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Quality Management of Software and Systems (WS19/20)

Problem Set 1

Due: in exercise, 13.11.2019

Problem 1: Systems in general

a) Please define the general term “system” according to Birolini and explicitly name the parts a system can encompass. Explain your answer in the view of a real domain.
b) What is the difference to a “technical system”?
c) For the analysis of a technical (embedded) system it is crucial to extract it from its environment. How can this be achieved? Please sketch your ideas.
d) Please list important non-functional requirements for embedded systems.

Problem 2: Reliability vs. Availability

Show the differences and the dependencies between “reliability” and “availability”.

Problem 3: Safety

Please explain the term “safety” in a general and a technical view.

Problem 4: Error, Fault, Failure

What is meant by the terms “failure”, “fault”, and “error”? Please explain their dependencies on a real example.

Problem 5: Correctness, Completeness, Robustness

Please give your opinion on the following statements:

	true	false
Correctness has a binary character	☐	☐
An artifact is not consistent to its specification, if it is not correct	☐	☐
If there is no specification the system works always correct	☐	☐
A system is complete, if all functions required in the specification are implemented.	☐	☐
Robustness has a binary character	☐	☐
A correct system can have low robustness	☐	☐
Robustness is a property only of the implementation	☐	☐

Problem 6: Quality

a) Please give some quality characteristics and explain how different characteristics might influence each other.

b) Think about the following dependencies and figure out, whether the influences are positive or negative.

i. Safety – Availability
ii. Safety – Reliability
iii. Availability – Reliability

(find others by yourself)

Problem 7: QIP

Please answer the following questions about the Quality Improvement Paradigm:

a) What is the objective of QIP?
b) What are the two feedback cycles?
c) What are the phases of each cycle?
d) Why does an organization achieve improvement when applying this paradigm?
e) In which of the QIP steps are GQM (Goal question metric) and EF (Experience Factory) applied?

Problem 8: Experience Factory

To answer some questions of this problem, please refer to the article *"Basili, V., Caldiera, G.. Rombach D.:The Experience Factory"*.

a) What is the experience factory used for?
b) Which kind of information is packaged in there?
c) Could you give some examples of "experience packages" and how are they defined?
d) In which way does the EF support improvement?
e) How does the EF support QIP?

Problem 9: GQM

a) What is the purpose of GQM?
b) How are goals refined into metrics? Please give a brief description.
c) Why is it necessary to have goals associated with metrics?

Within GQM a goal is defined by using the following template:

Object	**Purpose**	**Focus**	**Viewpoint**	**Context**

- **Object** refers to any process, model, product, which will be the measurable object of the goal.
- **Purpose** is the way, in which the collected measurement data will be used, e.g. characterize, evaluate, compare, predict, control, and improve.
- **Focus** refers to the quality characteristic to be taken into account when measuring, e.g. effectiveness
- **Viewpoint** refers to the perspective of the stakeholder which needs the information, e.g. researcher
- **Context** refers to the environment, in which the measurement goals are defined, e.g. company ABC

d) Using the aforementioned template, please define the following goals of members of the software company "IET" in terms of measurement goals:

1. The quality assurer would like to know: how effective are the currently used inspection techniques (PBR, CBI) with respect to fault detection?
2. IET has got a new project: development of a web based system for handling customer registration. The project manager has to select a suitable IDE for this web based development. He has two options either .NET (C#) or eclipse (Java).
3. The business manager would like to classify available Quality Management approaches, to select the most appropriate one to be implemented in the organization.

e) Please derive corresponding questions and metrics for the first goal. There are three groups of questions that can be derived:
   - Questions that characterize the object with respect to the goal
   - Questions that characterize attributes of the object with respect to the goal
   - Questions that evaluate (quality) characteristics of the object with respect to the goal

For more information about defining questions and deriving metrics, please use as reference the given article: *"Basili, V., Caldiera, G.. Rombach D., The Goal Question Metric Approach"*

Questions and metrics can be documented by using the following template:

Goal:	
Question Q1:	M1: M2: M3:
Question Q2:	M1: M2: M3:
Question Q3:	M1: M2: M3: