Software Engineering I

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Chapter 7
Moving To Design(II)

Steps(I)

1. Preparing proposal
2. Requirements determination
   - ➢ User story
3. Abstract Business Process Modelling
4. Analysis
   - ➢ Functional Modelling
   - ➢ Structural Modelling
   - ➢ Behavioral Modelling

Steps(II)

5. Design
   - Optimization
   - Database Management
   - User Interface
   - Physical Architecture

The purpose of **analysis** is to figure out what the business needs are.

The purpose of **design** is to decide how to build the system.

Layers

- Until this point in the development of our system, we have focused only on the problem domain; we have totally ignored the system environment (data management, user interface, and physical architecture).
- To successfully evolve the analysis model of the system into a design model of the system, we must add the system environment information.
- One useful way to do this, is to use *layers*.
- A *layer* represents an element of the software architecture of the evolving system.
- There should be a layer for each of the different elements of the system environment (e.g., data management, user interface, physical architecture).

Layers(Cnt’d)

- The idea of separating the different elements of the architecture into separate layers can be traced back to the MVC architecture of *Smalltalk.*
- Separate the application logic from the logic of the user interface. In this manner, it was possible to easily develop different user interfaces that worked with the same application.

Software layers

- Foundation,
- Problem domain,
- Data management,
- Human–computer interaction,
- Physical architecture

Foundation Layer

- Is a very uninteresting layer.
- It contains classes that are necessary for any object-oriented application to exist.
- They include classes that represent fundamental data types (e.g., integers, real numbers, characters, strings), classes that represent fundamental data structures, sometimes referred to as *container classes* (e.g., lists, trees, graphs, sets, stacks, queues), and classes that represent useful abstractions, sometimes referred to as *utility classes* (e.g., date, time, money).
- These classes are rarely, if ever, modified by a developer. They are simply used.
- Today, the classes found on this layer are typically included with the object-oriented development environments.

Problem Domain Layer

- Is what we have focused our attention on up until now.
- At this stage in the development of our system, we need to further detail the classes so that we can implement them in an effective and efficient manner.

Data Management Layer

- Addresses the issues involving the persistence of the objects contained in the system.
- The types of classes that appear in this layer deal with how objects can be stored and retrieved.
- Classes contained in this layer are called the Data Access and Manipulation (DAM) classes.
- Allow the problem domain classes to be independent of the storage used and, hence, increase the portability of the evolving system.
- Some of the issues related to this layer include choice of the storage format and optimization.

Human–Computer Interaction Layer

- The primary purpose is to keep the specific user-interface implementation separate from the problem domain classes.
- This increases the portability of the evolving system.
- Typical classes found on this layer include classes that can be used to represent buttons, windows, text fields, scroll bars, check boxes, drop-down lists, and many other classes that represent user-interface elements.

Physical Architecture Layer

- Addresses how the software will execute on specific computers and networks.
- This layer includes classes that deal with communication between the software and the computer’s operating system and the network.

