

Software Modelling

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Course Content

What is Software Modelling

Types of Models - OO Modelling

Revising UML Modelling

Modelling For Analysis Vs. Modelling for Design

Principles of Good Design - SOLID Principles

Refining Your Designs using Design Patterns

Course Learning Objectives

Apply requirements gathering and requirements elicitation techniques to properly model the requirements for a software system

Apply object-oriented principles and design principles to build a software design that could easily be maintained and extended to endure new requirements

Apply basic design patterns to enhance your design

(Tentative) Evaluation

- Final exam (60 marks)
- Midterm (20 marks)
- Project/Assignments/Lab tasks (20 marks)
- Quizzes during Lecture (bonus)
- Lab setup
 - Labs will be dedicated to performing tasks based on the **previous lectures' contents**
 - Students will be **submitting tasks** during the lab time, and the lab mark will depend on **correctly performing the task during the lab time.**
 - Tasks cannot be submitted after the lab.
 - Students should **NOT be attending outside their registered lab slot.**

Evaluation (Cont'd)

Cheating Policy

- There will be **ZERO** tolerance for any sort of cheating.
- COPYING your code from online resources **IS CHEATING**
- You are expected to submit your OWN ORIGINAL work for the graded course work.
- Discussing the details of your solution with your colleague **is CHEATING**
- **When in doubt, then it is probably cheating!**

Course Material

Textbooks

- ❑ McLaughlin, Brett, Gary Pollice, and David West. Head First Object-Oriented Analysis and Design: A Brain Friendly Guide to OOA&D. " O'Reilly Media, Inc.", 2007.
- ❑ Bernd Bruegge, Allen H. Dutoit, “**Object-Oriented Software Engineering: Using UML, Patterns and Java**”, 3rd Edition, Prentice Hall, Upper Saddle River, NJ, 2009;
- ❑ Freeman, Eric, et al. Head first design patterns. " O'Reilly Media, Inc.", 2008.

Additional readings may be added during each lecture.

Google Classroom

<https://classroom.google.com/c/NTQyNjg2MTMwNzQx?cjc=64aa6fr>

Is this a model?

