**Khulna University**
Computer Science & Engineering Discipline

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CSE3203 - Software Engineering and Information System Design

Chapter 5

Object Oriented Design

Chapter Outline

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- Objects and object classes
- An object-oriented design process
- Design evolution

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Lecture 8

Object Oriented Design

- Objects and object classes
- An object-oriented design process
- Design evolution

Object-oriented development



- Object-oriented analysis, design and programming are related but distinct.
- OOA is concerned with developing an object model of the application domain.
- OOD is concerned with developing an object-oriented system model to implement requirements.
- OOP is concerned with realising an OOD using an OO programming language such as Java or C++.

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Characteristics of OOD



- Objects are abstractions of real-world or system entities and manage themselves.
- Objects are independent and encapsulate state and representation information.
- System functionality is expressed in terms of object services.
- Shared data areas are eliminated. Objects communicate by message passing.
- Objects may be distributed and may execute sequentially or in parallel.

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Advantages of OOD



- Easier maintenance. Objects may be understood as stand-alone entities.
- Objects are potentially reusable components.
- For some systems, there may be an obvious mapping from real world entities to system objects.

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Object communication



- Conceptually, objects communicate by message passing.
- Messages
 - The name of the service requested by the calling object;
 - Copies of the information required to execute the service and the name of a holder for the result of the service.
- In practice, messages are often implemented by procedure calls
 - Name = procedure name;
 - Information = parameter list.

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Generalisation and inheritance



- Objects are members of classes that define attribute types and operations.
- Classes may be arranged in a class hierarchy where one class (a super-class) is a generalisation of one or more other classes (sub-classes).
- A sub-class inherits the attributes and operations from its super class and may add new methods or attributes of its own.
- Generalisation in the UML is implemented as inheritance in OO programming languages.

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Advantages of inheritance



- It is an abstraction mechanism which may be used to classify entities.
- It is a reuse mechanism at both the design and the programming level.
- The inheritance graph is a source of organisational knowledge about domains and systems.

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The Unified Modeling Language



- Several different notations for describing object-oriented designs were proposed in the 1980s and 1990s.
- The Unified Modeling Language is an integration of these notations.
- It describes notations for a number of different models that may be produced during OO analysis and design.
- It is now a *de facto* standard for OO modelling.

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Some UML modeling notations



- Use case diagram
- Sequence diagram
- Class diagram
- State chart diagram
- Activity diagram
- Deployment diagram
- Component diagram
- Collaboration diagram

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Use-case models



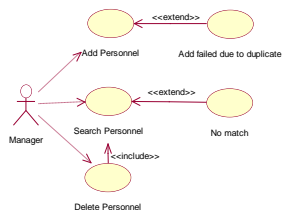
- Use-case models are used to represent each interaction with the system.
- A use-case model shows the system features as ellipses and the interacting entity as a stick figure.
- Flow of events within a use case can be depicted using sequence diagrams.

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Use cases for the personnel information system



The diagram is only part of the story.
Need to also develop use case descriptions (not shown here).

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Sequence models



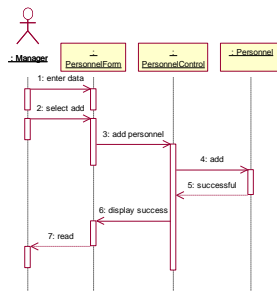
- Uses
 - depict interactions of objects; helps identify methods and other attributes and classes
- Review
 - Objects are arranged horizontally across the top;
 - Time is represented vertically so models are read top to bottom;
 - Interactions are represented by labelled arrows. Different styles of arrow represent different types of interaction;
 - A thin rectangle in an object lifeline represents the time when the object is the controlling object in the system.

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Add personnel sequence

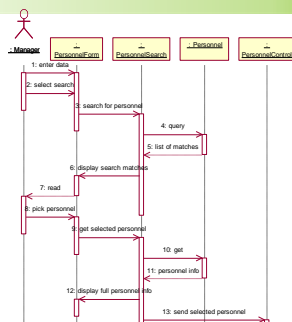


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Search personnel sequence

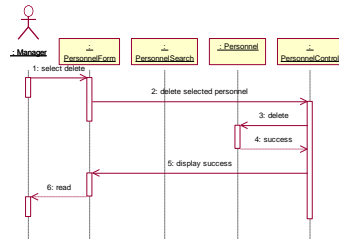


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Delete personnel sequence



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Object identification



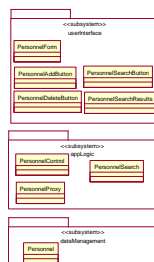
- Identifying objects (or object classes) is the most difficult part of object oriented analysis and design.
- There is no 'magic formula' for object identification. It relies on the skill, experience and domain knowledge of system designers.
- Object identification is an iterative process. You are unlikely to get it right first time.

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Static model – class diagram

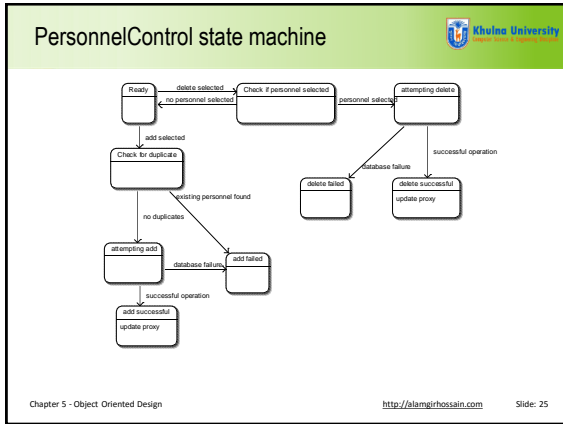


Includes objects from
solution domain.

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Lecture 10

Object Oriented Design

- Objects and object classes
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Design evolution

- Hiding information inside objects means that changes made to an object do not affect other objects in an unpredictable way.
- Example: the system must now support different types of personnel with different attributes.
- To support this, we can create subclasses of Personnel class as well as PersonnelForm class to accommodate different types of Personnel. The application logic does not have to change (ideally).

Key points



- OOD is an approach to design so that design components have their own private state and operations.
- Objects should have constructor and inspection operations. They provide services to other objects.
- Objects may be implemented sequentially or concurrently.
- The Unified Modeling Language provides different notations for defining different object models.

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Key points



- A range of different models may be produced during an object-oriented design process. These include static and dynamic system models.
- Object interfaces should be defined precisely using e.g. a programming language like Java.
- Object-oriented design potentially simplifies system evolution.

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THANK YOU
