Requirements Document

Chapter 4.2-4.3
Slides #10

CMPT 276

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Based on slides from Software Engineering 9th ed, Sommerville.

Topics

1) What is a requirements document (req. doc.)?
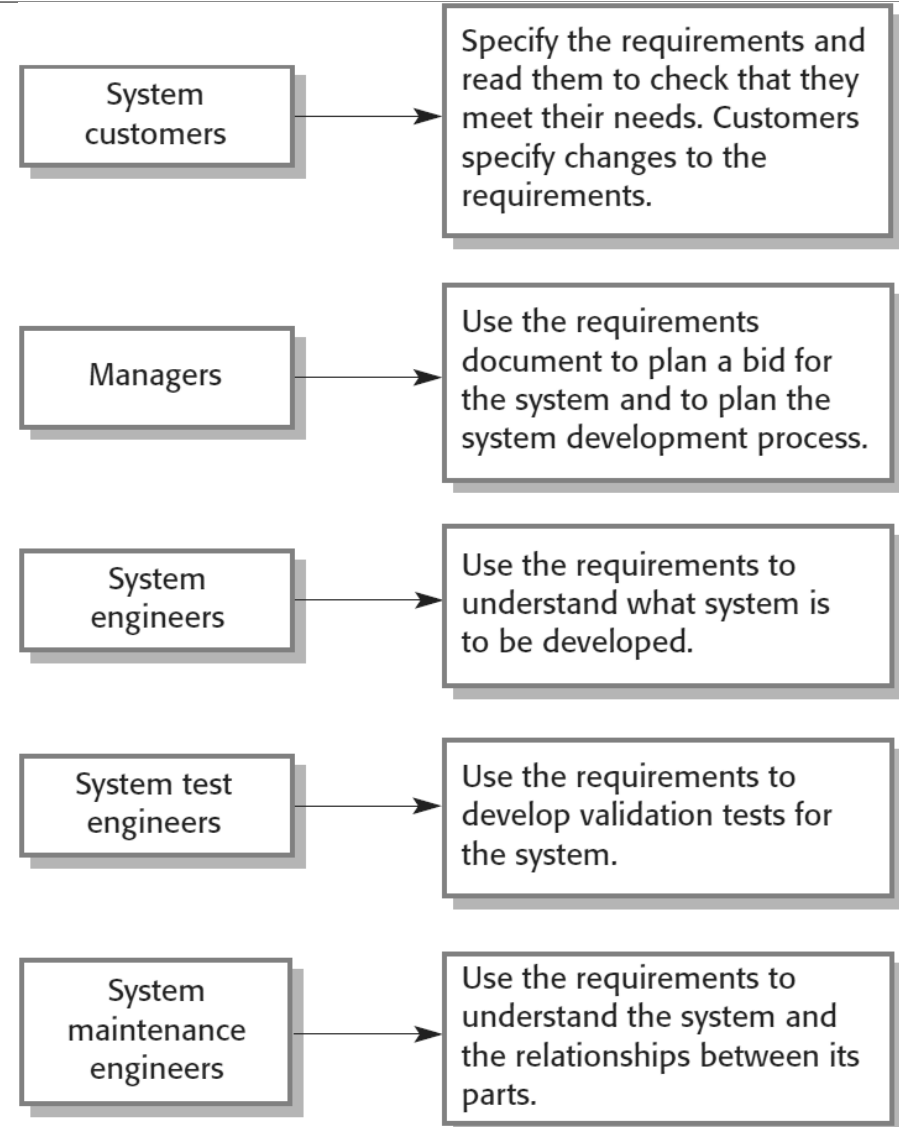2) How can we write requirements?

Software requirements document

- Software requirements document:
  - **official statement of what is required of the document.**

- Can include both:
  - user requirements and
  - system requirements.
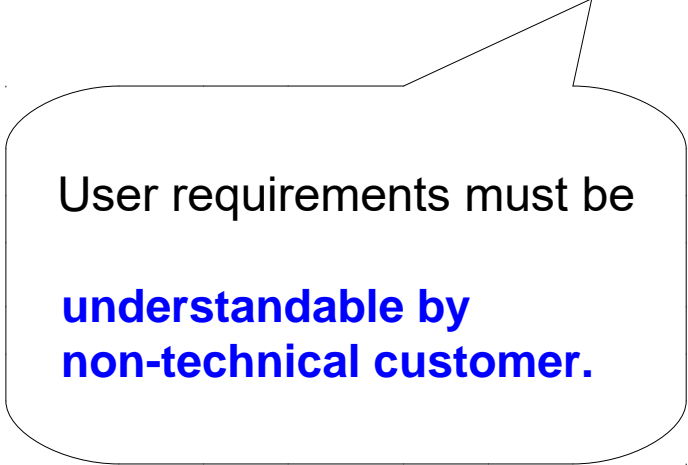
Users of a requirements document

- Req. doc. mainly part of a plan-driven method
  - Agile methods argue requirements change too quickly for a req. doc. to be useful.
  - Large systems and critical systems...

    still need a req. doc.

