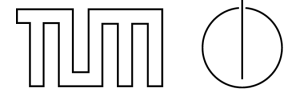


Last Name: First Name: Matr.-No.:

Examination for the course **Software Quality Management**
Summer Term 2010
Total Time 90 Minutes
Total Marks 40
Answers all the questions given below
Dr. S. Wagner, L. Heinemann, S. Islam



Technische Universität München
Fakultät für Informatik

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Assignment 1: Classification of QA Techniques [5 Marks]

Quality assurance (QA) can be categorized into *constructive* QA and *analytical* QA.

1. Briefly describe these categories and highlight their individual goals regarding quality defects.

[**Answer:** Constructive QA is anything you can do to "build quality in". This means all methods and techniques you use to achieve the desired level of quality while building ("constructing") the system. The goal is to avoid or prevent quality defects.

Analytical QA checks for quality defects in artefacts or the process. The goal is to find defects in the existing system.]

2. Assign each of the methods to the appropriate QA category (constructive or analytical).

- Dynamic Testing
- Typing in Programming Languages
- Coding Guidelines
- Code Metrics
- Process Standards
- Formal Verification
- Source Code Documentation
- Model Checking
- Design by Contract
- Review/Inspection

[**Answer:**

- Dynamic Testing: analytical
- Typing in Programming Languages: constructive
- Coding Guidelines: constructive
- Code Metrics: analytical
- Process Standards: constructive
- Formal Verification: analytical

- Source Code Documentation: constructive
- Model Checking: analytical
- Design by Contract: constructive
- Review/Inspection: analytical

]

Assignment 2: Quality Models [8 Marks]

Value-driven or activity-based quality models are a modern form of product quality models. They describe factors (entities and properties) of the software product and their impacts on activities that are performed with the product.

1. Give two advantages of using activities or tasks as a means for structuring quality models in comparison to ISO 9126.

[Answer: “-ilities” have no clear concept of decomposition, activities relate to value, activities can be mapped to scenarios and thereby requirements engineering]

2. The following three rules are from the Dutch Web Guidelines¹. Model them as activity-based quality model. Use a table as given below to model 3 model elements, which correspond to 3 rows in the table. One additional example is given in the table.

Entity	Property	Impact	Activity	Additional notes (optional)
Image	described	positive	Reading using screen reader	An additional textual description allows screen readers to communicate the content of images.

Rule 1 *Use the label element to explicitly associate text with an input field in a form.* Some screen readers and Braille displays have difficulty associating input fields with adjacent texts. Web developers do not explicitly associate these texts with input fields in the markup: the visitor has to visualise the connection himself.

Although screen readers will present texts in a linear order, followed by the input fields, the user will have to guess which field stands for which type of input. Navigating between these fields in a non-linear order may actually sometimes make it impossible to understand the form.

The label element was created for this situation. Thanks to this markup, the web developer can explicitly associate a text (or image) with an input field in a form.

¹<http://www.webguidelines.nl>

Rule 2 *Make sure that the meaning of communicative elements is not expressed only through colour.* Decorative design elements are literally used for decoration only. The lack of such elements – for instance background illustrations – does not affect the visitor’s understanding.

Communicative elements may have significance for the visitor. Information is communicated to the visitor by means of these elements. Examples are text (in HTML or images), links, navigation, symbols/icons and (form) buttons.

Rule 3 *Write both grammatically correct and descriptive markup.* Documents with descriptive markup are more accessible to special browsers. Screen readers can jump from heading to heading and speech browsers can add emphasis when reading certain content. Visual markup complicates the use of these functions.

[Answer:

Different ways of modelling these rules are possible. Below are 4 examples:

Entity	Property	Impact	Activity
Input field	described	positive	Reading using screen reader
Communicative element	understandable	positive	Reading using screen reader
Markup	correct	positive	Reading using screen reader
Markup	descriptive	positive	Reading using speech browser

]

Assignment 3: Metrics [5 Marks]

In Software Quality Management, *aggregation* is used to reduce the amount of data obtained from code metrics. An example is the *nesting depth* of methods. A high nesting depth can decrease the readability of a code section. The nesting depth is measured for each method in the code. To get an overview about the central tendency in a complete software project, this data has to be aggregated.

1. In which scale is the nesting depth metric?

[Answer: Ratio]

2. Which aggregation operator can be used to for determining the central tendency of the nesting depth values?

[Answer: Mean]

3. Given are the following nesting depth values for the methods of three classes. Determine the dispersion of the nesting depth by computing the standard deviation of the values in the table.

[Answer: Standard deviation: $\sqrt{2.5} \approx 1.6$]

Assignment 4: Goal Question Metric (Lars) [5 Marks]

Class	Method	Nesting Depth
A	a1	3
A	a2	1
A	a3	2
B	b1	4
B	b2	5
C	c1	3
C	c2	3

Apply the Goal Question Metric Approach to the following goal, by giving at least two questions for this goal and for each question at least two metrics.

"Reduce the resource utilization of the software system from the customer's viewpoint."

[**Answer:** Question 1: How is the memory consumption of the software?

Metrics:

- Mean amount of system memory used after 1 hour of operation
- Average number of crashes due to insufficient memory per month

Question 2: How is the processor utilization of the software?

Metrics:

- Mean percentage of CPU usage
- Maximum time period with CPU usage over 80%.

]

Assignment 5: Process Assessment [12 Marks]

Background Context

You are the sole personnel QM department of your company. Your management decided to bid the tender of the upcoming local government ministry office automation project. But the tender specification needs that vendor organizations must comply with a quality management system (QMS) standard. Currently your company has processes for the overall software project, which is not fully followed during the development and is incomplete. Therefore, management decided to review the existing processes and perform a complete audit before they apply for the ISO 9001:2000 certification. You proposed to employ your business partner, an Internet Service Provider (ISP), to audit the processes, once the processes and records are internally reviewed by you. The ISP Company has a professional auditor to perform the task. Therefore you and one of your colleagues have currently two tasks: audit the process to identify the non-compliance issues and revise to the process based on the initial audit report before the ISP company starts to audit.

