

# **System Analysis and Design**

## ***(IT3120E)***

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# Content:

- **Introduction of object-oriented system analysis and design**
  - **System analysis and design**
  - **Object-oriented modeling**
- Introduction of the modeling language UML
- Introduction of software development process
- Analysis of the environment and needs
- Function analysis
- Structure analysis
- Interaction analysis
- Behavior analysis
- Design of the system's overall architecture
- Class detail design
- User interface design
- Data design

# System analysis and design (1)

- What is a system?
  - A *system* is a collection of elements/components that are interrelated and work together towards a common goal
  - A system takes input and produces output
- Goal of (information) system analysis and design?
  - Every information system has a lifecycle
  - Main phases: *Understanding* of requirements/needs, *Analysis*, *Design*, *Implementation*, *Operation* and *Maintenance*
    - Can be linear (sequential), or
    - Can repeat phases

# System analysis and design (2)

- Phase “**Understanding of requirements/needs**”
  - Clarifying what the information system is built to meet the needs of users (immediate & future needs, explicit & implicit needs)
- Phase “**Analysis**”
  - Diving into the nature and details of the system, showing what the system is supposed to do and the data it uses
- Phase “**Design**”
  - Making the system design decisions to satisfy: 1) requirements identified in the analysis phase and 2) actual constraints
- Phase “**Implementation**”
  - Programming and testing
- Phase “**Operation and Maintenance**”
  - Putting the system into use, making corrections and upgrades if unsuitable points are detected

# System analysis and design (3)

- Do we need a method?
  - To efficiently complete (complex) jobs
  - Example: Building a house, Building a software system, etc.
- A method of system analysis and design is a combination of 3 factors:
  - **Concepts and models**
  - **Implementation process:** Step-by-step activities to do
  - **Support tools:** Software to help (support) the system analysis and design

# System analysis and design (4)

- Method of *functional* system analysis and design:
  - Introduced in the 70s to 80s of the 20th century
  - Taking the *function* as the base unit when performing system analysis and design
  - Implementing the system by procedural programming languages: Pascal, C, etc.
  - **Disadvantages: The system is difficult to repair, difficult to upgrade, difficult to reuse**
- Method of *object-oriented* system analysis and design:
  - Introduced in the 90s of the 20th century
  - Taking *object* as the basic unit of the system
  - Object: Combining function and data
  - Implementing the system by object-oriented programming language: C++, Java, C#, etc.

# Object-oriented modeling

- Concepts of model and modeling
- Modeling methods
- Object-oriented modeling

# Model and Modeling

- **Model** is an abstraction/an image/a representation of a described real system:
  - From a certain point of view,
  - To some degree of abstraction,
  - By some form of understandable representation (e.g., text, diagrams, graphs, etc.)
- **Modeling** is the use of models to perceive and describe a system
- The *system analysis and design process* is also called the *system modeling process*



# Purpose and quality of modeling

- Purpose of modeling:
  - To understand
  - To communicate (exchange)
  - To complete
- A good modeling must satisfy the following requirements:
  - Easy to read
  - Easy to understand
  - Easy to communicate (exchange)
  - Verifiable
  - Rigid
  - Complete
  - Easy to implement

# Modeling method

- Consist of:
  - **Notation:** Concepts and models
  - **Process:** Steps to do, products (documents, models) to be produced at each phase, how to run the process, how to evaluate quality
  - **CASE (i.e., computer aided software engineering) tool:** Support software for the modeling process, capable of:
    - Producing models and diagrams,
    - Quickly transforming and adjusting models and diagrams,
    - Checking syntax, rigidity, completeness,
    - Testing and evaluating,
    - Simulation of model execution

# Two main trends of modeling

- *Function-oriented* modeling (since 1970)
  - Taking *function* as the base unit of the system
  - Suitable for procedural programming methods
- *Object-oriented* modeling (since 1990)
  - Taking *object* as the base unit of the system
  - Suitable for object-oriented programming methods

# Programming methods

- Procedural programming methods: Pascal, C, Ada, Cobol, etc.
- Logic programming methods: Prolog, C5, etc.
- Object-oriented programming methods: C++, Java, etc.