Sektion 1

1 a) Which of the following statements are true? Wrong answers give minus credits. (2)

☐ The statement "The system has been well received by parents." is a requirement since it describes a property of the system

☐ The statement "The system shall be fast." is not a good requirement since "fast" is vague.

☐ The statement "The maximum response time of the system is 300 ms." is a functional requirement.

☐ The statement "As a student I want to access the library remotely so that I can study from home." is an example of a user story text.

1 b) *Scenario:* Analyze the Wiseflow system, that you are using now. Before the exam, the examiner and administrator design the exam by setting configuration parameters. The examiner and the graders write the problems together and can set rules for automatic grading of problems. Students and exam invigilators use the system for identification and other administrative things. Students can write answers and append photos of diagrams. After the exam, the assessors read and grade individual answers. The grades can be annotated with a text. When their tasks are completed, the assessors register their results which becomes visible to the examiner who sets the grades. When this is finished, the examiner registers the grades and the administrator retrieve results for reporting in LADOK. Where the grade is signed by the examiner.

Task 1: Write two use-cases of the system described above and draw a *UML use-case diagram*. At least three different *actors* shall be involved in the two use-cases, for instance, one actor in use-case 1 and two other actors in use-case 2. (4)

Append a diagram of the use-cases to this section and write in the text field below the name of the appendix that contains the answer to this question

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1 c) *Scenario:* Same as **1 b)** above

Task 2: Write a *quality requirement* and one *design constraint* of the system described above. For each of the two requirements, write a short motivation on which level of testing (unit, integration, ...) they can be tested. (Hint: a motivation is typically 1-2 sentences.) (4)

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2 a) Analyze the UML *state machine diagram* below:

For class
CoinHandler:
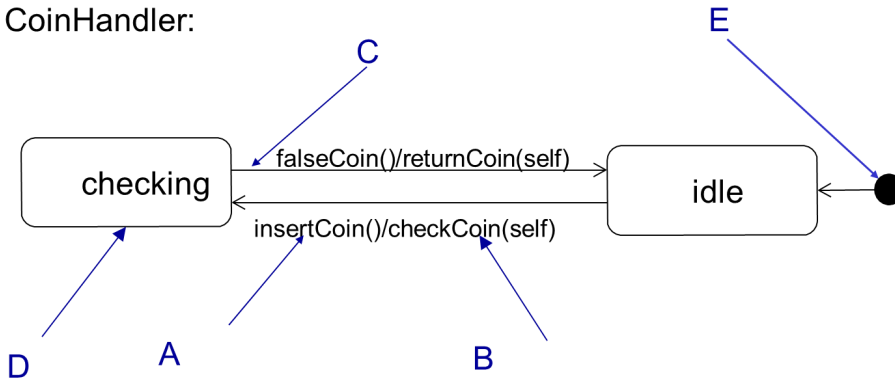
Which of the following statements are true? Wrong answers give minus credits. (2)

☐ A points at a *triggering event* that causes the *state* to change.

☐ B points to a *sub-triggering event* that also has to be fulfilled to cause a *state* change

☐ C points to a *message* arrow that shows that parameters are passed between the *states*.

☐ D points to a *state*, whereas E points to a *pseudo state.*

2 b) Name and describe an *object-oriented design pattern* with a UML *Class diagram*. Describe one *applicability* and one *consequence* of using the design pattern. You may use an example.

Append a diagram of the classes to this section and write in the text field below the name of the appendix that contains the answer to this question. (4)

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2 c) Give two reasons of why we would design and document an *architecture* in software engineering projects. Don't forget to motivate your answers. (4)
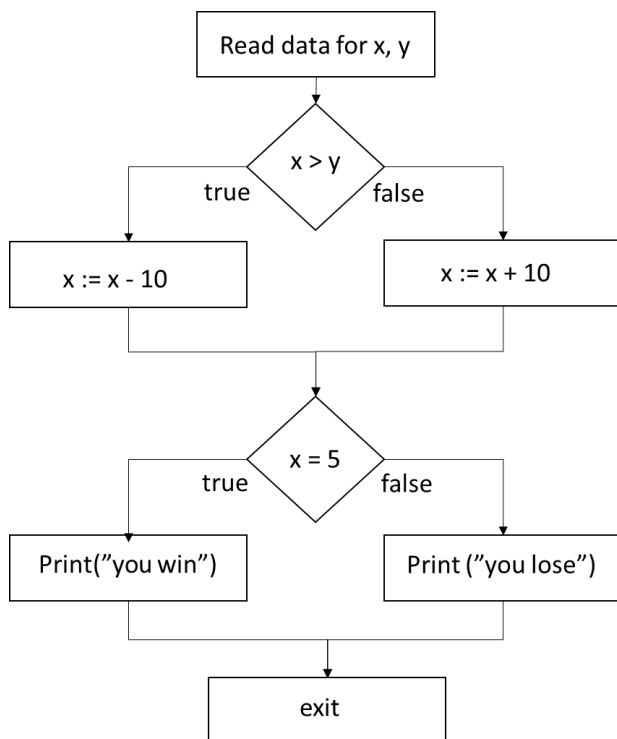
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3 a) Which of the following statements are true? Wrong answers give minus credits. (2)

☐ In a *feature branch workflow*, it's good to have long living branches to provide for traceability between features and software components.

