Topic 5

Introduction to UML Diagrams

Objectives

- To introduce UML Diagrams
  - A diagrammatic way of showing the relationships among classes
  - This will help our understanding of the definitions of our collections and the usage of our collections in applications

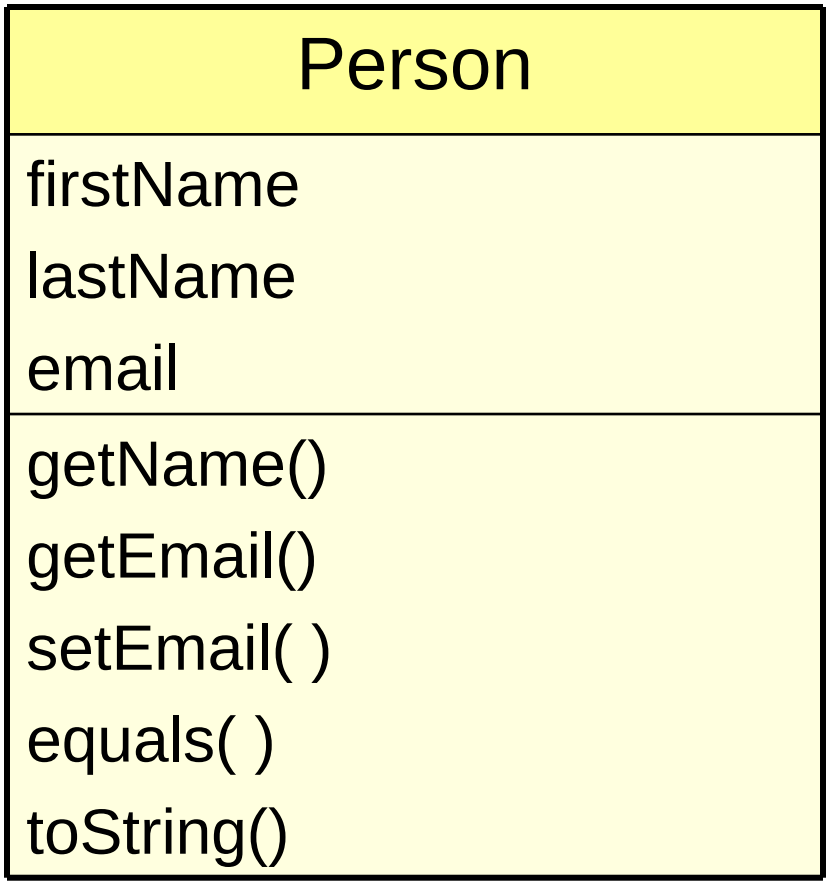
UML Diagrams

- ***Unified Modeling Language (UML)*** is a standard notation for object-oriented design
  - Used to ***model*** object-oriented designs
  - Shows overall design of a solution
    - Shows class specifications
    - Shows how classes interact with each other
  - Diagrams use specific icons and notations
  - It is ***language independent***

