is slightly faster than the original implementation.

E) The new implementation is MUCH faster than the original version. Nice Job! Promoted on your first day!

F) The new implementation is MUCH slower than the original version. You're fired!

Abstract Data Types and Data Structures

- "A type is a collection of values. For example, the Boolean type consists of the values true and false."
- "A data type is a type together with a collection of operations to manipulate the type."
- "An abstract data type (ADT) is the specification of a data type within some language, independent of an implementation. The interface for the ADT is defined in terms of a type and a set of operations on that type. An ADT does not specify how the data type is implemented. These implementation details are hidden from the user of the ADT and protected from outside access."
- "A data structure is the implementation for an ADT. In an object-oriented language, an ADT and its implementation together make up a class."

(OpenDSA 1.2.1)

List, ArrayList, LinkedList

- Java interfaces can be thought of as ADT's*:
  - List (Map, Set, Queue, Deque)
- Java collection classes are data structures:
  - ArrayList
  - LinkedList

*Some authors would argue that an ADT is an abstract mathematical description that is not tied to any particular language construct.

Two Steps Back: CS261

- MIPS Assembly language example:

```
lw $t0, 0($s0)
add $t0, $t0, $t0
sw $t0, 0($s0)
```

- The structure of memory...

- Contiguous vs. Linked Structures...

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- Algorithm Analysis
  - How can we determine the performance characteristics of our code before we write it

Back to Linked List vs. ArrayList...

- LinkedList CRUSHED ArrayList in our earlier code snippet. Which, if any, of these will be much *faster for an ArrayList* (assuming a large number of entries)?

```
A) list.get(0);
B) list.get(list.size() - 1);
C) list.get(list.size() / 2);
D) None of the above.
```

For Friday

- Do the posted reading for Friday (and today).
- Sign into Canvas and log into Piazza.
- Complete:
  - The course survey
  - The group preference survey
  - The “Before” quiz