☐ A *pull request* automatically uploads your code to the main repository.

☐ A *baseline* in a configuration management context is a set of *configuration items* that are known to work well together.

☐ A *Gitflow workflow* (Git workflow in the lecture slides) has one main branch and one develop branch.

3 b) Look at the following *flow chart* of a program

Create a *test table* (as explained in the course) of *test cases* that ensures *full path* coverage. (4)

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3 c) Describe two different ways of performing *acceptance testing*. Maybe 2 sentences each. (4)

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Sektion 4

4 a) Which of the following statements are true? Wrong answers give minus credits. (2)

☐ The *Risk Magnitude Indicator* is the product of *probability* and *impact* of an identified risk.

☐ *Risk mitigation* is a process of finding ways so that someone else is taking the risk.

☐ The risk "Our lease of testing hardware will end before our tests are ready" is a *direct risk.*

☐ For a student project of 6 credits, you should at least expect to manage 20-50 risks.

4 b) Describe the *SCRUM* meetings: *daily SCRUM, sprint planning meeting, sprint review meeting*, and the *sprint retrospective meeting*. About 1-2 sentences per concept is probably enough. (4)

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4 c) Describe two advantages with the *classical waterfall* model. Clearly motivate your answers. (4)

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5 a) Which of the following statements are true? Wrong answers give minus credits. (2)

☐ In the staged representation of *CMMI* an organization can be rated to a specific maturity level by satisfying a predefined set of *process areas*.

☐ To be rated at *level 1: Initial* in the staged representation of *CMMI* you need to satisfy *process areas* in *process adherence* and *requirements management.*

☐ Each *process area* in *CMMI* has a number of *specific and generic goals* that all have to be met in order to satisfy the process area

☐ To meet a *specific goal* of a *CMMI process area* you must follow the *specific practices* given in the SEI standard.

5 b) Explain how you measure Cyclomatic complexity, V(G), of a software component. You may use an example. Give a quality factor that can be (partially) related to V(G). Write a short motivation of why you think it is related to V(G).(4)

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5 c) What are the responsibilities of the *inspection leader* (also known as moderator) in the four steps of an *inspection* process? (4)

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6. *Scenario:* You are about to develop a decision support system for the migration board in order to make applications of immigration of workforce and refugees faster and more consistent. The stakeholders are: the applicant, the case officer, managers at the migration board, the legal counsellor of the applicant, personnel in government overseeing the migration board, and judges at the appeal court. The system handles massive amounts of information from foreign department, laws, and precedents. Data about the applicants are very sensitive.

Task: Your task is to elicit and analyze the requirements for this system.

a) For elicitation, describe how each of the techniques listed below can be used. For each technique, name a stakeholder that is appropriate for the technique and write down a requirement that you think you could have found using the technique.

1. Personal interviews
2. Workplace observation
3. Group discussions around a scenario
4. Prototyping

 (12)

b) For the analysis, suggest two ways of classifying the requirements. For each choice, give a one-sentence motivation.

(Hint: What do we mean with "ways to classify requirements"? One way to classify requirements is by priority. Priority can of course not be one of the answers to the question.)

(4)

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Sektion 7

7. *Scenario:* The Sea rescue has a drone which can be launched if there is an alarm. The drone takes off and searches for the location of the caller. When the location is found the drone collects data and sends to the Sea rescue to direct helicopters or vessels. When the data is received the drone flies back to the base. If there are living humans at the location, the drone drops a life preserver communication equipment and hovers over the location with lights on until help arrives. When help has arrived, the drone can either go back to the base, if the remaining energy is enough, or try to land on water or a vessel.

Task: Draw an UML State diagram of the class Drone with at least three states (9)

Append a diagram of the UML State diagram and write in the text field below which appendix that contains the answer to this question.

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Sektion 8

8. Describe the *integration strategies top-down* and *bottom-up* thoroughly (maybe 4-5 sentences each).

For each of the strategies, describe benefits and potential problems when you apply them to a system with a deep *functional decomposition tree*. There are only a few ancestors per level.

For each of the strategies, describe benefits and potential problems when you apply them to a system with a shallow *functional decomposition tree*. There are many ancestors per level. (15)

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9. Describe *metrics* that can be measured on the following artefacts. One metric per artefact is sufficient.:

1. *Software requirements specification*
2. The *execution view* of an *architecture*
3. A *UML Class diagram*
4. A set of *test cases* coded for automated tests, e.g. in Junit.

Use our standard of describing metrics (Description, How to obtain data, How to calculate the metric, Relevant quality factor).

Select one of the metrics above that can also be used on source code. Motivate why. (10)

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