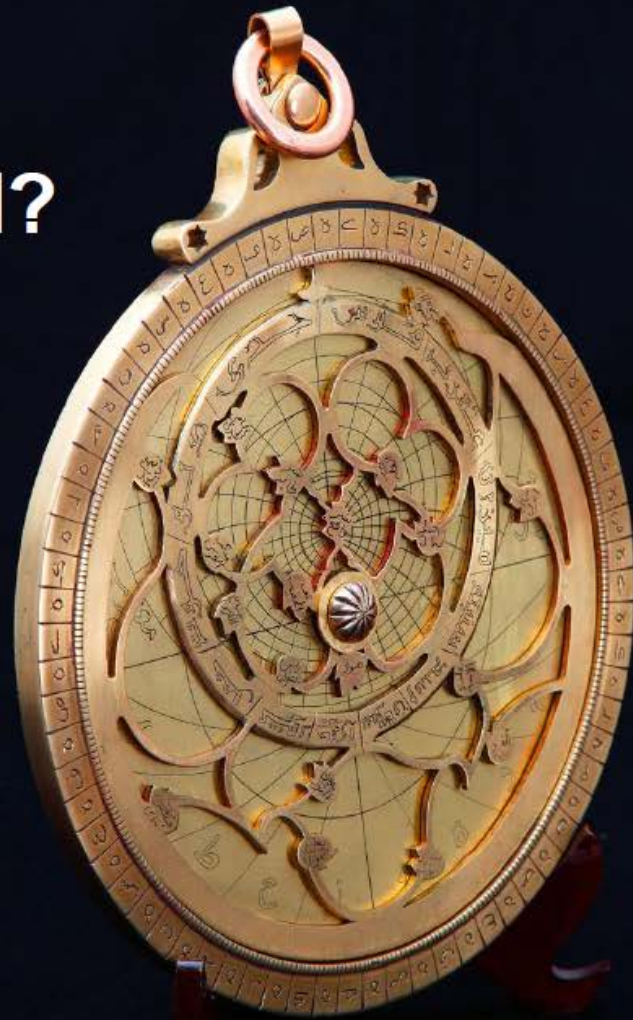
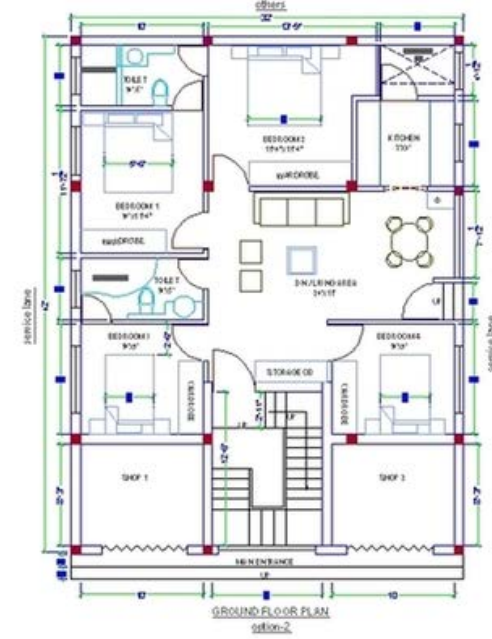
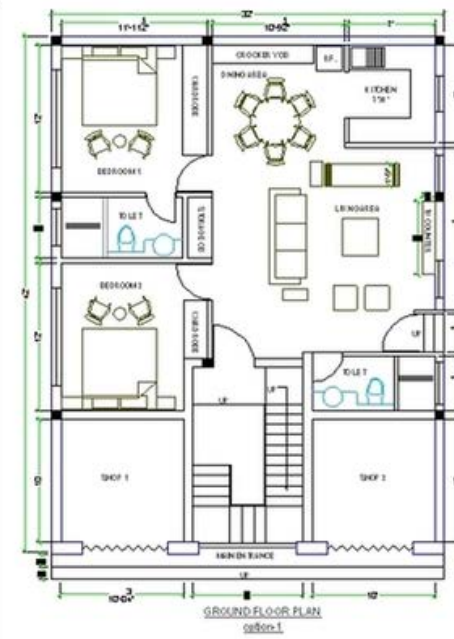
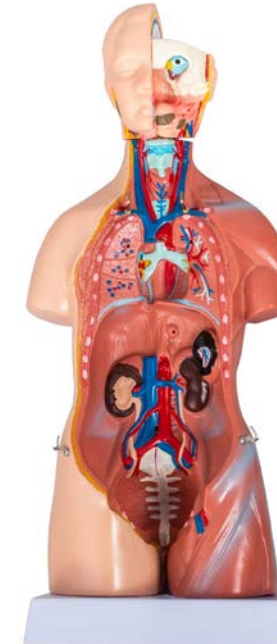
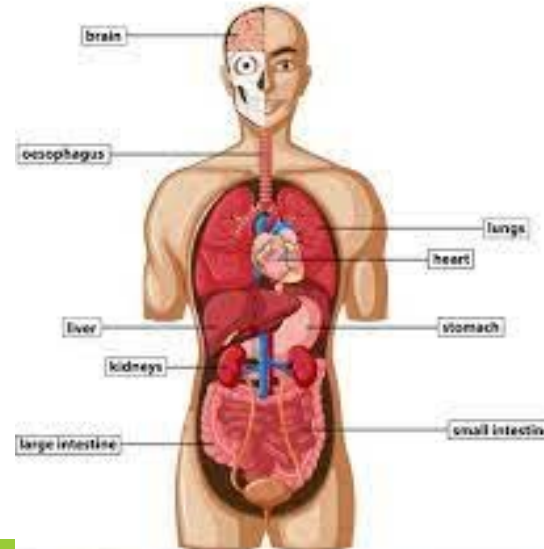


Photo Credit: Masoud Safarniya [CC BY-SA](#)

What is a Model?



ANATOMY OF THE HUMAN BODY



What is a Model?

A simplified or idealized description or conception of a particular system, situation, or process, often in mathematical terms, that is put forward as a basis for theoretical or empirical understanding, or for calculations, predictions, etc.; a conceptual or mental representation of something.

(Oxford English Dictionary, <http://dictionary.oed.com/>)

- A model is an abstract or simplified representation of some aspects of an architecture, the purpose of which is to communicate those aspects of the system to one or more stakeholders. (Rozanski & Woods, Software System Architecture, 2006)

Models and Modeling in SE

Model: a model is an **abstract representation** of an **existing reality** or a reality **to be created** (Pohl & Rupp, 2011).

