# Quality Management of Software and Systems (WS 11/12)

# Problem Set 1

Wednesday, November 9<sup>th</sup>, 2011

The first 7 Exercises in this Problem Set are almost the same as in Problem Set 1 of the lecture "Safety and Reliability in Embedded Systems".

# **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 6: Correctness, Completeness, Robustness

Please give your opinion on the following statements:

Correctness has a binary character An artifact is not consistent to its specification, if it	true	false □ □
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 7: 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 8: 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 9: 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 10: 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"

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

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