Sektion 1

1 a) Take a look at these two *user story* cards:

#1 As a teacher I want to record student lab results so that I can make a correct result file at the end of the course.

Priority: 1
Estimate: 40

#2 As a teacher I want to make sure that only allowed collaboration between labgroups are used so that I don't need to report anyone for cheating.

Priorty: 2
Estimate: 800

Which of the following statements are true? Answer with the statement letter only, no motivation is needed. Wrong answers give minus credits. (2)

- ☐ *User story* #1 is twice as important as *user story* #2.
- ☐ Both user stories follow the pattern "As a (role) I want (something) so that (benefit)"
- ☐ The *estimate* shows how much the customer is willing to pay for the story.
- ☐ *User story #2* is too large and general to be used in an *agile* development project.

1 b) *Scenario:* Your hairdresser salon has started a website for frequent customers. If you have signed up for the free membership you can login and book treatments. You can search for different employees to perform the treatment, date, or time. The customer can erase bookings if more than 24 hours remain before the start of the treatment. The website also has an interface for the hairdressers to use for management of the salon, for instance editing their working hours, customer bookings, and times for serving drop-in customers. The hairdressers can also edit advertisements from their vendors.

Task: Now, create a UML *use-case diagram* of the website consisting of two different *actors* and two different *use-cases*. Don't forget the use case descriptions (texts). Only logging in and logging out are basic functions, not to be considered as individual use-cases.

Append a diagram of the use-cases and write in the text which appendix that contains the answer to this question. (4)

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1 c) *Scenario:* Same as in problem **1b)** above
Task: 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)

Sektion 2

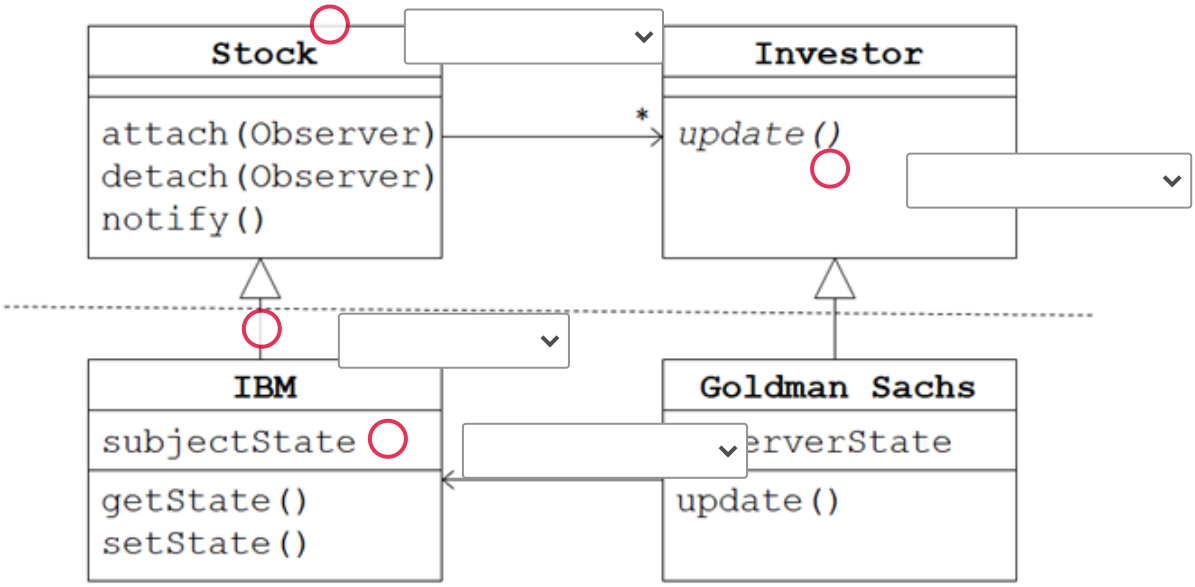
2 a) Which of the following statements are true? Answer with the statement letter only, no motivation is needed. Wrong answers give minus credits. (2)

- ☐ Isolating the most critical parts of a system is a way to achieve *safety* of the system.
- ☐ *Redundancy* is used to speed up calculations.
- ☐ Separating *user interfaces* from *logic* is used to achieve *usability*.
- ☐ Parallel execution of algorithms is a way to increase *portability*.

2 b) Draw a *UML state diagram* of a telephone answering service with the following properties:
1. If the receiving subscriber does not answer after 4 signals, the answering service starts.
2. If the receiving phone is busy, the answering service starts immediately.
3. The answering service plays a message and accepts voice input from the calling subscriber.
4. If the receiving subscriber answers the phone when the answering service is working, the service is cancelled, started recordings deleted, and the conversation can start as a normal phone call.

Append the state diagram and write in the text which appendix that contains the answer to this question. (4)

2 c) This is a diagram of the structure of the *Observer design pattern*.
In the figure below select the correct name for the different model elements or the role the model elements are playing in the design pattern. No minus credits for a wrong answer.



