HUST

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System Analysis and Design

IT3120E

ONE LOVE. ONE FUTURE.

Part 2: System analysis

Start the project

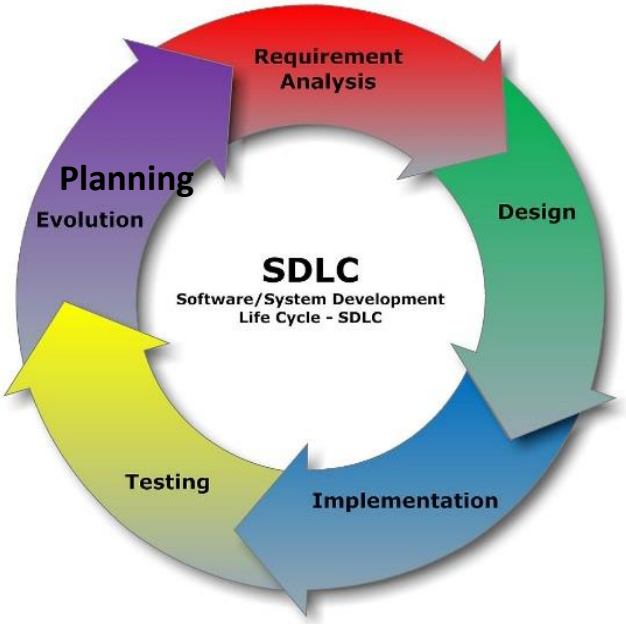
Analysis and Design Review

- Analysis
  - who will use the system,
  - what the system will do,
  - and where and when it will be used

  => System Proposal

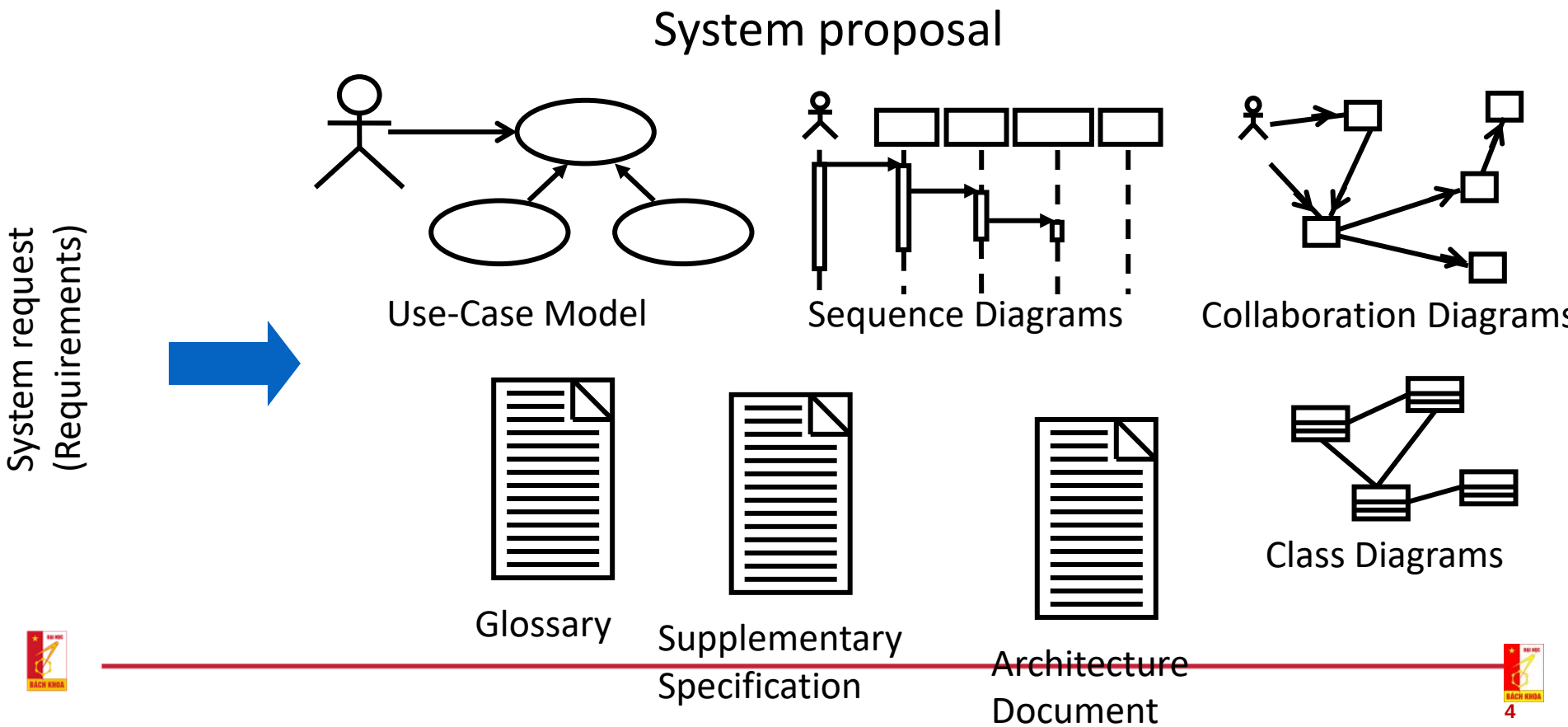
- Design:
  - how the system will operate (hardware, software, network infrastructure; user interface, forms/reports; databases, etc.)

