



Developing Data Structures with Open Source Tools

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Module One – Introduction

Part C – Data Structures

What's a Data Structure?
A Simple Example
What are they good for?
Data Structures in Nature
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What's a Data Structure?

Generally, a data structure is a storage processing machine that handles (sometimes large) sets of data. These structures, often called *collections*, have operations for accessing the items as well as adding and removing items.

- A “storage processing machine” is an academic way to refer to a part of computer program in the sense that we understand them today.
- Think of a data structure as a scheme for organizing related bits of data.

Data structures...

- store data (nouns, perhaps)
- provide attributes (adjectives) describing the nature of the data
- provide operations (verbs) to manipulate the data in certain ways

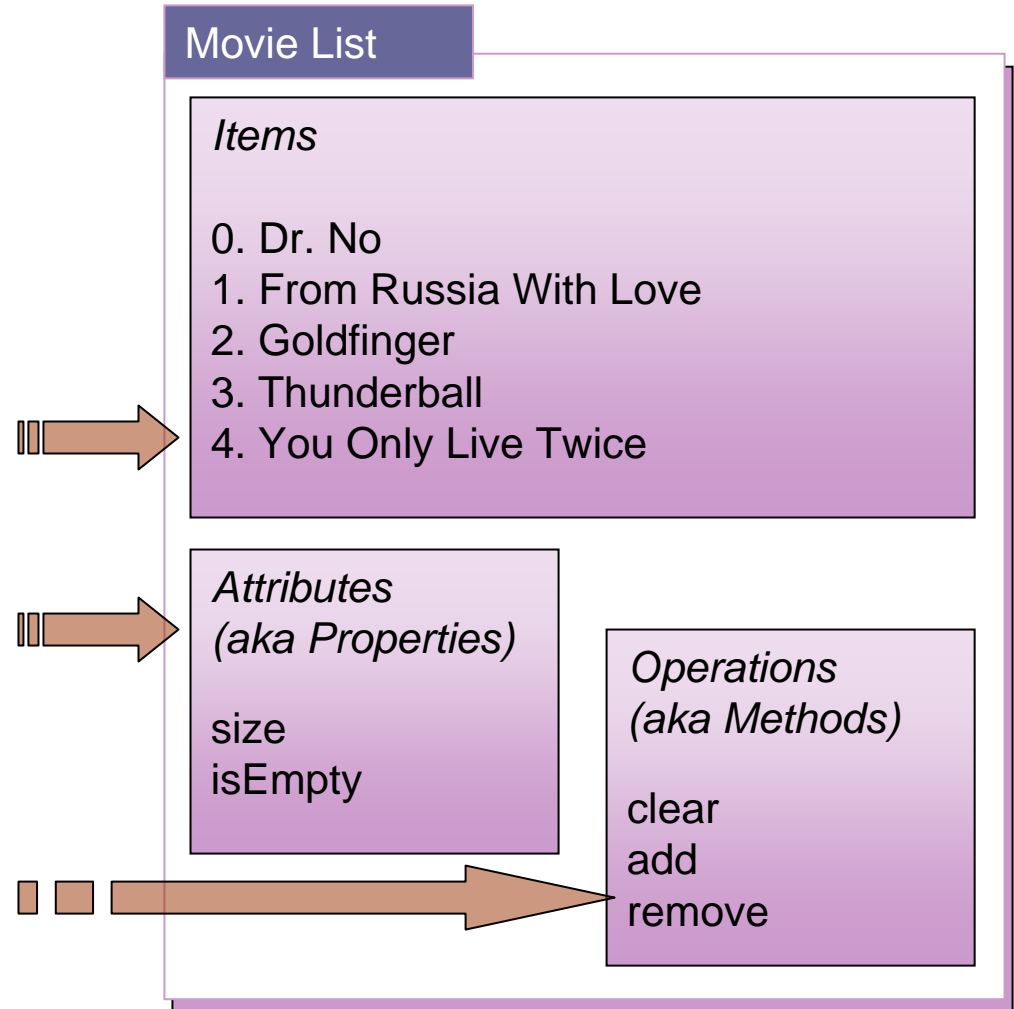
Let's look at a simple example...

A Simple Example

The list *collection* is a very common data structure.

Data structures...

- store data (nouns, perhaps) or *elements* of the collection
- provide attributes (adjectives) or *properties* describing the nature of the data
- provide operations (verbs) or *methods* to manipulate the data in certain ways





What are Data Structures good for?

Data structures play a crucial role in almost every aspect of Computer Science and Information Technology today.

They are a key element in the design of just about every application, from games to office applications, from databases to the Internet, data structures are everywhere.

Since they are used to store and organize data, and without data we've got nothing interesting to do with computers, we'd better gain a proper understanding of various types of data structures, how to build them, and how to use them.



Data Structures in Nature

People lining (or “queuing”) up for a movie

- The first one in line is the first to get in.

Stacks of plates in a cafeteria

- Plates are pushed “down” on the stack one at a time, and removed one at a time.
- The first one pushed on is the last to be popped off.

The organizational chart of a company

- From the most general, top-level position, branching out to middle management and then branching more and more on the way down to the specialized jobs, this hierarchy is a data structure.

The indexed names in a phone book

- A specialized list with specific properties regarding order, this represents another data structure.

And many more...



The Course Ahead

A study of data structures necessarily involves a study of algorithms in order to ensure proper and efficient handling of data. [Niklaus Wirth](#) famously noted that...

Algorithms + Data Structures = Programs

Data structures need good algorithms. The converse is also true.

We will focus on various algorithmic techniques throughout the course, looking at their relation to various data structures.

There may be places where we can exploit certain features of a data structure to enhance the processing algorithm we're using. That's but one of the more enjoyable challenges that lie ahead.



Resources to Explore

Sun's [New To Java Center](#)

Sun's [Java Tutorial](#)

Advanced article from Sun: [How to Build Data Structures in Java](#)





Self-review

Define a data structure.

Give some examples of data structures from the “real” world.

Why bother to study data structures?



Discussion Topics

Along the lines of my examples of data structures in nature, can you come up with some other instances of structured data in your natural environment?



Homework



- 1c1. In the simple list example, why is the list numbered from zero?
- 1c2. In the simple list example, what value should we get when we ask for the size of the list?
- 1c3. Define the term *algorithm* and describe its importance to programming.



Coming Attractions



The Eclipse Environment – About Eclipse