This week (Chapter 2):

- Abstract data types (**Today**)
- Data structures “discovery lab” (Thursday)
- Data Structures (Friday and next week Monday)
- Programming practices (also next week Monday)
- (Begin Case Studies next week Wednesday)

Today:

- Definition *abstract data type*, especially in contrast with *data structure*
- The “canonical” ADTs
- Categories of data structures
- Introduction to conventions of our code base

An abstract data type (ADT) is a data type whose representation is hidden from the client. Implementing an ADT as a Java class is not very different from implementing a function library as a set of static methods. The primary difference is that we associate data with the function implementations and we hide the representation of the data from the client. When using an ADT, we focus on the operations specified in the API and pay no attention to the data representation; when implementing an ADT, we focus on the data, then implement operations on that data.

[Sedgewick and Wayne, *Algorithms*, Pg 64; also cf pg 84]

The “canonical ADTs”:

List. Linear collection with sequential and random access.

Stack. Linear collection with LIFO access.

Queue. Linear collection with FIFO access.

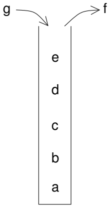
Set. Unordered collection with binary membership.

Bag. Unordered collection with enumerated membership.

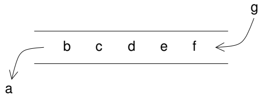
Map. Unordered collection of associations between keys and values.

a	b	c	d	e	f	g
0	1	2	3	4	5	6

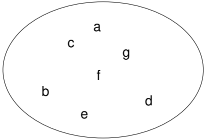
List



Stack



Queue



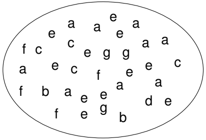
Set

c	t
b	z
a	y
f	w
g	u
e	x
d	v

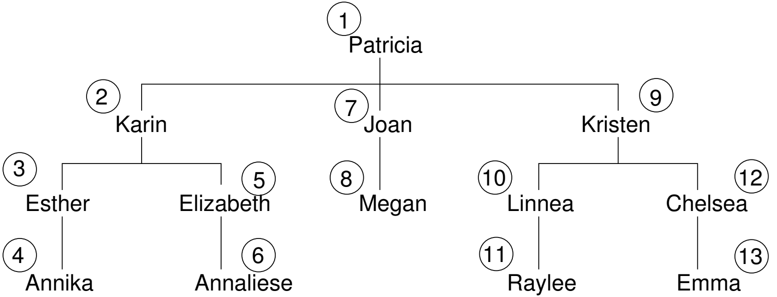
Map

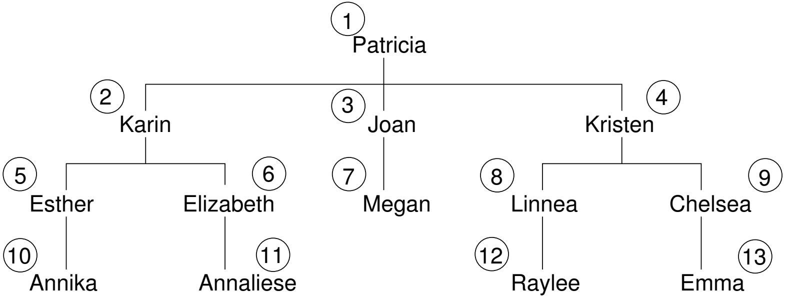
c	||||
b	||
a	𝍸 ||||
f	||||
g	|||
e	𝍸 𝍸 |
d	|

OR



Bag


1 Patricia
2 Karin
7 Joan
9 Kristen
3 Esther
5 Elizabeth
8 Megan
10 Linnea
12 Chelsea
4 Annika
6 Annaliese
11 Raylee
13 Emma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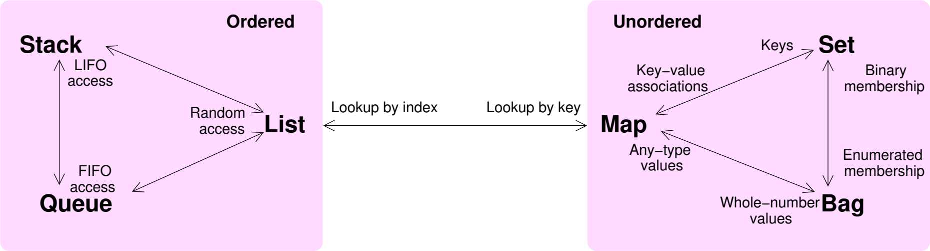

Ordered

Stack

LIFO access

Random access

List

FIFO access

Queue

Lookup by index

Lookup by key

Unordered

Keys

Set

Key–value associations

Binary membership

Map

Any–type values

Enumerated membership

Whole–number values

Bag

The four basic ways to implement an ADT:

- Use an array
- Use a linked structure
- Use an "advanced" data structure, varying and/or hybridizing linked structures and arrays
- Adapt an existing implementation of another ADT.

Coming up:

Due **Wed, Sept 11** *(end of day):*
Read Section 2.1
Do Exercise 1.11
Take quiz

Due **Mon, Sept 16***:*
Read Section 2.(2, 4, & 5)
(No exercises)
Take data structures quiz

Also:
Do **“Basic ADTs and data structures”** *project (Fri, Sept 20)*