

Solved Past Paper SRE Fall 2017 Finals

Q1: What are the major reasons for requirements documentation? Discuss in detail the quality criteria of requirements documents.

Major Reasons for Requirements Documentation

Lecture 4: Slide 3 – 6.

Documenting Requirements

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Document Design

The main and most important documentation task in requirements engineering, though, is to document the requirements for the system in a suitable manner.

Requirements Document / Requirements Specification

A requirements specification is a systematically represented collection of requirements, typically for a system or component, that satisfies given criteria.

Reasons for the documentation

During the life cycle of a requirements document, many people are trusted with the documentation.

During communication, the documentation has a goal-oriented and supporting role.

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Reasons for documentations

1- Central role of requirements

• *Requirements are the basis of the system development.*

• *Requirements of any kind influence the analysis, design, implementation, and test phases directly and indirectly.*

• *The quality of a requirement or of a requirements document has a strong impact on the progress of the project and therefore on its success.*

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Reasons for documentations (contd...)

2- Legal relevance

- *Requirements have a legal relevance.*
- *Requirements are legally binding for the contractor and the client, and the client can sue for their fulfillment.*
- *Documenting the requirements can help to quickly overcome legal conflicts between two or more parties.*

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Reasons for documentations(contd...)

3- Complexity

- *Requirements documents are complex.*
- *Systems that possess thousands of requirements that in turn have complex interdependencies on multiple layers are not unheard of in practice.*
- *Without suitable documentation, keeping on top of things can become very difficult for anyone involved.*

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Reasons for documentations(contd...)

4- Accessibility

• *Requirements must be accessible to all involved parties.*

• *Projects undergo certain "development" as time goes by— with regard to the subject as well as the staff.*

• *When requirements can be permanently accessed, uncertainty can be avoided and staff that has recently joined the project can quickly get up to speed.*

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Quality criteria of requirements documents

Lecture 4: Slide 40 - 44

Quality Criteria for Requirements

Quality criteria for single document requirements

• **Agreed:** A requirement is agreed upon if it is correct and necessary in the opinion of all stakeholders.

• **Unambiguous:** [ISO/IEC/IEEE 29148:2011] A requirement that is unambiguously documented can be understood in only one way. It must not be possible to interpret the requirement in a different way. All readers of the requirement must arrive at the same understanding of the requirement.

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Quality Criteria for Requirements (Contd..)

• **Necessary:** [ISO/IEC/IEEE 29148:2011] A documented requirement must represent the facts and conditions of the system context in a way that it is valid with regard to the actualities of the system context. These actualities may be the different stakeholders' ideas, relevant standards, or interfaces to external systems.

• **Consistent:** [ISO/IEC/IEEE 29148:2011] Requirements must be consistent with regard to all other requirements, i.e., the requirements must not contradict one another, regardless of their level of detail or documentation type. In addition, a requirement must be formulated in a way that allows for consistency with itself, i.e., the requirement may not contradict itself.

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Quality Criteria for Requirements (Contd..)

• **Verifiable:** [ISO/IEC/IEEE 29148:2011] A requirement must be described in a way that allows for verification. That means that tests or measurements can be carried out that provide evidence of the functionality demanded by the requirement.

• **Feasible:** [ISO/IEC/IEEE 29148:2011] It must be possible to implement each requirement given the organizational, legal, technical, or financial constraints. This means that a member of the development team ought to be involved in rating the goals and requirements so that he can show the technical limits of the implementation of a particular requirement. In addition, the costs for the implementation must be incorporated into the rating. Occasionally, stakeholders withdraw a requirement if the costs for its realization become apparent.

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Quality Criteria for Requirements (Contd..)

• **Traceable:** [ISO/IEC/IEEE 29148:2011] A requirement is traceable if its origin as well as its realization and its relation to other documents can be retraced. This can be done by means of unique requirement identifiers. Using these unique identifiers, requirements that are derived from other requirements on a different level of the specification can be connected. For example, a system goal can be traced through all levels of abstraction, from design to implementation and test.

• **Complete:** [ISO/IEC/IEEE 29148:2011] Each individual requirement must completely describe the functionality it specifies. Requirements that are yet incomplete must be specially marked, for example by inserting "td" ("to be determined") into the respective text field or by setting a corresponding status. These markings can then be systematically searched for and missing information can be amended accordingly.

