Data Abstraction and APIs

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Todays Lecture

Abstract Data Types
Application Program Interface(API)
Implementing an API
Consuming an API (writing an API client)
Useful APIs for this module

Data Abstraction

A data type is a set of values and a set of operations on those values

- primitives(e.g. int)
  - value (2^{31} and 2^{31}- 1)
  - operations (+,-,*...)
- reference types(e.g. Name Java class)
  - values (firstName, lastName …)
  - operations (getFirstName(), toString())

Lots of predefined data types and **you can build your own…**

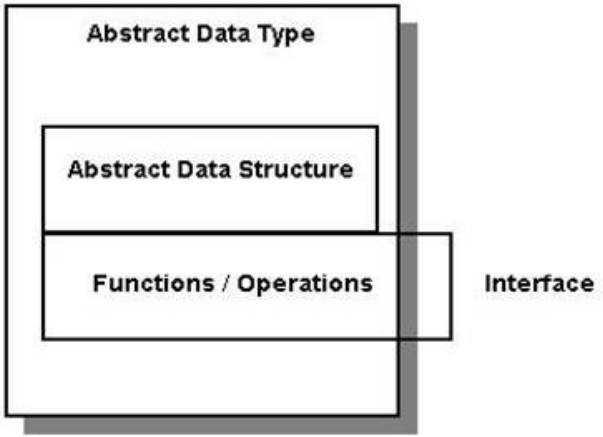
Abstract Data Type (ADT)

Implementation hidden from client.

Hide data from client and focus on operations.

This is Good for algorithms

- we can substitute one algorithm for another to improve performance.
- no need to change any client code.



Application Program Interface(API)

Specifies behaviour of Abstract Data Type
API provides a list of Constructors and Instance Methods
Often including short description of methods

public class Counter		
	Counter(String id)	*create a counter named* `id`
void	increment()	*increment the counter by one*
int	tally()	*number of increments since creation*
String	toString()	*string representation*

public class String		
	String()	*create an empty string*
int	length()	*length of the string*
int	charAt(int i)	*`i` th character*
int	indexOf(String p)	*first occurrence of `p` (`-1` if none)*
int	indexOf(String p, int i)	*first occurrence of `p` after `i` (`-1` if none)*
String	concat(String t)	*this string with `t` appended*
String	substring(int i, int j)	*substring of this string (`i` th to `j`-1st chars)*
String[]	split(String delim)	*strings between occurrences of `delim`*
int	compareTo(String t)	*string comparison*
boolean	equals(String t)	*is this string's value the same as `t`'s ?*
int	hashCode()	*hash code*

Java String API (partial list of methods)

Implementing an ADT

Use a Java Class

See implementation of counter API here:

https://github.com/fxwalsh/algorithms-2016-examples/blob/master/src/topic1/Counter.java

Client Code

Declare variable of the type
Use to refer to object

```
Counter c1 = new Counter("ones");
c1.increment();
Counter c2 = c1;
c2.increment();
StdOut.println(c1);
```

Useful ADT Libraries

- Stdlib_package.jar
  - http://introcs.cs.princeton.edu/java/stdlib/stdlib-package.jar
- Other useful APIs
  - http://algs4.cs.princeton.edu/10fundamentals/

Other APIs

- Java has thousands of ADTs
  - Standard system ADTs in java.lang.*
  - Collection ADTs to facilitate manipulation collections of data of the same(e.g. ArrayList, Stack….)