  => System Specification



Purposes of Analysis

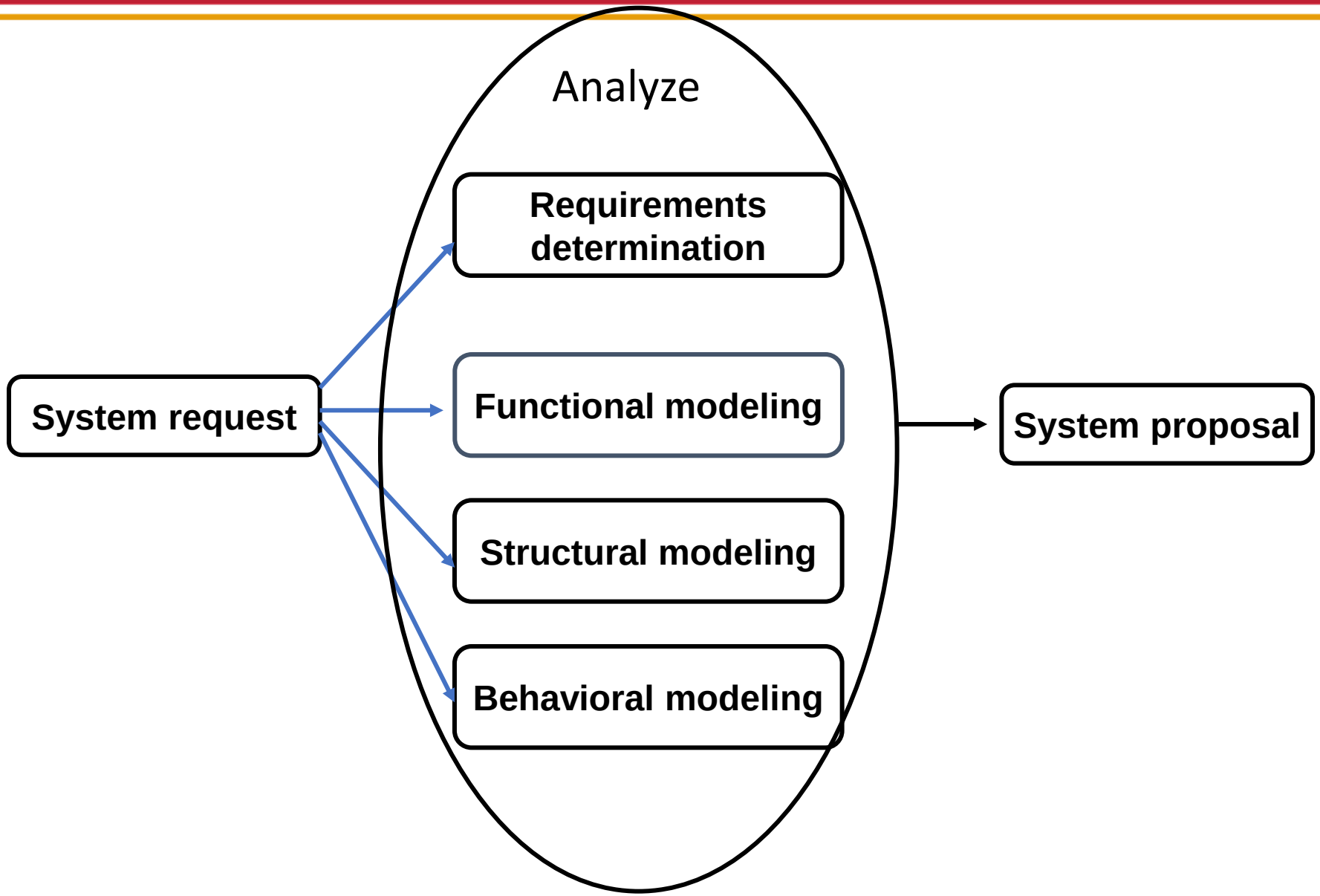
- Transform the System request into a System Proposal which can be designed of the new system.
- Evolve a robust architecture for the system.
- Adapt the system to match the implementation environment.