Sektion 3

3 a) Which of the following statements are true? Answer with the statement letter only, no motivation is needed. Wrong answers give minus credits. (2)

- ☐ Testing cannot detect *missing functionality* (sins of omission).
- ☐ A *fault* is observed once a *failure* of the software is executed.
- ☐ An *error* denotes a human mistake done during coding.
- ☐ *Equivalence class testing* is based on the specification.

3 b) Let s = minimum number of test cases for statement coverage;
b = minimum number of test cases for branch coverage, and
p = minimum number of test cases for full path coverage.
Draw a flowgraph of a program where s < b < p. Motivate your answer.
Append a diagram of the flowgraph and write in the text which appendix that contains the answer to this question.

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3 c) Explain what happens in *Git* when you give the following commands: *clone*, *pull*, *push*, and *commit*. You may use an example. (4)

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4 a) Which of the following statements are true? Answer with the statement letter only, no motivation is needed. Wrong answers give minus credits (2)

- [ ] The process in SCRUM is the main focus, so the *sprint retrospective* continues as long as is necessary even if it delays the *sprint planning*.
- [ ] A *task board* in SCRUM is an organization that sets priorities on changed and new *product backlog items*.
- [ ] SCRUM can be used for many different types of projects, not only software development.
- [ ] The *team* is a role in SCRUM.

4 b) The following practices are popular in *agile* methods:
- *Test-driven development*
- *Pair programming*
- *User stories*
- *Refactoring*

Can any of these be used in a project run according to the *classical waterfall* model? For each of the practices give a short motivation for why or why not. (4)

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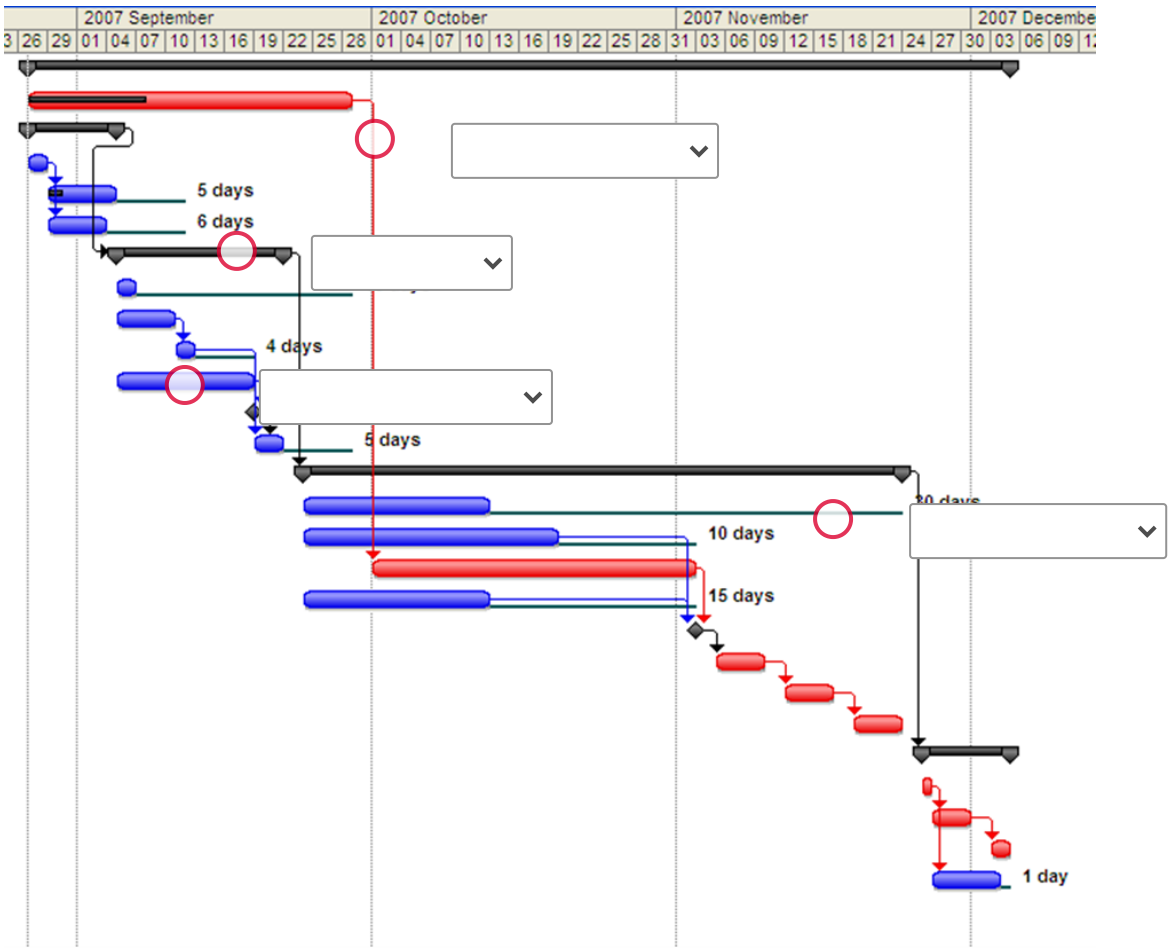
4 c) In the Gantt-chart below, select the correct name for the different elements. No minus credits for wrong answers. (4)