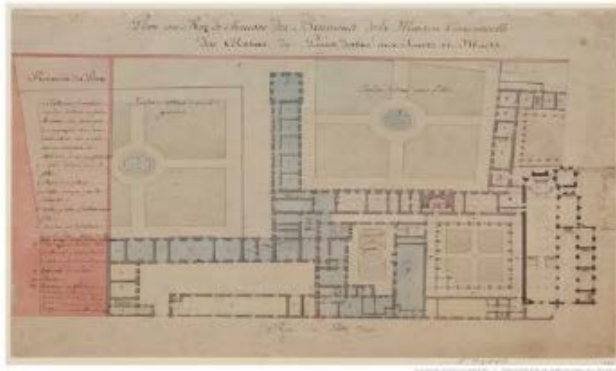
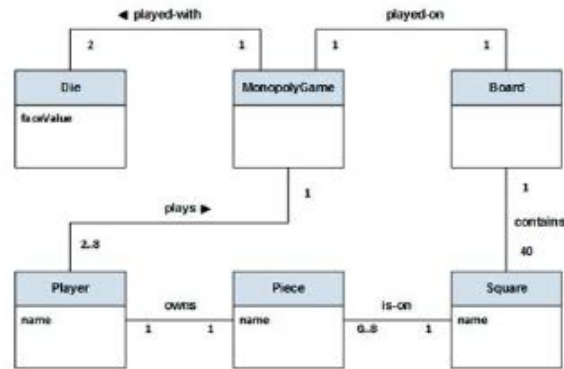
A model is a purposeful abstraction of a system expressed in a standard notation

It is associated with a modelling language

- ❑ Primitive components (Vocabulary)
- ❑ Structure (Syntax)
- ❑ Meaning (Semantics)
- ❑ Constraints

Are models really necessary? When? Why?

