

# Object Oriented Design Essentials

## Concepts and Principles

# Concepts and Principles

## Chapter 1

## Objectives

You will learn:

- How to appreciate the differences between design and analysis.
- Differences between a functional and object-oriented approach to design.
- Object-oriented terminology.
- How to do define an object and its characteristics.
- The tools of object-oriented design, object-oriented analysis, and object-oriented programming.

# Object Oriented Design Essentials

## Concepts and Principles

### Object-Oriented Design

- Structured or functional design derived the design from the *functioning* of a system.
- O-o design is different; it considers design from the point of view of:
  - interacting objects of various types.
  - information hiding.

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### Objects

- An object is defined to be an entity which has
  - a private state.
  - a set of operations to manipulate that state.
- An object is an instance of a type - the type specifies the valid set of operations available for each object of that type.
- The objects provide abstract behavior - the detailed implementation is hidden from the user.
- The state of the object may be accessed only by the defined operations.

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### Deriving an O-O Design

- Consists of conceptualizing/planning:
  - The types of object that may be needed in a system.
  - The ways that instances of those types interact.
- Start with a natural language overview of the system.
- Then identify:
  - nouns (objects or their attributes).
  - verbs (operations).
  - adjectives (subclasses ).

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### Object Components

- The objects consist of:
  - data attributes (e.g. an array or variable).
  - operations (e.g. functions) which can be applied to the data.
- These 2 components are sometimes known as:
  - data members.
  - member functions.
- The only disadvantage to o-o design is that it is difficult to identify the most suitable objects to give the best design.

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## Example

A natural language overview of part of the email system:

*Messages in a mail box can be examined, printed, deleted, forwarded or filed, and new messages can be added.*

*A mail message consists of a subject line and the contents of the message, plus the sender's name, the receiver's name, the date and time sent, and the (circuitous) route it took.*

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## Example (cont)

*MESSAGES in a MAIL BOX can be examined, printed, deleted, forwarded or filed, and new messages can be added.*

*A mail message consists of a SUBJECT LINE and the CONTENTS of the message, plus the SENDER'S NAME, the RECEIVER'S NAME, the DATE and TIME SENT, and the (circuitous) ROUTE it took.*

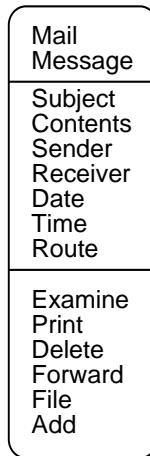
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### Graphical Representation of Objects



- Objects can be represented as round-cornered rectangles.
- Attributes or data members.
- Operations or member functions.

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### Inheritance

- Very important feature in o-o systems, providing great power.
- An object is an instance or concrete example of a type or class.
- Similar objects belong to the same class.
- Classes can be formed into a hierarchy, subclasses inheriting all the attributes and operations of their superclass(es) as well as having additional ones of their own.

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### Advantages of O-O Design

- Security
  - Information is hidden rather than shared by the system.
  - Global variables and shared data structures are avoided, reducing coupling and the possibility of changes to data by different parts of the system.
  - This helps to make the system more understandable.
  - Access to data is only possible through the object's interface.
- Abstraction
  - Implementation details are hidden, making the objects:
    - independent, with high cohesion.
    - understandable, in bite-size chunks.
    - easy to maintain, changes are localised.
    - reusable.

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### O-O Languages and Tools

- O-o languages make the implementation of o-o designs easy - e.g. using C++ classes, Ada packages, Modular-2 modules, Java classes.
- VB has many of the features of an object oriented language.
- Non-o-o languages such as C or Pascal *can* be used to implement an o-o design.
- Tools are now available for o-o.

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