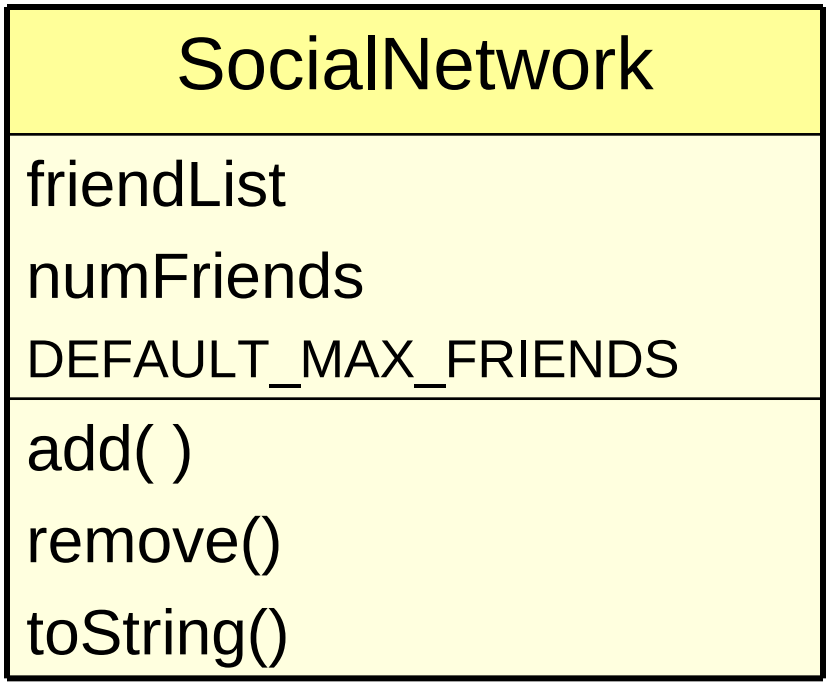
UML Class Diagram

- A class is represented in a UML diagram by a rectangle divided into **3** sections:
  - ***name*** of the class
  - ***attributes*** of the class (i.e. the data fields of the class, including variables and constants)
  - ***operations*** of the class (essentially equivalent to a Java method or a C++ function)

Example: UML Class Diagram



Example: UML Class Diagram

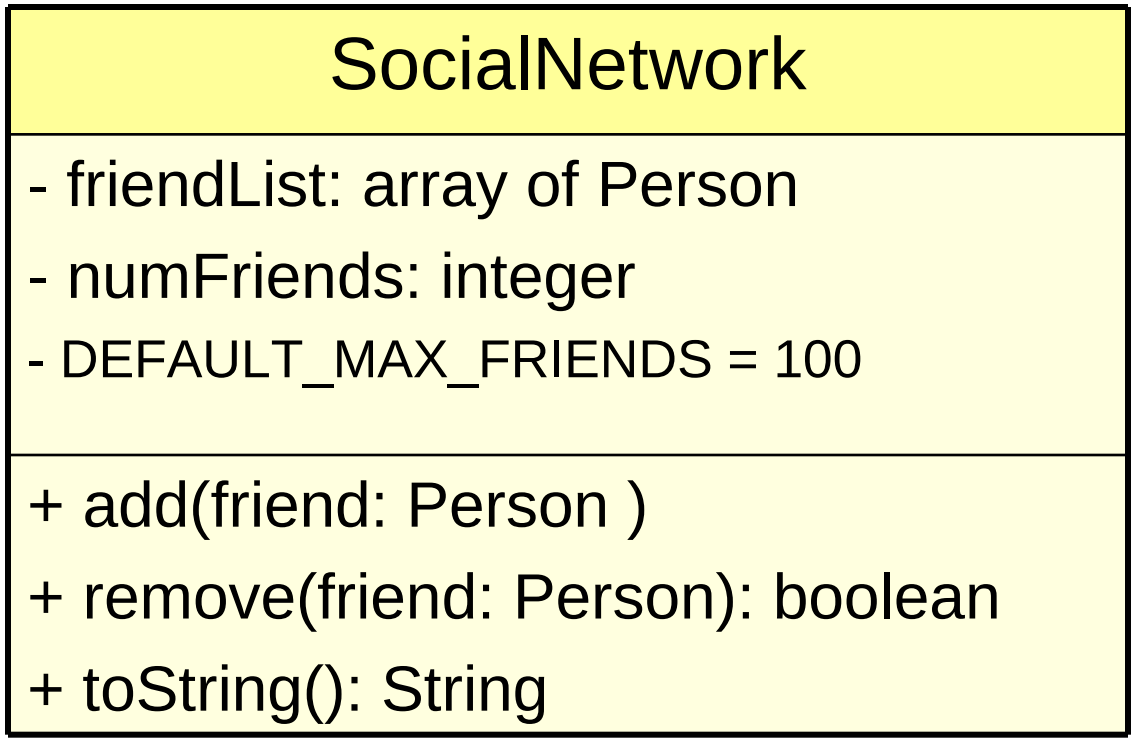


Features of UML Class Diagrams

- Attributes and operations may include:
  - ***visibility***: public (+) or private (-)
  - ***type*** of attribute or operation
  - ***parameter list*** for operations
- Including this information is of the form:

visibility variable_name: type
visibility variable_name: type = default_value
visibility method_name(parameter_list): return_type {property}