Quality Criteria for Requirements (Contd..)

- **Understandable:** Requirements must be comprehensible to each stakeholder. In requirements engineering, it is important to strictly define the terms used.

Glossary

All relevant terms must be defined in a common glossary. A glossary is a collection of term definitions and contains the following elements:

- Context-specific technical terms
- Abbreviations and acronyms
- Everyday concepts that have a special meaning in the given context
- Synonyms, i.e., different terms with the same meaning
- Homonyms, i.e., identical terms with different meanings

Q2: Explain in detail Goal Model approach of requirements specifications. Differentiate between use case diagram and use case specifications.

Goal Model approach of requirements specifications

Lecture 5: Slide 12 - 18

Requirements Models (Contd...)

Support perspectives of documentation

An additional advantage when using requirements models is that in contrast to natural language, the modeling languages used have a strictly defined focus.

Requirements models also have the advantage that the different types of modeling elements within the same modeling language dictate the method of abstraction as well as what is being abstracted and what is not.

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Requirements Models (Contd...)

Combined Use of Models and Natural Language

- Using both natural language and requirements models in combination allows the advantages of both documentation techniques to be exploited while minimizing their disadvantages.
- For example, natural language requirements can be summarized and their interrelations depicted using models.
- On the other hand, natural language can help enrich requirements models and modeling elements with additional information.

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Goal Models

- Many methods in requirements engineering are based on the explicit consideration of stakeholders' intentions by means of goals
- Goals are a stakeholder's (e.g., a person's or an organization's) description of a characteristic property of the system to be developed or the development project.

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Goal Models (Contd...)

Natural-language-based and model-based documentation

Goals are very well suited to refine the vision of the system.

Refining a goal known as goal decomposition. Goals can be documented using natural language (e.g., by means of predefined templates) or using goal models.

A widely known and very common goal modeling technique is the use of AND/OR trees. By means of AND/OR trees, hierarchical decompositions can be documented. The type of refinement relation is depicted by graphic representations of the branches.

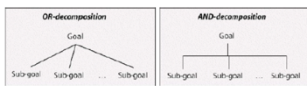
The direction of the goal decomposition is not represented through branches but through the top-down structure of the tree.

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Goal Models (Contd...)

Goal Documentation Using AND/OR Trees

The following figure schematically shows two types of decomposition as well as their modeling elements.



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Goal Models (Contd...)

AND-decomposition vs. OR-decomposition

In case of AND-decomposition, every sub-goal must be fulfilled so that the super-goal (the root) is fulfilled. In contrast, in OR decomposition, it suffices if at least one sub-goal is fulfilled so that the super-goal is met.

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Goal Models (Contd...)

Example of AND/OR Trees

Figure shows an AND/OR tree that documents the hierarchical decomposition of the goal "Comfortable navigation to destination".



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Goal Models (Contd...)

Modeling goals with AND/OR trees

AND trees

The goal "comfortable navigation to destination" is refined into the following three sub-goals via AND-decomposition:

- "dynamic route calculation with respect to traffic congestion",
- "dynamic route calculation with respect to traffic congestion", and
- "comfortable route guidance".

This depicts that all three sub-goals must be met to consider the super-goal fulfilled.

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Goal Models (Contd...)

OR trees

The sub-goal "dynamic route calculation with respect to traffic congestion" in turn is refined by the two sub-goals

- "manual input of traffic conditions" and
- "automatic update of traffic data".

The type of decomposition relation depicts that only one of the two sub-goals must be met to consider the super-goal met.

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Differentiate between Use case diagram and use case specifications.

Lecture 5: Slide 19 – 35 (Sirf read kr k summary bna lain. Very easy topics)

Goal Models (Contd...)

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Use Cases

- Use cases were first proposed in [Jacobson et al. 1992] as a method to document the functionalities of a planned or existing system on the basis of simple models.
- The use case approach is based on two concepts that are used in conjunction with one another:

- Use case diagrams
- Use case specifications

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Use Cases (Contd...)

UML Use Case Diagrams

Relations between use cases

Use case diagrams in the UML are simple models to schematically document the functions of a system from a user's perspective and to document the interrelations of these functions and their environment.