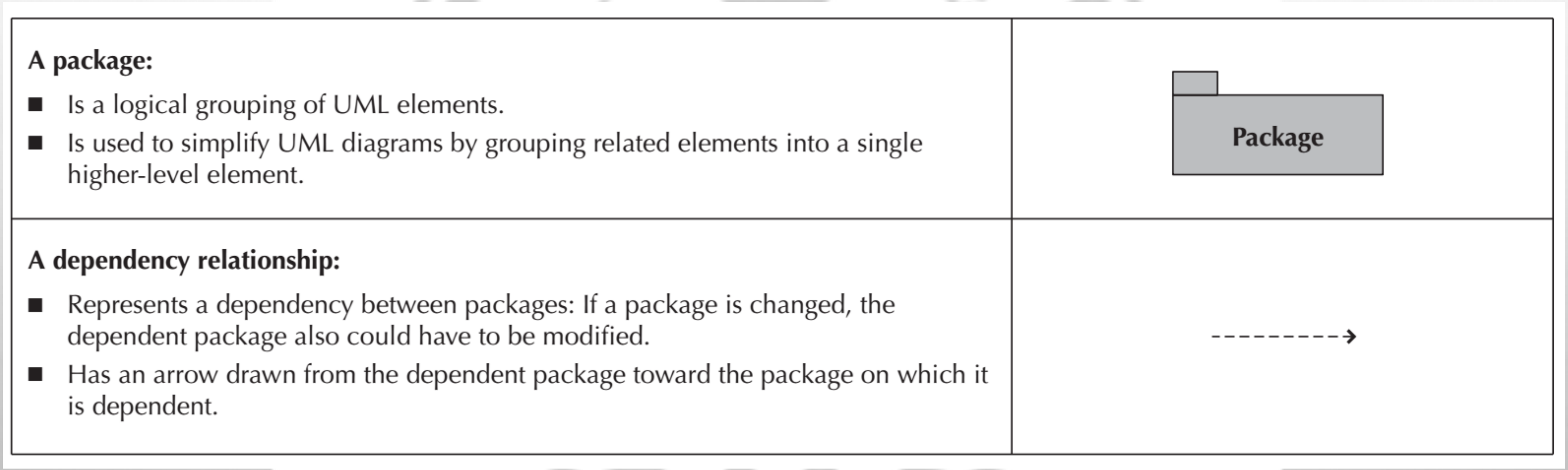
Packages

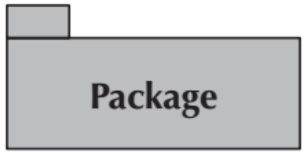
- In UML, collaborations, partitions, and layers can be represented by a higher-level construct: a package.
- In fact, a package serves the same purpose as a folder on your computer.
- A *package* is a general construct that can be applied to any of the elements in UML models, group of use cases together to make the use-case diagrams easier to read and to keep the models at a reasonable level of complexity or a set of class and communication diagrams.

Package Diagrams

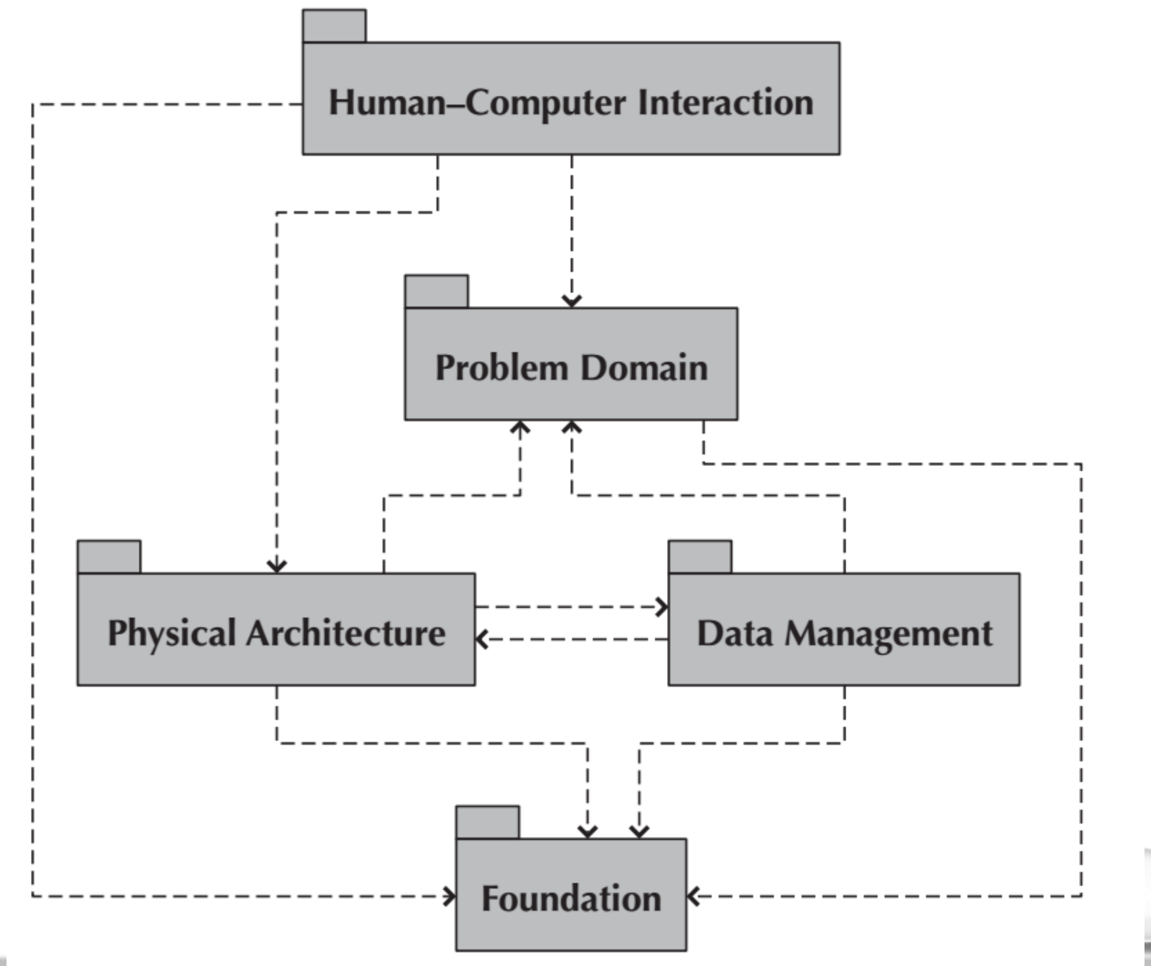
- A diagram composed only of packages.
- In a package diagram, it is useful to depict *dependency relationship.*
- Dependency relationship represents the fact that a modification dependency exists between two packages. That is, it is possible that a change in one package could cause a change to be required in another package.