Example: UML Class Diagram



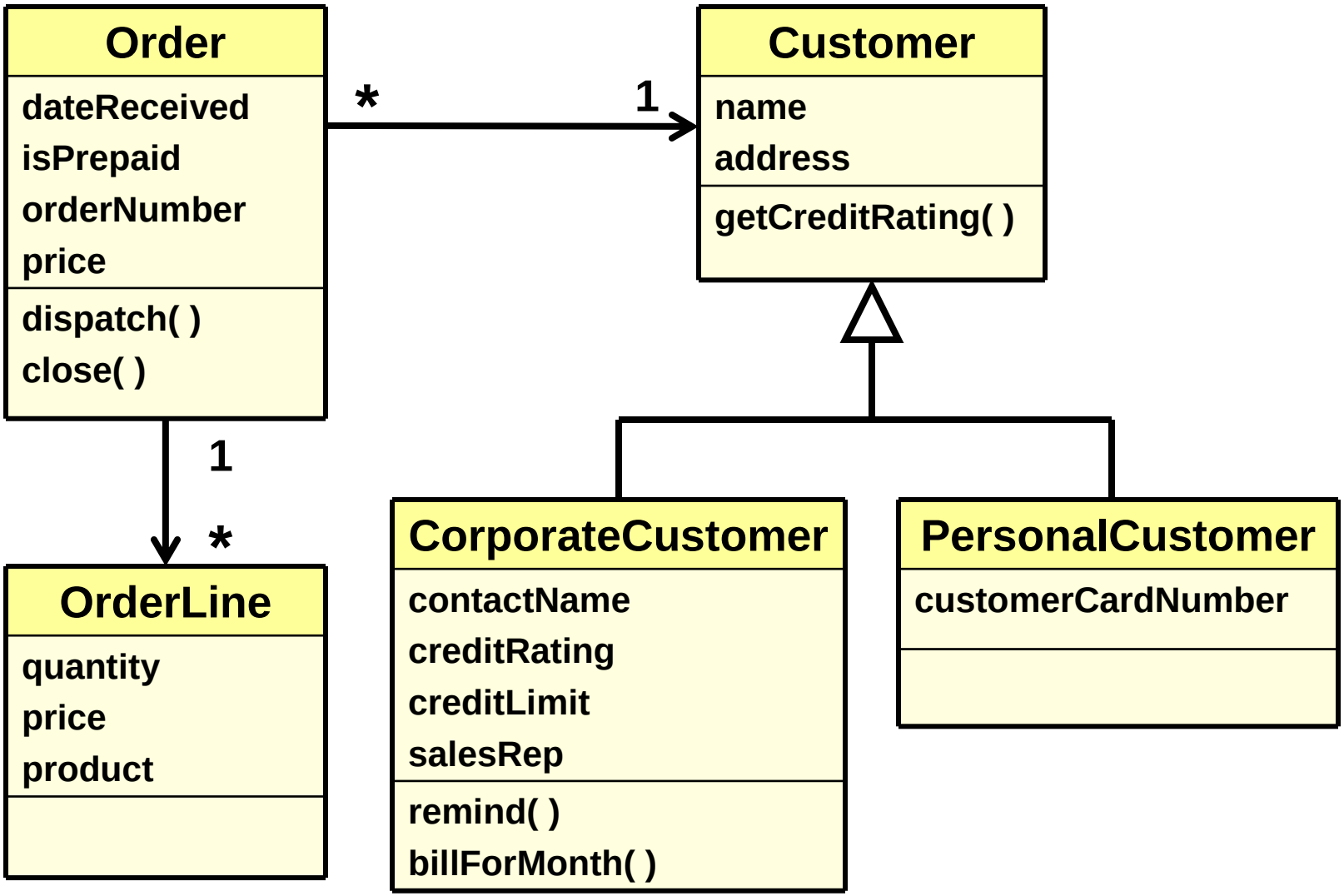
Features of UML Class Diagrams

- Attributes and operations may be left incomplete, and completed as design is developed

