

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

- We say that two requirements are *testable* if, and only if, they can always be satisfied simultaneously
- Prototyping* can be used both for *requirements elicitation* and *requirements validation*.
- An *Entity-Relationship diagram* is useful when we want to describe the dynamic behaviour of an embedded control system
- The IEEE Standard 830 for Software Requirements Specification encourages that you to adapt the disposition of headlines to your particular application.

1 b) *Scenario*: You are developing a home page for a consumer product test magazine that provides readers with results of professionally performed tests with recommendations.

Anyone can see headlines, read summaries of the tests, and buy an article containing the full test with a credit card. The purchased article can be accessed for seven days. Subscribers have full access to all test articles during the subscription period and can also make comments under the articles sharing their own experience of the product with other subscribers. The editor publishes the tests and writes the summaries and explaining information about the test. The editor can remove subscribers' comments and archive outdated tests.

Task: Your task is to draw a UML *use-case diagram* of the site comprising at least two different *use-cases* and two different *actors*. Don't forget the use-case texts (also known as descriptions).

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

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1 c) Define the following concepts in the context of requirements engineering: *non-functional requirements*, *unambiguous requirement*, *user story*, *human bias*.

About 1-2 sentences per concept is probably enough.(4)

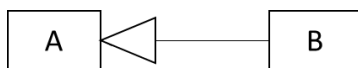
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2 a) Which of the following statements are true? Two statements are true. Wrong answers give minus credits. (2)

The composition association implies “no sharing”. Instances of B can only be owned by a single instance of A in the diagram:



Generalization means that A inherits all properties and operations of B in the diagram:



The Observer design pattern can be used when we need to use different variants of the same algorithm in a class.

The Façade design patterns can be used to provide a simple interface to a complex subsystem.

2 b) Describe two ways you can make an architecture for a system that is easy to maintain. Don't forget to motivate your answers. 2-3 sentences per solution might suffice.

If you want to, you can draw illustrating diagrams. Write in the text which appendix that contains the answer to this question. (4)

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2 c) Let's put you in the teacher's role. You have asked the students to "Draw a small example of a UML State diagram for a book in a library." You received two solutions, A and B. Identify the incorrect solution. Give the incorrect solution constructive feedback of about 4 sentences. (4)

Diagram A

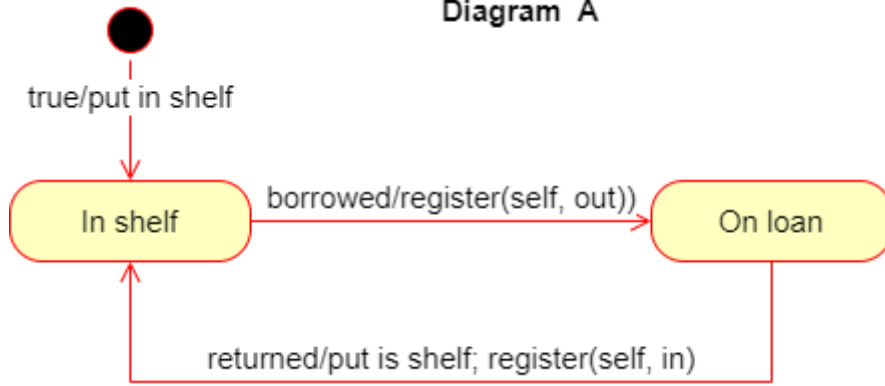
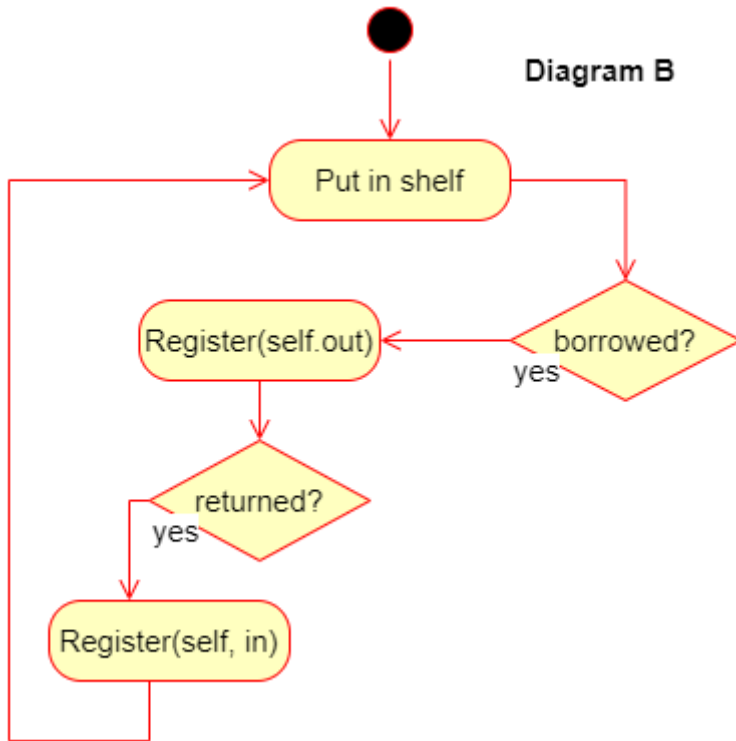