- Which party audit would it be when the ISP Company initiates to audit your software development processes and why? [**Answer:** It is a second party audit. The reason is that the ISP Company is a business partner even though they have a professional auditor.]

- Write a brief audit report. A requirement specification process and related control documents are provided. (Hints: The report only includes audit findings and summary) **[Answer: Summary]** This audit report covers one process and two records of evidence. The requirement specification process is documented and signed by the management. The process is implemented in the organizational context. However the process is incomplete and may not meet the intended purpose of requirements engineering in software development projects. Several non-compliance issues are noted in the audit report. Some guidelines are also included to improve.

Findings from procedure

The purpose of the requirements specification procedure is incomplete; it only addresses the project needs. The aspects for requirement analysis ignore several organizations information such as business vision, business goals, user expectations, usability, acceptance criteria. Overlooking these documents can bring incomplete requirements specification documents. Related documents do not include requirements specification and requirements change request (non-compliance).

Finding from records

There is no input evidence of requirements specification (non-compliance) There is no input evidence of requirement change request Visit log and requirement specification review checklist does include document number(non-compliance)

Wong k Kao (Auditor) S.K. Khan (Chief Information Officer)]

- Write at least 3 actions to improve the audit findings. What types of actions do you recommend?

[Answer: Preventive Actions

The process is implemented and managed however may not meet its intended purpose since defects exist in the process. The purpose should specifically include user expectations and overall organizational business goals. The process also needs to include change requests and it is recommended to have a requirements change request process and records. These are the preventive actions, because no defect is directly observed from these issues.

Corrective Actions

The evidence of document must include requirements specification documents. Documents reference numbers should be included in the every document. These are corrective actions as they are the main reasons for the non-compliance issues.]

Requirement Specifications

1. Purpose & Scope

To understand the project needs, in order to prepare Requirement Specification.

2. Responsibility

Team Leader and designated member of the project

3. Procedure

3.1 Project manager discussing with project members will assign a team for requirements engineering

3.2 The Analysis Team will interview the client, collect forms & observe the organization in order to understand the system requirements. The following aspects are covered during requirement analysis

- Existing Business Process, Hardware & Software, and Security Requirements

3.3 All information collected is recorded in the Customer Visit Log

3.4 The Review Record is maintained on Requirement Specification Review Checklist.

3.7 The Requirement Specification is then submitted to Client for Approval. Any changes required are incorporated and verified by the customer.

4. Related Documents

- | | |
|--|-----------|
| - Customer Visit Log | SWD/3/008 |
| - Requirement Specification Review Checklist | SWD/3/010 |

Prepared By : Anthony Miller, Software Engineering **Approved By:** S.K. Khan, Chief Information Officer

Date : 12/02/08

Visit Log

Project Name: GP SMS

Client: GP

Date: 12/10/09

Person Interviewed	Req. Type	Requirement Description	Doc. Collected	Remarks
Mr. Martin Head, Sales	System	Message link with the utility service	Electricity bill	Complete information

Pollob (Head customer care)
(Sign of the Clients)

Anthony Miller
(Sign of the team member)

Requirement Specification Review Checklist

Project Name: GP SMS

Client: GP

Date: 22/02/10

Items	Check for	Yes	No
Purpose and Scope	Are the Purpose & scope well defined?		N
Functionality	-All Functionalities are well described?		N
	- Use cases of customer business process are identified?	Y	
	-All required performance issues are well described?		N
	-All requirements reflect the customer needs?		N
	-All User Interface issues are clearly identified?	Y	
	-All external links of the SMS functions identified and agreed	Y	
Performance	-Any response time for functions is defined	Y	
Security	-Are all security and accessibility issue clearly defined?		N
	-Are login and Password system required by the customer defined?	Y	
	-Is any back-up system is required? If yes has it been addressed?	Y	
Acceptance criteria	-Are all acceptance criteria clearly defined?		N

Comments: There are errors in the requirements such as application interactions with the utility service provider are incomplete, functionalities are missing, project acceptance criteria do not fully reflect the goals. There is no sign for the user acceptance.

(Anthony Miller)

Assignment 6: V&V Planning [5 Marks]

V&V planning is the task in a development project that plans the verification and validation of all work products. There exist various methods and techniques for verification and validation of which a good combination needs to be found.

1. A very interesting concept that can be used for V&V planning is the cost of quality as proposed by Feigenbaum. For V&V, however, only part of the quality costs play a role. Discuss the relationship of prevention costs and constructive quality assurance.

[**Answer:** Constructive quality assurance is not part of V&V. The aim of constructive quality assurance is to make sure that the product is built with high quality in the first place. It avoids defects. Hence, prevention costs measure the costs for constructive quality assurance.]

2. Woijicki and Strooper proposed a structured approach to find a good combination of V&V techniques based on their effectiveness and efficiency data. Given below is a table with the necessary data. Propose an initial V&V plan using that approach and discuss what needs to be considered in addition.

	Timing	Interface	Function	Documentation
Data flow tools		L[H]	L[L]	
Review		H[L]	H[M]	M[H]
Random tests	M[H]	M[H]	H[L]	
Black-box tests	M[M]	M[M]	M[H]	

[**Answer:**

Reviews

Random tests

We need to use reviews to find documentation defects. In addition random tests have lower effort for similar defects as black-box tests.

There are additional dependencies, for example, between data flow tools and reviews. The reviews might need less effort if data flow tools are used before.

]