

CMPT 276 Class 10: Requirements Documents

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Today's Topics

1. What is a **requirements document**?
2. How can we write requirements?

Software Requirements Document

- **The official statement** of what is required of the system.
- Call them a req. doc. if you're in a hurry and want to sound cool.
- Can include both **user requirements** and **system requirements**.

Who Uses 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

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

- Requirements **specification** is the process of **writing a requirements document**.
- It includes the user and system requirements.
 - **User requirements** must be understandable by non-technical customers.
 - **System requirements** are detailed with more technical information.
- Important to be as complete as possible.
 - May be the basis for the system's **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 inseparable.**
 - **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 are often written in natural language (i.e. sentences, diagrams, and tables).
- Natural language is 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

Class Exercise: Requirement Improv

- Let's write two natural-language requirements for a system that interests us.
- First we'll need:
 - A job
 - A location
 - A device

“Why do you never ‘yes, and’ my proposed system requirements??”



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**
 - Several different requirements may be expressed together.
- See *the* cookie recipe: MIL-C-44072C
 - Ex: Sections 3.2.2, 3.3.11

3.2.2 Oatmeal. Oatmeal shall be the commercial product known as quick cooking oatmeal. It shall have natural rolled oat flavor and odor and shall be clean and free from burned particles, rancid, musty, sour, or other undesirable flavors and odors.

3.3.11 Chocolate coating preparation. The formula for chocolate coating shall be blended on a dry-solids basis. Sorbitan monostearate and polyoxyethylene (20) sorbitan monostearate shall be melted, mixed with the added fat and the dry-solids blend and brought to a temperature of not less than 150⁰F. The mixture shall be held at that temperature or higher for a period of at least 30 minutes. The coating shall be refined (20 microns or less, 7/10,000 inch) so that it has a smooth mouthfeel without grittiness. The coating shall be such that, when the vacuum packaged product (at least 72 hours after manufacture) is held at a temperature of 100⁰F for two hours, the product can be easily removed from the bag without loss of coating. The product shall be allowed to cool at a temperature between 40⁰F and 70⁰F, for resolidification to occur, for approximately one hour prior to performing the test. The chocolate coating shall be Salmonella free (see 4.5.1.4).

Ways of Writing a System Req. Doc.

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 machines Unambiguous, but hard for customers to understand.

Structured Spec. for 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 ($r_2 < r_1$)	CompDose = 0
Sugar level stable ($r_2 = r_1$)	CompDose = 0
Sugar level increasing and rate of increase decreasing ($(r_2 - r_1) < (r_1 - r_0)$)	CompDose = 0
Sugar level increasing and rate of increase stable or increasing ($(r_2 - r_1) \geq (r_1 - r_0)$)	CompDose = round $((r_2 - r_1)/4)$ If rounded result = 0 then CompDose = MinimumDose

Exercise:

Our Own Tabular Specification

- What would a tabular specification for a gearshift in a car? (Automatic, not manual)



<u>State</u>	<u>Shift up</u>	<u>Shift down</u>	<u>Notes</u>
P	Button, move	Break, button, move	Stopped
R	Button, move	Button, move	Reverses
N	Button, move	Button, move	Neither
D	Move	Move	Advances
S	Move	Move	"Sport"

Recap – the Required Documentation

- 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 and numbered sentences.
 - Conforms to a **uniform style**.