Set of UML Class Diagrams

- A set of UML class diagrams shows:
  - The classes used in the system
  - The ***relationships*** among classes
  - The ***constraints*** on the connections among classes

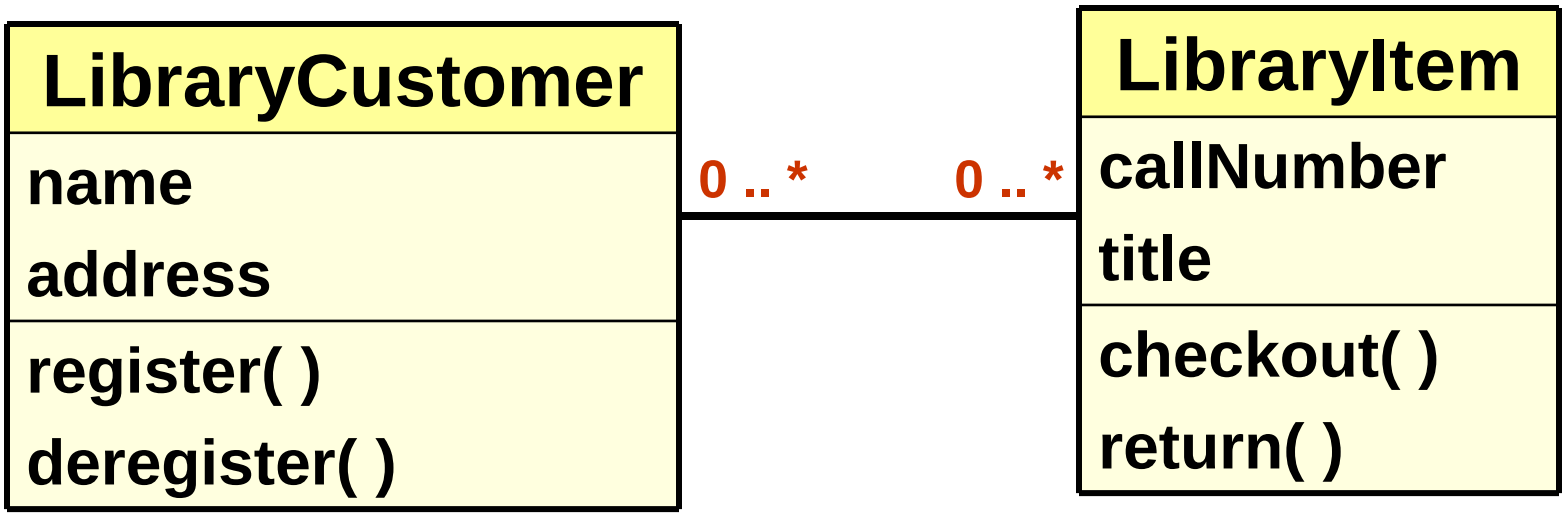
Example: UML Diagram for Order Processing



Features of Set of UML Diagrams

- ***Association between classes***:
  - Represents a relationship between objects of those classes
  - Indicated with a *solid line* between the classes
  - Can be annotated with ***cardinality***: indicates a numeric association between classes, such as:
    - **one-to-one**
    - **one-to-many (1..*)**
    - **many-to-many (*..*)**
    - **zero-to-many (0..*)**
    - **zero-to-5 (0..5)**
    - **etc.**

Example: Association Between Classes



Association Between Classes

- What is the Order-Customer relationship in our Order Processing System?