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Modeling Elements of UML Use Case Diagrams

Use cases:

Use cases that are defined for the system are depicted using oval shapes. These shapes contain the name of the use case. Alternatively, the name can be written beneath the use case.

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Modeling Elements of UML Use Case Diagrams (Contd...)

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Modeling Elements of UML Use Case Diagrams (Contd...)

Actors:

Actors are outside the system boundary and represent people or systems that interact with the system modeled.

Actors are depicted by a rectangle that contains the name of the actor and is labeled with the stereotype "actor".

If the actor is a person, a stick figure may be used.

If the actor is a system, either a rectangle or a stick figure may be used in conjunction with the stereotype "system".

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Modeling Elements of UML Use Case Diagrams (Contd...)

System boundaries:

System boundaries within a use case diagram separate the parts of the use case that are part of the system from the parts (people or systems) that are outside the system boundary. Optionally, the name of the system may be denoted at the system boundary in the diagram.

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Modeling Elements of UML Use Case Diagrams (Contd...)

Extend relation:

An extend relation depicts that an interaction sequence that belongs to use case A extends some interaction sequence in use case B at a specified point. This is known as the extension point. The extension is triggered by the condition defined.

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Modeling Elements of UML Use Case Diagrams (Contd...)

Include relation:

An include relation from one use case to another use case depicts that the interaction sequence of the first use case includes the interaction sequence of the other use case.

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Modeling Elements of UML Use Case Diagrams (Contd...)

Relation between actors and use cases:

If communication between a use case and one or more actors takes place during the execution of the use case, the communication must be annotated by means of a communication relation between the respective actors and the use case.

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Example of UML Use Case Diagrams

Example of UML Use Case Diagrams

The model comprises the use cases "download traffic information", "navigate current position", and "input navigable to destination".

The use case "navigate to destination" is related to the use case "input navigable to destination" as an include relation.

The relationship depicts that the interaction steps defined in the use case "input navigable to destination" and "navigate current position" are contained in the use case "navigate to destination".

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Example of UML Use Case Diagrams (Contd...)

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Generalization

UML also provides a generalization relation between use cases or actors.

In this case, the specializing use cases or actors inherit the properties of the generalizing use case or actor.

For instance, the actor "service mechanic" and "customer service representative" can be generalized as the actor "employee".

The generalizing actor should carry all aspects that the actors "service mechanic" and "customer service representative" have in common (e.g., employee ID).

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Use Case Specifications

Use case diagrams show the system's relevant functions from a user's perspective and specific relationships between the functions of the system or between functions of the system and aspects in the system's context.

With the exception of a use case name and the relationship, use case diagrams do not document any information about the individual use cases both in the externally visible between a use case and an actor.

This information is documented internally by means of adequate templates in conjunction with use case diagrams.

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Use Case Specification (Contd...)

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Use Case Specification (Contd...)

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Use Case Specification Example

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**Q3: What is use cases and why they are important for requirements documentation?
Draw a detailed registration system of Abasyn University, Islamabad.**

Use cases and why they are important for requirements documentation

What is Use Case

Lecture 6: Slide 20

Use Cases (Contd...)

UML Use Case Diagrams

Relations between use cases

Use case diagrams in the UML are simple models to schematically document the functions of a system from a user's perspective and to document the interrelations of the functions of a system and the relations between these functions and their environment.

Use Case importance in requirements documentation

Lecture 4: Slide 12

Requirements Documentation using Conceptual Models

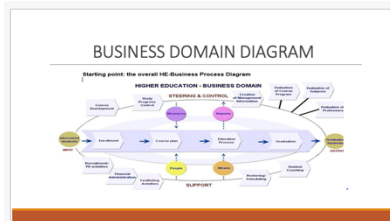
Overview of system functions

Use case diagram:

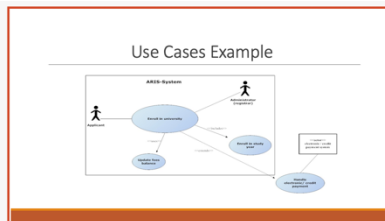
- A use case diagram allows you to gain a quick overview of the functionalities of the specified system.
- A use case describes which functions are offered to the user by the system and how these functions relate to other external interacting entities.
- However, use cases do not describe the responsibilities that the functions have in detail