Purposes of Analysis

- Analysis Focus on
  - understanding the problem
  - Functional requirements
  - Behavior
  - System structure
  - Idealized design

Part 2: System analysis



- System proposal template

1. Table of Contents

2. Executive Summary

A summary of all the essential information in the proposal so that a busy executive can read it quickly and decide what parts of the proposal to read in more depth.

3. System Request

The revised system request form

4. Workplan

The original workplan, revised after having completed analysis

5. Feasibility Analysis

A revised feasibility analysis, using the information from analysis

6. Requirements Definition

A list of the functional and nonfunctional business requirements for the system

7. Functional Model

An activity diagram, a set of use-case descriptions, and a use-case diagram that illustrate the basic processes or external functionality that the system needs to support

8. Structural Models

A set of CRC cards, class diagram, and object diagrams that describe the structural aspects of the to-be system . This may also include structural models of the current as-is system that will be replaced.

9. Behavioral Models

A set of sequence diagrams, communication diagrams, behavioral-state machines, and a CRUDE matrix that describe the internal behavior of the to-be system . This may include behavioral models of the as-is system that will be replaced.

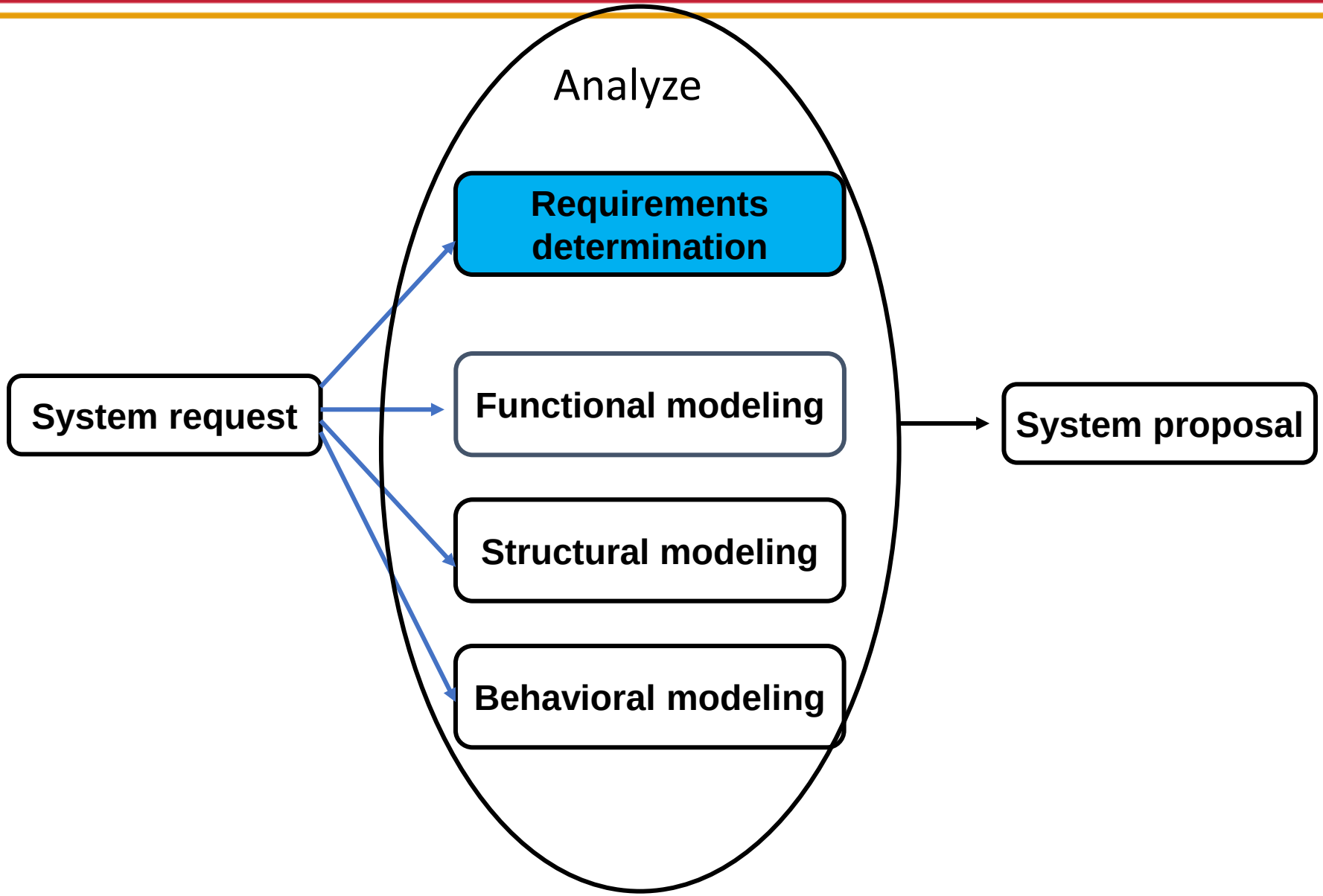
10. Appendices

These contain additional material relevant to the proposal, often used to support the recommended system. This might include results of a questionnaire survey or interviews, industry reports and statistics, and so on.

Part 2: System analysis

Chapter 4: *Requirements determination*

Part 2: System analysis



Course syllabus

- 4.1 Requirements determination
- 4.2 Requirements analysis methodologies
- 4.3 Requirements gathering techniques

4.1. Requirements determination

- What is the requirement?
  - A requirement describes a must-do system function or a must-have system specification
    - business requirements:
      - From the business person's perspective
    - system requirements
      - From the developer's perspective

4.1. Requirements determination

- What is the requirement?
  - ***Functional requirement:***
    - Operation that the system must do
    - Information that the system must store.
  - ***Nonfunctional requirements***: Behavioral properties that the system must have :
    - Operability
    - Access ability
    - Environment
    - Performance
    - Security
    - Cultural and political requirements