Elements of a package diagram

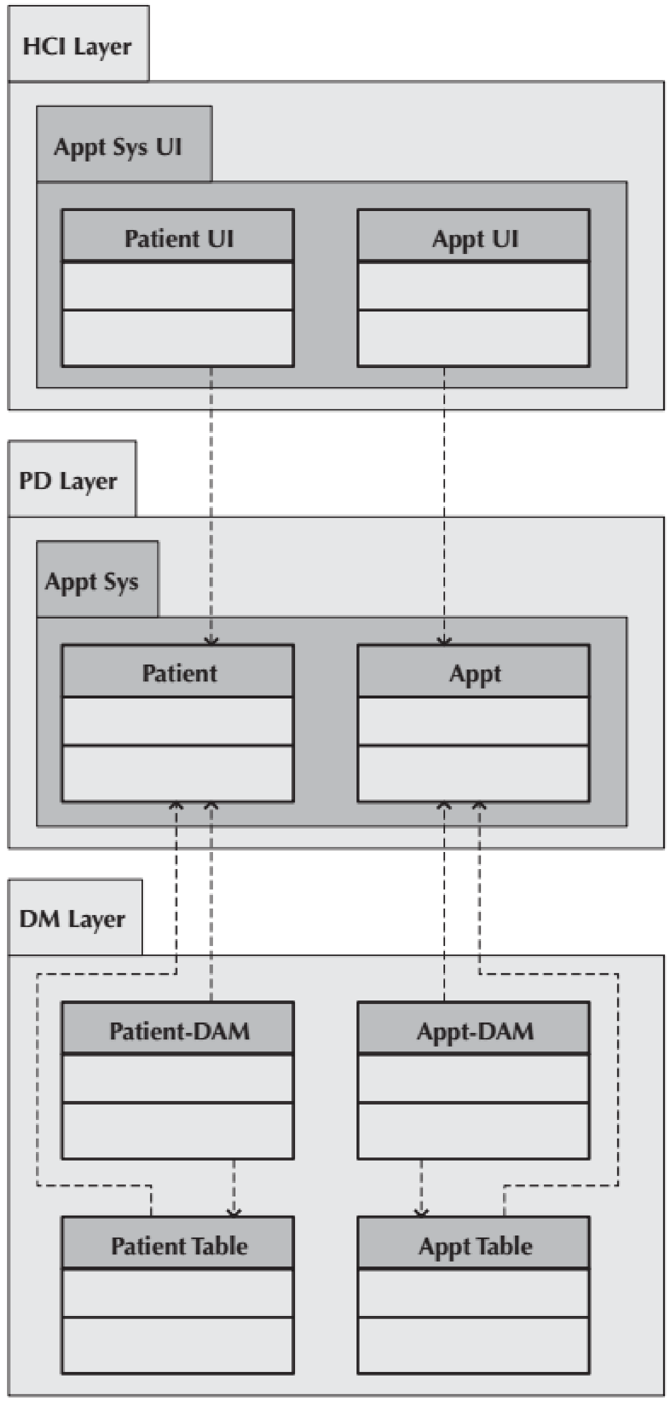


A package: ■ Is a logical grouping of UML elements. ■ Is used to simplify UML diagrams by grouping related elements into a single higher-level element.	 Package
A dependency relationship: ■ Represents a dependency between packages: If a package is changed, the dependent package also could have to be modified. ■ Has an arrow drawn from the dependent package toward the package on which it is dependent.	--------→

Package Diagram of Dependency Relationships among Layers



An example of package diagram



Verifying and validating package diagram

- Like all the previous models, package diagrams need to be verified and validated.
- First, the identified packages must make sense from a problem domain point of view.
- Second, all dependency relationships must be based on message-sending relationships on the communications diagram, and associations on the class diagram.

Design Strategies

- **Custom Development**
- **Packaged Software**
- **Outsourcing**

Custom development or building a new system from scratch,

- Teams have complete control over the way the system looks and functions.
- Allows developers to be flexible and creative in the way they solve business problems.
- Is easier to change to include components that take advantage of current technologies that can support such strategic efforts.
- Building a system in-house also builds technical skills and functional knowledge within the company.
- As developers work with business users, their understanding of the business grows and they become better able to align IS with strategies and needs.
- These same developers climb the technology learning curve so that future projects applying similar technology require much less effort.