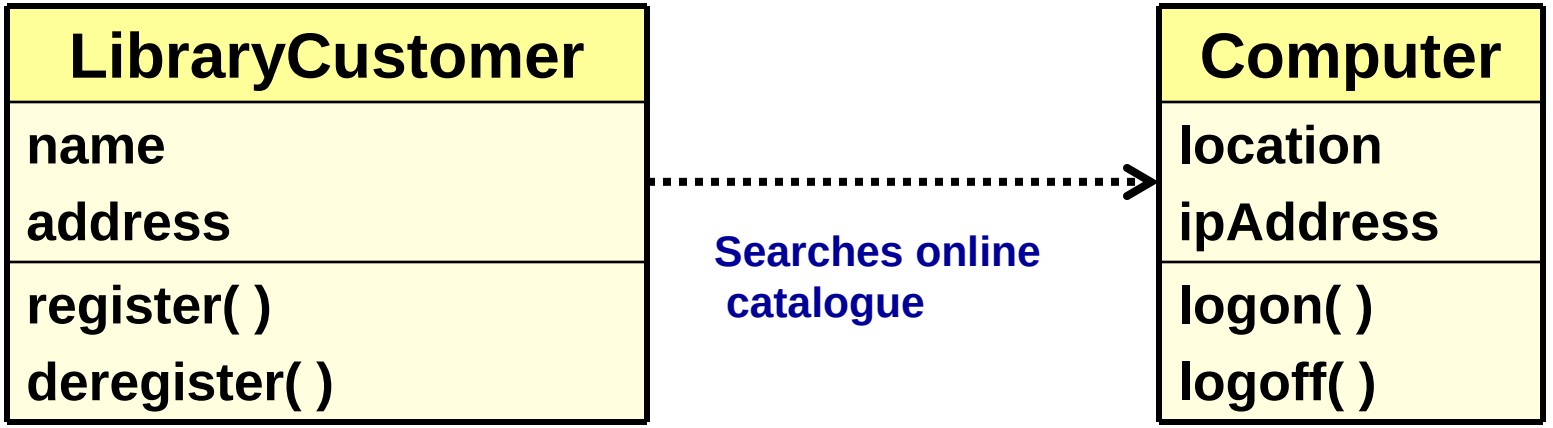
- How would we annotate that a Library Customer can not check out more than 5 library items?

Features of Set of UML Diagrams

- ***Usage of another class***:
  - Broken line with an arrow indicates that one class makes use of the other

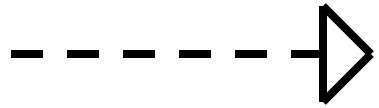
  - Line can be labeled with a message indicating the type of usage