... are mainly used at the system design step

4.1. Requirements determination

- The purpose of Requirements is to:
  - Establish and maintain agreement with the customers and other stakeholders on what the system should do.
  - Give system developers a better understanding of the requirements of the system.
  - Delimit the system.
  - Provide a basis for planning the technical contents of the iterations.
  - Provide a basis for estimating cost and time to develop the system.
  - Define a user interface of the system.
- Requirements determination step is **the single most critical step** of the entire SDLC
  - Studies show that most of system failures are due to problems with requirements

4.1. Requirements determination

- How ...
  - What is it ? (Business task, Information technology task)
  - Stakeholders (Business people, Analysts)
  - Use strategies and tools to help analysts do problem analysis to guide the users in explaining what is wanted from the system

  => Determines the kinds of function & nonfunctional requirements that they will collect about the system

  - Use requirements gathering techniques to acquire information from users

  => Collect information

  - Test, modify, and refine the requirements collected and determine the importance of the requirements.

  => List the requirements: Requirements definition Document/Report

can be an iterative and ongoing process
whereby the analyst collects information with requirements-gathering techniques

4.1. Requirements determination

- Requirements definition Document/Report
  - A document that lists functional and non-functional requirements
  - Provides input for the next steps in the system analysis + the design process
  - The most important purpose : to define the scope of the system

The document must describe to the analyst exactly what the system needs in the end.

Nonfunctional Requirements

1. Operational Requirements
1.1. The system will operate in Windows environment.
1.2. The system should be able to connect to printers wirelessly.
1.3. The system should automatically back up at the end of each day.

2. Performance Requirements
2.1. The system will store a new appointment in 2 seconds or less.
2.2. The system will retrieve the daily appointment schedule in 2 seconds or less.

3. Security Requirements
3.1. Only doctors can set their availability.
3.2. Only a manager can produce a schedule.

4. Cultural and Political Requirements
4.1. No special cultural and political requirements are anticipated.

Functional Requirements

1. Manage Appointments
1.1. Patient makes new appointment.
1.2. Patient changes appointment.
1.3. Patient cancels appointment.

2. Produce Schedule
2.1. Office Manager checks daily schedule.
2.2. Office Manager prints daily schedule.

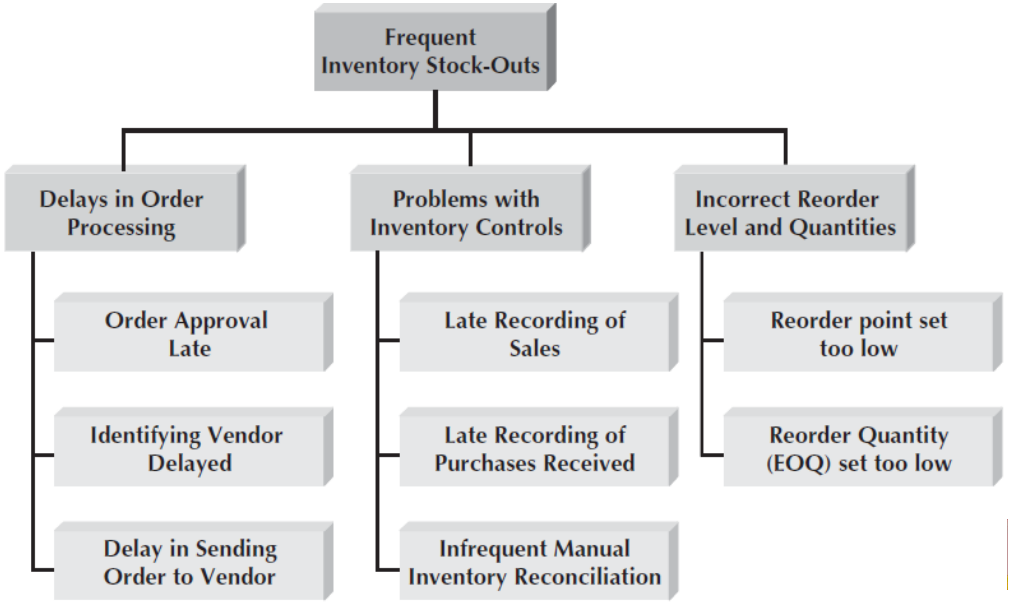
3. Record Doctor Availability
3.1. Doctor updates schedule