Sektion 5

5 a) Which of the following statements are true? Answer with the statement letter only, no motivation is needed. Wrong answers give minus credits (2)

- ☐ In an *inspection* meeting the *author* should only listen for feedback.
- ☐ By analyzing *inspection data*, you can both improve the *product* and the *development process.*
- ☐ A *walk-through* is performed by a 3rd party to evaluate *conformance* to standards.
- ☐ One of the tasks for a *technical review* is to evaluate if the software is complete and suitable for intended use.

5 b) Describe the following concepts of the CMMI (The one we used in the course: CMMI for Development v 1.3, staged representation): *Maturity level, process area, specific goal,* and *specific practices.*(4)

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5 c) Explain how **MTTF** (Mean Time To Failure) can be used to give an approximation for *reliability* and *availability*. Don't forget to motivate your answer. (4)

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6. *Scenario:* You are building a system of robots to carry fragile goods in an unknown indoor environment. All robots have a communication device. There are two kinds of robots: Transport robots and scouts. Transport robots carry goods and have a central processing unit that calculates the shortest safe way. Scouts come in two types: those that fly and those that moves on the ground. Scouts can be configured with one of two skill sets. The first skill set involves detecting the borders of the room: walls, ceiling, and conditions of the floor. The second skill set involves finding hindering objects in the room.

Task: Create a UML *class diagram* modelling the equipment described above. Each physical equipment is a *class* and you use at least one *generalization* and one *composition* association.

Append the *class diagram* and write in the text which appendix that contains the answer to this question. (10)

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7. *Scenario*: You are about to start a development project for a mobile system under the following circumstances:
The goal is to help disabled people to find their way around in the center of large cities. For example, you shall avoid stairs.

- The Client development team is located in Sweden and the Backend development team is working in India.
- In India you have a data base specialist. She was one of the top students in the country and has worked for your company for seven years now.
- In Sweden, you have a very good UX (User experience) designer who is working half-time as university researcher and teacher.
- You are planning to use a software called React Native to develop for multiple mobile platforms at the same time. For functions supported the generated code is almost as good as the natively programmed code.
- You might need to use NFC (Near Field Communication) which is hard to use with IPhone, but you have a reliable source that it will become much easier in the coming 12 month period.
- Your first deliverable is scheduled in 10 months from now.
- You may make more assumptions, as long as you write them down.

Your task is now to formulate five *risks* and show how they will be managed. Each risk shall contain:

- description,
- short motivation for the *Probability*,
- short motivation for the *Impact*,
- and a suitable, motivated *plan* for the Risk. (10)

8. *Scenario*: You are testing a prototype of an almost finished version of a website intended for all people who can read and type. To perform the testing you have hired a panel of representative users, and you are now thinking about which data you will collect to give a picture about the *usability* of the system

Task:

a. Describe two types of data that are suitable to capture automatically when the user is using the system. No human intervention shall be needed to gather the data. How would you be able to say something about usability from the data? Are there any potential problems of using the data for decisions about usability?
b. Describe two types of data that are suitable to capture by observing the user using the system. You are not supposed to talk to the user during the usage. How would you like to record the data? How would you like to process the data after the test session? How would you be able to say something about usability from the data?
c. Describe two questions suitable for a questionnaire to be filled by the users after the testing session. How would you be able to say something about usability from the data? Are there any potential problems of using the data for decisions about usability?

Your answers will be judged according to the clarity of your description, but also according to the suitability of the method. If you, for instance, make extremely complex procedures to automatically collect data that is best to collect by observation you will not get full credits. (18)

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9. *Scenario*: We assume that you have figured out the pricing policy for the railroad tickets and now you will build a little app to help other travelers. The policy works like this:

If there are more than 100 days before the departure, the tickets are sold at fixed, rather high price.
If there are between 100 and 51 days before the departure decrease the price with 1% of the fixed price per day.
If there are between 50 and 10 days before the departure and the train is booked 50% or less, continue decreasing the price with 0.5 % of the fixed price per day.
If there are between 50 and 10 days before the departure and the train is booked more than 50%, start increasing the price with 1 % of the fixed price per day.
If there are less than 10 days before the departure increase the price with 1 % of the fixed price per day.

Task: Identify *input* and *output* variables of the program you coded. Identify *valid equivalence classes* and provide a *test table* for *equivalence class testing*. Use the built-in table editor of Wiseflow. This program does not calculate the price; it only determines the speed of increase or decrease. Remember that the variables depend on each other (12)