

Abstract Data Types

CS2263 – Systems Software Development

Rock N Roll Duty, Kim Mitchell (Rockland, 1989) https://www.youtube.com/watch?v=YgWg4_VvfTA

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Learning Outcomes

At the conclusion of this lecture students should be able to:

- Describe an abstract data type (ADT)
- Explain the advantages and power of an ADT
- Recall your previous experiences with ADTs

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References

- Lu, Yung-Hsiang. 2015. Intermediate C Programming. CRC Press. New York. (Chapter 16)



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Concrete Data Types

What is an `int`?

- Data type:
 - Whole/natural numbers?
 - Number without a fractional component
- Implied functionality ► operators:
 - Addition, subtraction, multiplication
 - division
 - =
 - <, <=, >, >=, ==, !=

What is a `char`?

- Data type:
- Implied functionality ► operators

What is a `float`?

- Data type:
- Implied functionality ► operators
- Mathematical functions: `sqrt()`

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#Sidebar

The C Standard Library

The C Standard Library is defined as a set of black-boxes

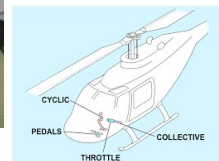
- Black-box versus white-box
- Defines
 - Inputs
 - Expected behavior
- Does not define specific internal processes
 - Define what you want to achieve, not how to do it
- Examples:
 - `<stdio.h>`
 - `<stdlib.h>`

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Abstraction

Separates specification/functionality from implementation.

- How is C's `sqrt()` implemented?
- Purchase an item online
- Order a pizza
- Steering a vehicle:
 - Car
 - Aircraft
 - Small boat



External versus internal structure

Key to polymorphism

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Abstract Data Type

- Separates public /external
 - External view of structure and operations
 - Provided by interfaces
- from private/internal
 - Actual structure and operations
- You've seen this before in Java
 - OOP is *all* about abstraction

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Typical ADTs

- Lists
 - A set of items
- Stacks
 - A LIFO set of items
- Queues
 - A LILO set of items
- Binary Trees
 - A graph with at most two connections per node
- Directed Graphs
 - A graph with only one direction of traversal

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Typical ADT Operations

- Create the ADT
 - instantiate
- Read (access) the ADT
 - e.g. report the items
- Update the ADT
 - Add/remove items
- Delete the ADT
 - What it says

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