4.2 Requirements analysis methodologies

- 3 steps in the requirements analysis process:
  - Analyze the status of the current system
  - Identify exactly what improvements can be made
  - Build requirements of the system to be built
- 3 requirements analysis techniques:
  - Business process automation (BPA)
  - Business process improvement (BPI)
  - Business process reengineering (BPE)

Business process automation (BPA)

- Does not change current activity of the current system
- Automate some tasks using computer technology
- 2 BPA techniques
  - Problem analysis: identifying problems in the current system and finding ways to solve them in the new system.
    - Describe how to solve them in the new system.
    - Focus on solutions
  - Root cause analysis: analyze the root cause of the problem
    - Generate all the possible root causes for the problems
    - Investigated them
    - Focus on problems, not solution



Business process improvement (BPI)

- Change the current activity of the current system
- Improve system performance and efficiency
- Focus on the new system for improvement
- 3 analytical activities:
  - Duration analysis: detailed analysis of the execution time of a certain stage in the current system and identify the stage that can be improved
  - Activity based costing: determine the cost of each step in the current system and identify the most expensive steps and improve accordingly to reduce costs.
  - Informal benchmarking: studying how other organizations do business so that lessons can be drawn for improvement.

Business process reengineering (BPR)

- Make a fundamental change to the current system activity
- 3 analytical activities:
  - Outcome analysis: analyze the output of the system that bring value to the customer or not.
  - Technology analysis: Identify a list of important and attractive technologies → analyze the possibilities and benefits of applying technology to business operations.
  - Activity elimination: find ways to eliminate inefficient activities in the business, analyze the consequences as well as the effects of such elimination.

4.2 Requirements analysis methodologies

- All of the above methods have their pros and cons.
- No method is outstanding => usually combined Technical
- Selection will be based on evaluation criteria

	Business Process Automation	Business Process Improvement	Business Process Reengineering
Potential business value	Low–moderate	Moderate	High
Project cost	Low	Low–moderate	High
Breadth of analysis	Narrow	Narrow–moderate	Very broad
Risk	Low–moderate	Low–moderate	Very high

4.3 Requirements gathering techniques

- The analyst needs to discover the requirements;
- They know there is a problem to solve => need to find clues to solve.
- Problems are not always obvious => Analysts need information gathering techniques.
- The requirements gathering process is used to develop management support for the project; establish trust and connection between the implementation team and the user.
- The challenge for requirements gathering is the selection of information => techniques of requirements gathering .

4.3 Requirements gathering techniques

- Interviews
- Join Application Development (JAD)
- Investigation (Questionnaires)
- Document analysis
- Observation

Interviews

- 5 steps:
  - Choose an interviewee : Managers, employees, staff members, customers, suppliers, etc.
  - Design interview questions : close-ended question, open-ended question, probing question
  - Prepare for the interview
  - Do the interview
  - Do the job after the interview

Types of Questions	Examples
Closed-Ended Questions	How many ... ? How do customers ... ? What is ... ?
Open-Ended Questions	What do you think about the current system? What are some of the problems you face on ? How do you decide what types of marketing campaign to run?
Probing Questions	Why ... ? Can you give me an example ? Can you explain that in a bit more detail?

Interviews

INTERVIEW REPORT
Interview notes approved by: _____ Person interviewed _____ Interviewer _____ Date _____ Primary Purpose: Summary of Interview: Open Items:

Join Application Development

- A process developed by IBM used in SDLC to select business requirements
- A structured process in which 10-20 people (project team, users, and management, etc.) meet to work together under the direction of a skilled person.
- The JAD team will meet and work until
  - - all matters discussed
  - - and all the necessary information is selected.
- Reduces project scope creep by about 50%.
- Avoid requirements that are too specific or too vague.