Why Models

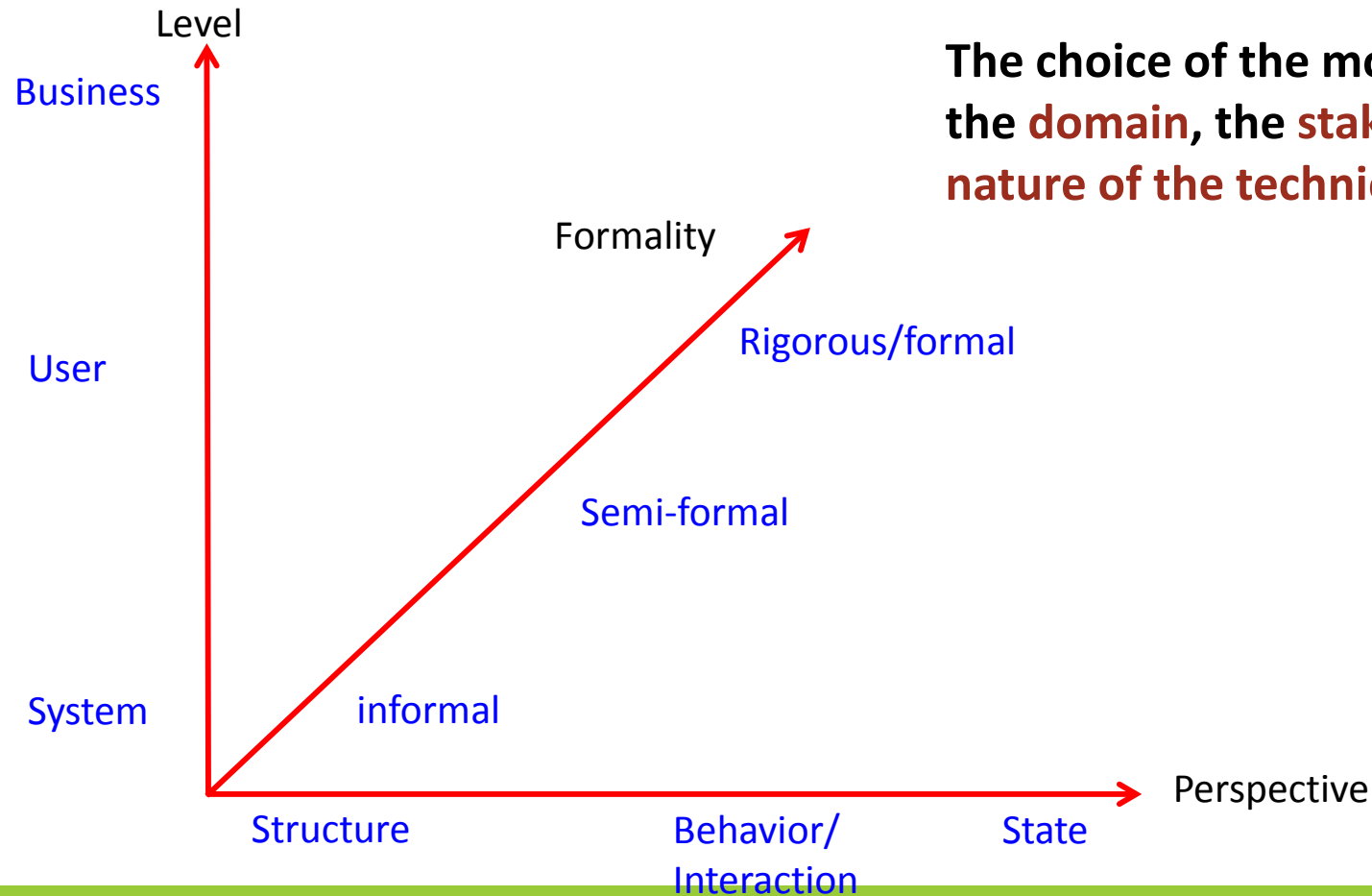


Properties of Models

- ❑ Mapping of reality: Every model maps specific aspects of reality onto its modeling elements.
 - ❑ Descriptive models: the model documents existing reality (as is).
 - ❑ Prescriptive models: the model describes a desired (fictitious) reality.
- ❑ Reduction of reality: Models reduce the mapped reality. This reduction could be through selection (modeling only particular aspects) or compression.
- ❑ Pragmatic property: The model is constructed for a purpose, which affects the way reality is reduced. A model aims to contain the information needed for the purpose/ audience.

(Pohl & Rupp, 2011)

Modeling Approach Dimensions



The choice of the model depends on the **domain**, the **stakeholders**, the **nature of the technical system**, etc.

Conceptual Modeling

Developing models is a key concept to requirements analysis.

- Understand the problem
- Initiate design of the solution

Elements from the problem domain configured to reflect real world relationships and dependencies.

Conceptual Modeling- Business Process Models

Used for modeling work flows

- Business Process Model (BPM)
- Business Process Modeling Language (BPML)
- Business Process Modeling Notations (BPMN)

Conceptual Modeling

- ☐ Data and control flow
- ☐ State models
- ☐ Event traces
- ☐ User interaction models
- ☐ Object models
- ☐ Data models
- ☐ others

Conceptual Modeling

Factors affecting choice of model:

- Nature of problem
 - Control flow ... real-time systems
 - Data models ... information management
- Expertise of software engineer
 - It is more productive to use modeling technique you are familiar with.

Conceptual Modeling Factors

- ❑ A requirement for the customer
 - ❑ Customer may impose notation or method
 - ❑ Customer may prohibit notation they are not familiar with.
- ❑ The availability of methods and tools
 - ❑ Wide spread acceptance of tools and notations
 - ❑ UML
- ❑ Formal modeling
 - ❑ Discrete math
 - ❑ Traceable logic reasoning

Conceptual Modeling Standard

- ❑ IEEE Std 1320.1, IDEF0
 - ❑ for functional modeling;
- ❑ IEEE Std 1320.2, IDEF1X97 (IDEFObject)
 - ❑ for information modeling.

Modeling – Computer Science Perspective

- ❑ Simulation models
- ❑ Graph models (nodes/arcs)
- ❑ Mathematical models (set theory)
- ❑ Statistical models

Modeling: Definition

A model is a purposeful abstraction of a system expressed in a standard notation

- It is a language
 - Primitive components (Vocabulary)
 - Structure (Syntax)
 - Meaning (Semantics)
 - Constraints

Modeling – Modelling Technique

A modeling technique provides a notation (*a language*), that is, a set of primitives (*Vocabulary*) and a set of structural rules (*Syntax*), a model represents a meaning (*Semantics*).

Modeling – Modelling Process

- ❑ The modeling process is a reformulation of statements in one language to the modeling language.
- ❑ Syntax depends on the modeling technique, while semantics depends on the modeled problem.

Models to Describe Requirements

- ❑ Why do we need models to describe requirements?
 - Diagrams are more formal therefore they remove the ambiguity often associated with text.
 - Diagrams communicate certain types of information more efficiently than text.

- ❑ There are many different diagrams and modelling techniques to choose from to create visual representations of the requirements.

- ❑ These models are useful for elaborating and exploring the requirements, as well as for designing software solutions.

Questions ?