Custom development or building a new system from scratch(Cnt’d)

- Requires dedicated effort that involves long hours and hard work. Many companies have a development staff who already is overcommitted to filling huge backlogs of systems requests and just does not have time for another project. Also, a variety of skills—technical, interpersonal, functional, project management, and modeling—must be in place for the project to move ahead smoothly.
- The risks associated with building a system from the ground up can be quite high, and there is no guarantee that the project will succeed.
- Developers could be pulled away to work on other projects, technical obstacles could cause unexpected delays, and the business users could become impatient with a growing timeline.

Packaged Software

- There are thousands of commercially available software programs that have already been written to serve a multitude of purposes.
- Similarly, most companies have needs that can be met quite well by packaged software, such as payroll or accounts receivable. It can be much more efficient to buy programs that have already been created, tested, and proven.
- Moreover, a packaged system can be bought and installed in a relatively short time when compared with a custom system. Plus, packaged systems incorporate the expertise and experience of the vendor who created the software.

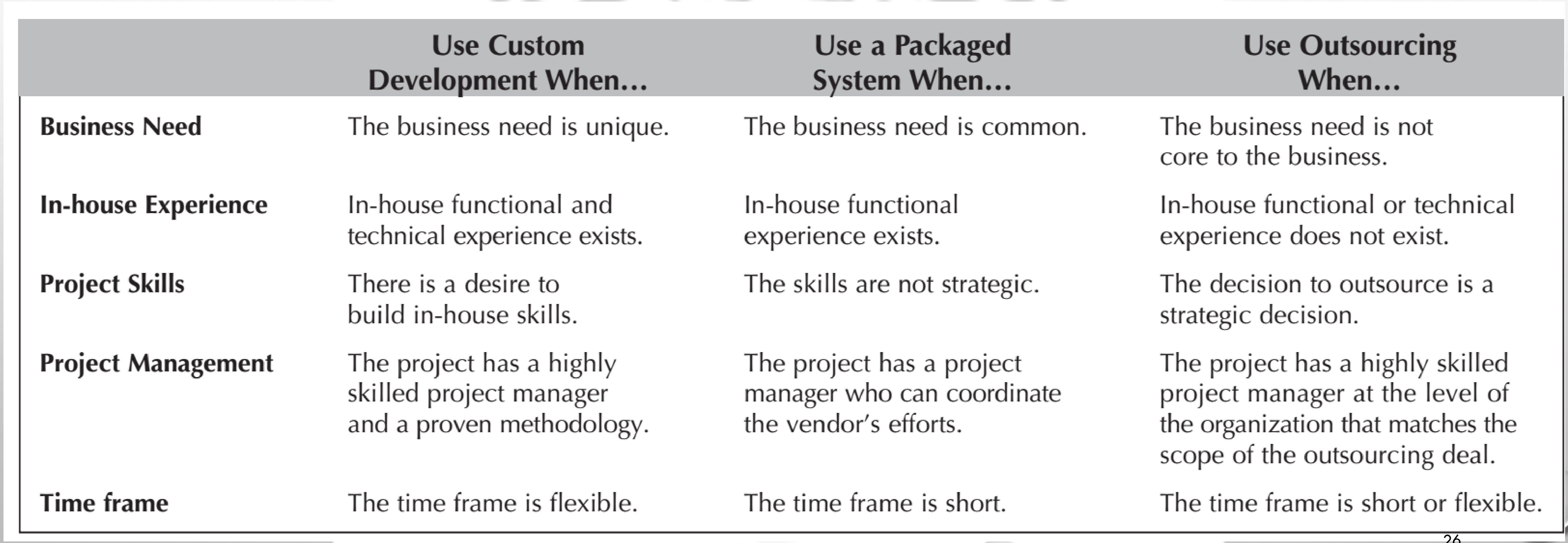
Packaged Software(Cnt’d)

- Most packaged applications allow *customization,* or the manipulation of system parameters to change the way certain features work.
- *Systems integration* refers to the process of building new systems by combining packaged software, existing legacy systems, and new software written to integrate these.

Outsourcing

- Hire an external vendor, developer, or service provider to create the system.
- This transfer requires two-way coordination, exchange of information, and trust.

Selecting a Design Strategy



	Use Custom Development When…	Use a Packaged System When…	Use Outsourcing When…
Business Need	The business need is unique.	The business need is common.	The business need is not core to the business.
In-house Experience	In-house functional and technical experience exists.	In-house functional experience exists.	In-house functional or technical experience does not exist.
Project Skills	There is a desire to build in-house skills.	The skills are not strategic.	The decision to outsource is a strategic decision.
Project Management	The project has a highly skilled project manager and a proven methodology.	The project has a project manager who can coordinate the vendor's efforts.	The project has a highly skilled project manager at the level of the organization that matches the scope of the outsourcing deal.
Time frame	The time frame is flexible.	The time frame is short.	The time frame is short or flexible.

Reference

- **Dennis, Wixon, Tegarden, "System Analysis and Design, An Object Oriented Approach with UML", 5th Edition, 2015.**