Others

- Questionnaire
  - Set of pre-written questions to gather information from individuals.
  - Use when need information from a lot of people.
    - Objects outside the organization (customers, salespeople).
    - Due to geographical location.
- Document analysis
  - Typical documents used: Forms, Reports, Policy manuals, Organization chart
  - Look for user additions to forms, Look for unused form elements to provides clues about system
- Observation
  - Directly observe running processes to collect information
  - Useful for current system analysis

4.3 Requirements gathering techniques

- Selecting the Appropriate Techniques

	Interviews	Joint Application Design	Questionnaires	Document Analysis	Observation
Type of information	As-is, improvements, to-be	As-is, improvements, to-be	As-is, improvements	As-is	As-is
Depth of information	High	High	Medium	Low	Low
Breadth of information	Low	Medium	High	High	Low
Integration of information	Low	High	Low	Low	Low
User involvement	Medium	High	Low	Low	Low
Cost	Medium	Low to Medium	Low	Low	Low to Medium

CASE STUDY

- The Internet Bookstore

Doug Rosenberg and Matt Stephens, 2007, *Use Case Driven Object Modeling with UML*, *Theory and Practice*, Apress

The Internet Bookstore
High-level requirements

1. The bookstore will be web based initially, but it must have a sufficiently flexible architecture that alternative front-ends may be developed (Swing/applets, web services, etc.).

2. The bookstore must be able to sell books, with orders accepted over the Internet.

3. The user must be able to add books into an online shopping cart, prior to checkout.

    a. Similarly, the user must be able to remove items from the shopping cart.

4. The user must be able to maintain wish lists of books that he or she wants to purchase later.

5. The user must be able to cancel orders before they've shipped.

6. The user must be able to pay by credit card or purchase order.

7. It must be possible for the user to return books.

8. The bookstore must be embeddable into associate partners' websites using mini-catalogs, which are derived from an overall master catalog stored in a central database.

    a. The mini-catalogs must be defined in XML, as they will be transferred between this and (later to be defined) external systems.

    b. The shipping fulfillment system shall be carried out via Amazon Web Services.

9. The user must be able to create a customer account, so that the system remembers the user's details (name, address, credit card details) at login.

    a. The system shall maintain a list of accounts in its central database.

    b. When a user logs in, his or her password must always be matched against the passwords in the master account list.

The Internet Bookstore
High-level requirements

10. The user must be able to search for books by various search methods—title, author, keyword, or category—and then view the books' details.

11. It must be possible for the user to post reviews of favorite books; the review comments should appear on the book details screen. The review should include a customer rating (1–5), which is usually shown along with the book title in book lists.

    a. Book reviews must be moderated—that is, checked and "OK'd" by a member of staff before they're published on the website.

    b. Longer reviews should be truncated on the book details screen; the customer may click to view the full review on a separate page.

12. It must be possible for staff to post editorial reviews of books. These should also appear on the book details screen.

13. The bookstore shall allow third-party sellers (e.g., second-hand bookstores) to add their own individual book catalogs. These are added into the overall master book catalog so that sellers' books are included in search results.

14. The bookstore must be scalable, with the following specific requirements:

    a. The bookstore must be capable of maintaining user accounts for up to 100,000 customers in its first six months, and then a further 1,000,000 after that.

    b. The bookstore must be capable of serving up to 1,000 simultaneous users (10,000 after six months).

    c. The bookstore must be able to accommodate up to 100 search requests per minute (1,000/minute after six months).

    d. The bookstore must be able to accommodate up to 100 purchases per hour (1,000/hour after six months).

Case studies for students

(1)

(2)

(3)

Gmail

(4)

(5)

(6)

Microsoft Teams

(7)

facebook

(8)

(9)

(10)

Exercise – *Requirements determination*

- Write down the requirements for your case-study. At least 6 main functions.