Example: One Class Indicating its Use of Another



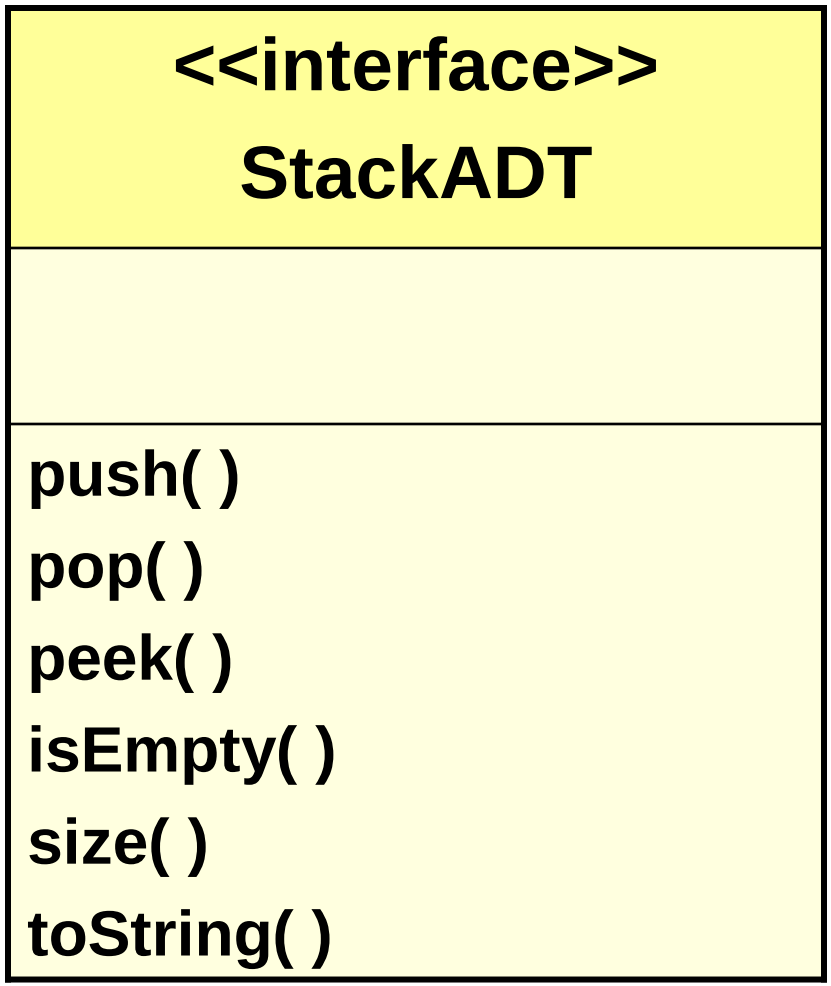
Features of Set of UML Diagrams

- ***Implementation of an interface***:
  - Indicated by a broken line with an open arrow

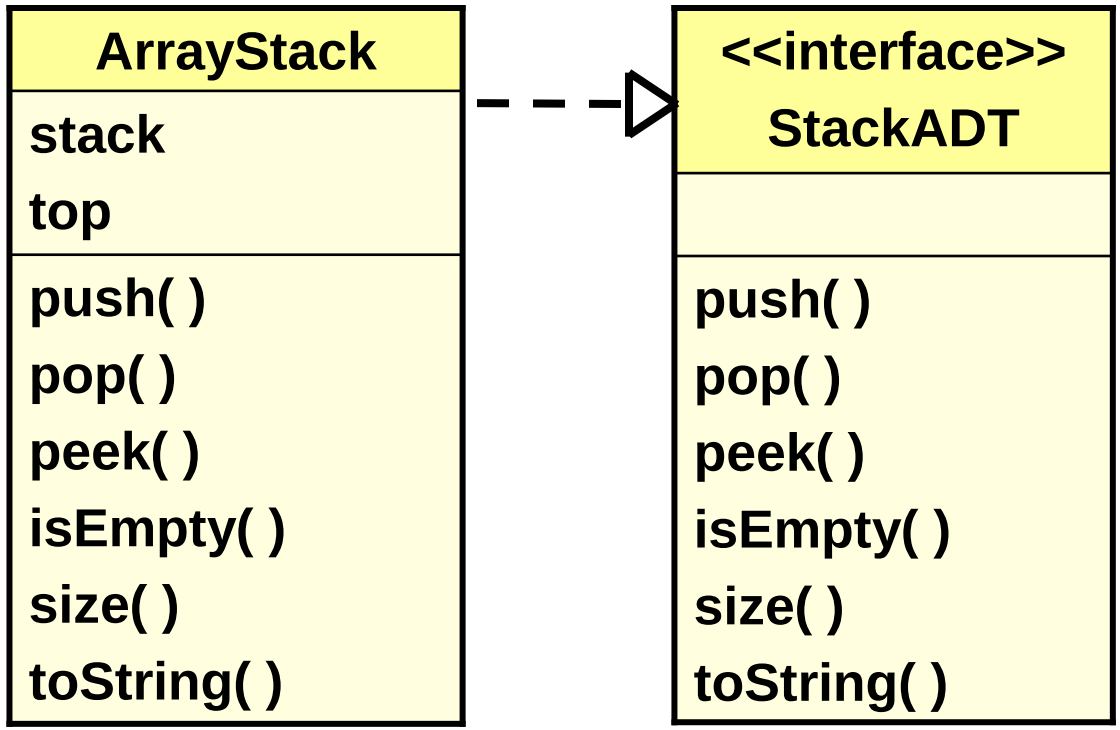


  - ***UML diagram for an interface*** is much like the UML diagram for a class
    - But there are no attributes (why not?)