Detailed registration system for Abasyn University

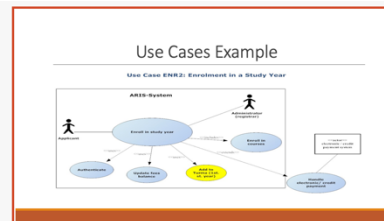
Lecture 6: Slide 41 – 43



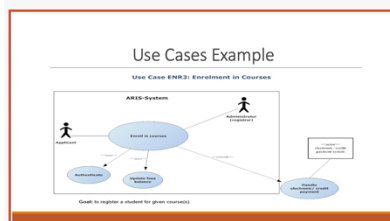
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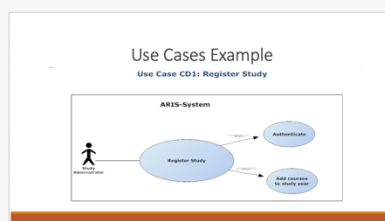
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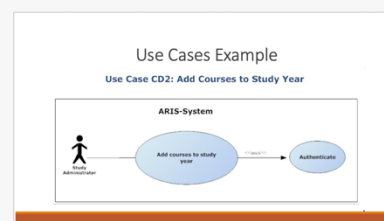
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Q4: What are major goals of requirements validation? Discuss in detail implications of violations of documents engineering.

Major goals of requirements validation

Lecture 7: Slide 7

Quality Aspects of Requirements (Contd..)

- In correspondence with the overall goals of the requirements engineering process, the validation is carried out with the following goals:
 1. **Content:** Have all relevant requirements been elicited and documented with the appropriate level of detail?
 2. **Documentation:** Are all requirements documented with respect to the predetermined guidelines for documentation and specification?
 3. **Agreement:** Do all stakeholders concur with the documented requirements and have all known conflicts been resolved?

Implications of violations of documents engineering

Lecture 7: Slide 19

Implications of the violation of documentation guidelines

Ignoring the documentation guidelines can, among other things, lead to the following risks:

- **Impairment of development activities:**
 - It may be impossible to carry out development activities that are based upon a specific documentation format.
- **Misunderstandings:**
 - Requirements may not be understandable or may be misunderstood by the people that need to comprehend them. As a result, the requirement may be unusable.
- **Incompleteness:**
 - Relevant information is not documented in the requirements.
- **Overlooking requirements:** If requirements are not documented at the position that they are supposed to in the requirements document, these requirements may be overlooked in subsequent activities.

Q5: What are the four test criteria of quality aspects of requirements documentation? Discuss six principles of requirements validation and how it increases the quality in requirement documents?

Four test criteria of quality aspects of requirements documentation

Lecture 7: Slide 21 – 23 (Only headings)

Implications of the violation of documentation guidelines

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Test criteria of the quality aspect "documentation"

Requirements validation with regard to the quality aspect "documentation" is successful when requirements validation has been applied to the error types and no significant shortcomings have been detected

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Four test criteria of the quality aspect "documentation"

1. Conformity to documentation format and to documentation structures:

Are the requirements documented in the predetermined documentation format? For instance, has a specific requirements template or a specific modeling language been used to document the requirements?

Has the structure of the requirements document been maintained? For instance, have all requirements been documented at the position defined by the document structure?

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Four test criteria of the quality aspect "documentation" (Contd..)

2. Understandability:

Can all documented requirements be understood in the context given? For instance, have all terms used been defined in a glossary.

3. **Unambiguity:** Does the documentation of the requirements allow for only one interpretation or are multiple different interpretations possible? For instance, does a text-based requirement not possess any kind of ambiguity?

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Four test criteria of the quality aspect "documentation" (Contd..)

4. Conformity to documentation rules:

Have the predetermined documentation rules and documentation guidelines been met? For instance, has the syntax of the modeling language been used properly?

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Quality Aspect "Agreement"

The quality aspect "agreement" deals with checking requirements for flaws in the agreement of requirements between stakeholders.

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Six principles of requirements validation

Lecture 7: Slide 27

Principles of Requirements Validation

The following six principles of requirements validation increases the quality of the validation results:

Principle 1: Involvement of the correct stakeholders

Principle 2: Separating the identification and the correction of errors

Principle 3: Validation from different views

Principle 4: Adequate change of documentation type

Principle 5: Construction of development artifacts

Principle 6: Repeated validation