- Many uses for a req. doc.:

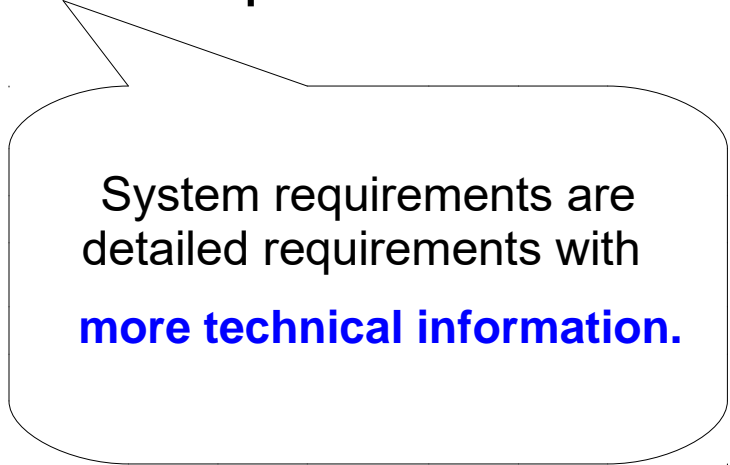| System customers	Specify the requirements and read them to check that they meet their needs. Customers specify changes to the requirements.
Managers	Use the requirements document to plan a bid for the system and to plan the system development process.
System engineers	Use the requirements to understand what system is to be developed.
System test engineers	Use the requirements to develop validation tests for the system.
System maintenance engineers	Use the requirements to understand the system and the relationships between its parts.

Requirements specification process

Requirements specification

- Requirements specification is
    - process of writing a requirements document.
    - Includes the user and system requirements.

User requirements must be

understandable by non-technical customer.

System requirements are detailed requirements with

more technical information.

- Important to be as complete as possible:
    - may be the basis for system development contract.

Requirements and design

- In principle:

  requirements state **what** the system should do;

  design describes **how** it does this.

- In practice:..

  requirements and design are inseperable

  - Interaction with other systems may generate design requirements.

  - A non-functional requirement may need a specific architecture design.

  - Design constraints may be from regulatory requirements.

Guidelines for writing requirements

- Requirements often written in natural language:..
  sentences, diagrams, and tables.

- Natural language used because it is..
  expressive, intuitive, and universal
  - Understood by customers and developers.

- Use language in a consistent way.
  - Use shall for... **mandatory requirements**
  - Use should for... **desirable requirements**

- Avoid computer jargon: use domain terminology

- Include an explanation (rationale) of...
  why a requirement is necessary

Exercise

- Write a natural language specification for the shifter on an automatic transmission

Problems with natural language

- Lack of clarity..
  - **Precision is difficult without making the document difficult to read**

- Requirements confusion
  - Functional and non-functional requirements tend to be mixed-up.

- Requirements amalgamation
  - If several different requirements are expressed together.

- See **the** cookie recipe: MIL-C-44072C
  - Ex: Sections 3.2.2, 3.3.11.

Ways of writing a system req. specification

Notation	Description
Natural language sentences	Requirements are... **numbered sentences** in plain English.
Graphical notations	Diagrams and text to describe the system. Ex: UML
Mathematical specification	Ex:... **Finite state machine** Unambiguous, but hard for customers to understand.

Structured spec.: an insulin pump

Action
- CompDose is zero if the sugar level is **stable or falling** or if the level is increasing but the **rate of increase is decreasing**.
- If the **level is increasing and the rate of increase is increasing**, then CompDose is computed by dividing the difference between the current sugar level and the previous level by 4 and rounding the result.
- If the **result is rounded to zero** then CompDose is set to the minimum dose that can be delivered.

Requirements
Two previous readings so that the rate of change of sugar level can be computed.

Pre-condition
The insulin reservoir contains at least the maximum allowed single dose of insulin.

Post-condition   r0 is replaced by r1 then r1 is replaced by r2.

Side effects   None.

Tabular specification: Insulin pump

Condition	Action
Sugar level falling (r2 < r1)	CompDose = 0
Sugar level stable (r2 = r1)	CompDose = 0
Sugar level increasing and rate of increase decreasing ((r2 – r1) < (r1 – r0))	CompDose = 0
Sugar level increasing and rate of increase stable or increasing ((r2 – r1) ≥ (r1 – r0))	CompDose = round ((r2 – r1)/4) If rounded result = 0 then CompDose = MinimumDose

Exercise

- Write a tabular specification for the shifter on an automatic transmission

current state	car motion	up state	condition to shift up	down state	condition to shift down
P	stopped	-			
R	backwards				
N	roll				
D	...				
S	...				

Summary

- The software requirements document is
  - an agreed statement of the system requirements.
  - organized so that both system customers and software developers can use it.

- Often written in natural language with diagrams
  - Numbered sentences;
  - Conforming to uniform style.