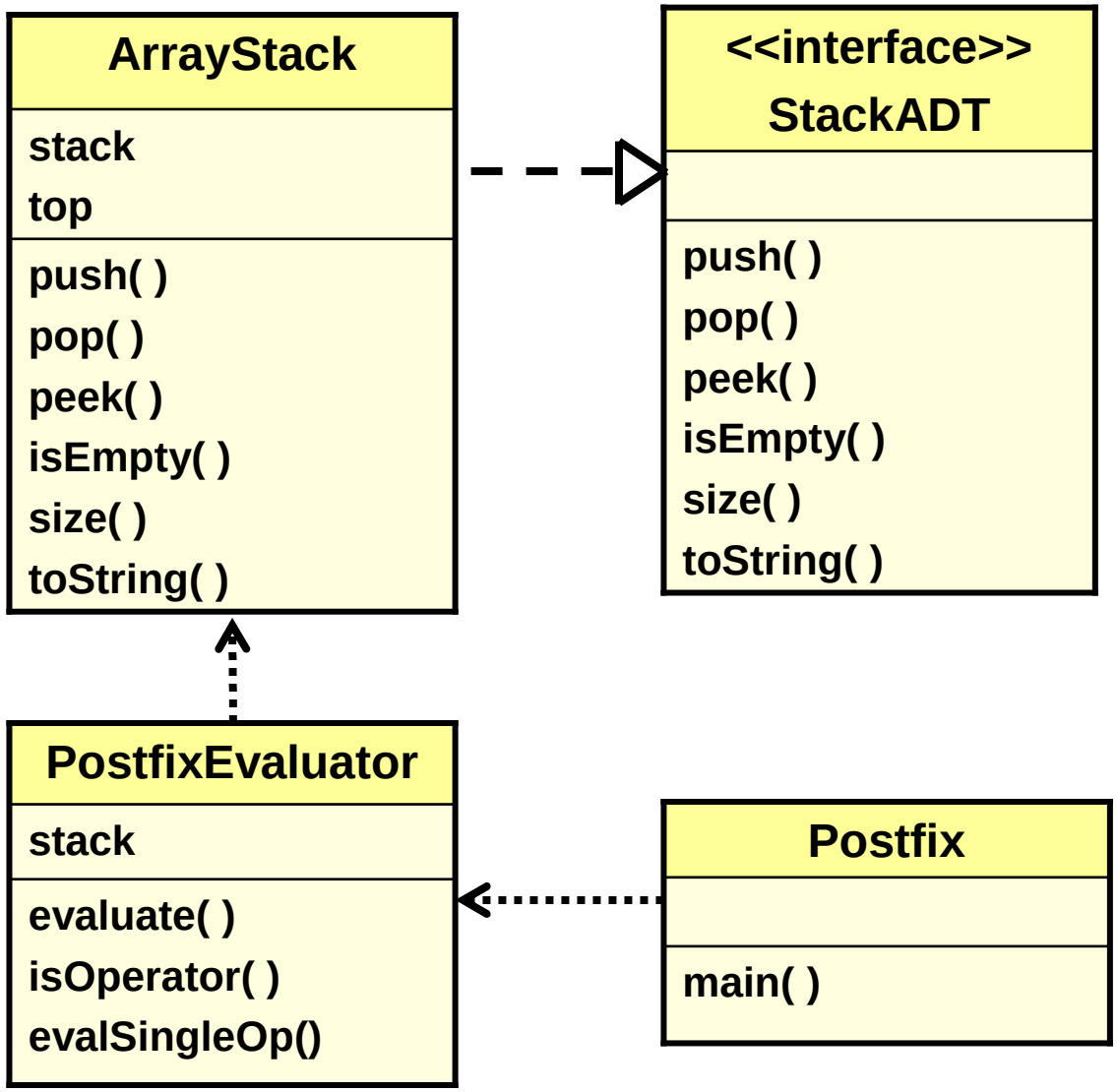
UML Diagram for StackADT Interface



UML Diagram for ArrayStack Implementation of StackADT



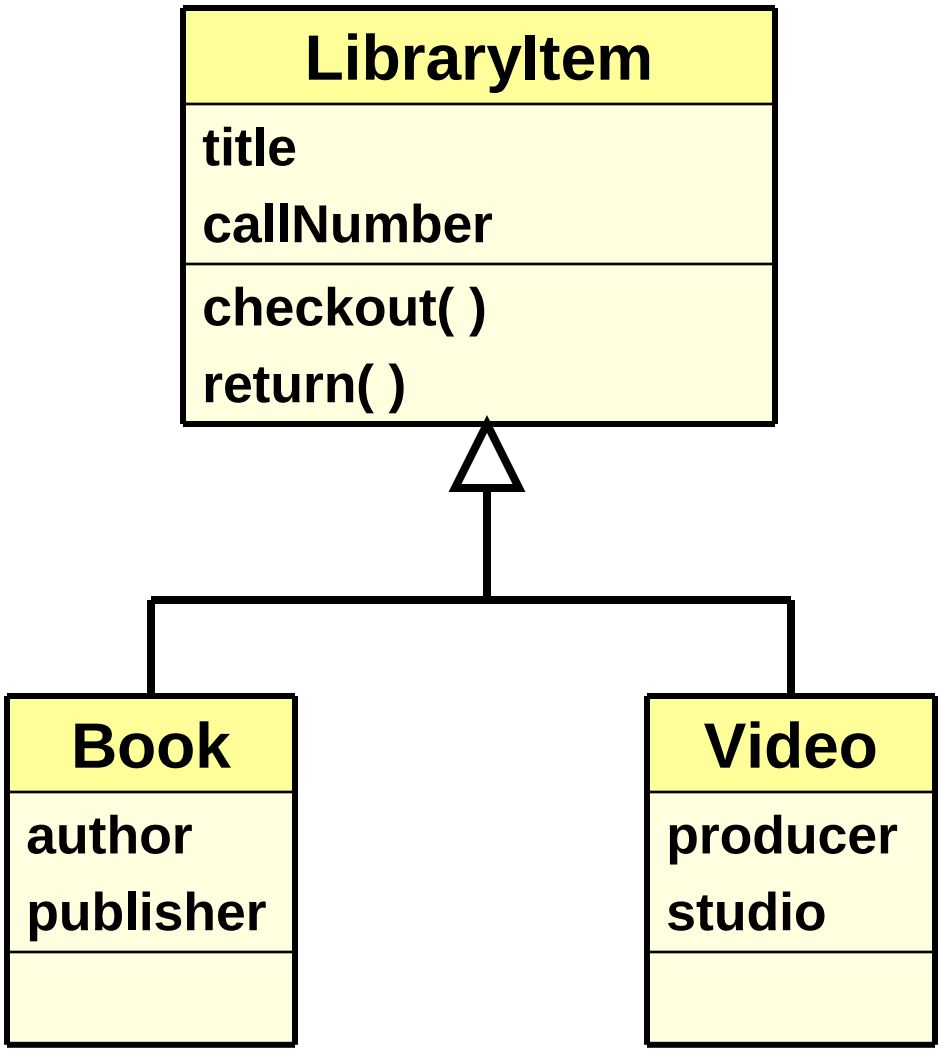
UML Diagram for Postfix Expression Program



Features of Set of UML Diagrams

- ***Inheritance:***
  - An arrow on an association line indicates that one class is derived from the other

Example: Inheritance Relationships



Example: Inheritance Relationships