Diagram B



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

- The *classical waterfall model* can be good for fixed-price projects
- A problem with the *classical waterfall model* is that it is hard to understand.
- A prerequisite to use *iterative development* is that the requirements can be divided in smaller parts
- A problem with the *iterative model* is that work cannot be done in parallel.

4 b) Assume that you have a contract with the customer stating that a list of features must be present in the coming release. Give examples of things you can do if:

- Two people leave the project.
- Your manager wants you to deliver the product a month earlier.
- Your strategic product manager decides that you need to deploy on more platforms than was originally agreed.
- You realize that your time estimations for the features were too optimistic

We don't assume that all the above problems occur simultaneously, just account for them one by one. For each of the changes, write a short motivation, 1-2 sentences, of how it will help. (4)

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4 c) Shortly describe the following concepts in planning with a *GANTT-chart*: *phase*, *slack time* (also called *float time*), *critical path*, and *mile-stone*.

A short description is typically 1-2 sentences.

If you want to, you can draw an illustrating diagram. Write in the text box below which appendix that contains the answer to this question. (4)

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

In object-oriented software, a high maximum depth in the *inheritance tree* indicates that the software is harder to understand.

A high number of *reused* code lines can be an indicator of high *reliability* with the argument that the reused parts have been tested and run for a longer time than newly produced code

If we draw a *flow-graph* of a program, that only contains *binary decisions*, then the *cyclomatic complexity*, $V(G)$, of the program grows quadratically with the number of decisions. (e.g. if you double the number of binary decisions, $V(G)$ becomes four times higher).

The *reliability* can be approximated by $MTBF/(1-MTBF)$, where MTBF denotes Mean Time Between Failures.

5 b) Scenario: You are the manager of a company of 15 people and you have passed the state of being a start-up. The software helps the customers well and you have a good reputation for well-tested software. Sometimes you are a bit late in delivering a new release, but it is tolerable. However, your staff complains about the large amount of overtime. They believe that this is because you need to spend much time in adapting the components you chose; nothing seems to work right off the shelf.

Task: Select and describe a CMMI process area that you believe will help your company to improve. A description of a process area contains major ideas of the process area and the specific goals. For full credit, the purpose statement alone is not enough. Also, motivate why the process can help you. (4)

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5 c) Compare the review methods *Inspection* and *Walk-through*^[1] in terms of:

- Goal
- Participants
- Process
- Data collected

Hint: Make a table with the methods as columns and comparison criteria as rows. Write 1-2 sentences in each cell. Preferably, you can use the table tool in Wiseflow. (4)

^[1] In older literature called: Structured walk-through

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7. *Scenario:* You are about to design an application of a patient record database for a healthcare district and have formulated the following use-case:

Name: Retrieve data about a specific patient

Actors: User, GUI, database, authentication server

Description:

- The user logs in to the system through a GUI.
- The user fills in the personal number of the patient and selects the type of information that is of interest on the starting screen.
- The user presses the “send” button.
- The GUI formulates a query to the database.
- The database checks if the user is eligible to retrieve the wanted information for the patient with an authentication server.
- If authentication is granted, the result of the query is sent from the database to the GUI.
- The GUI presents the results in a results screen.

Task: Model the use case as a *UML sequence diagram*. The diagram shall take the case when authentication is not granted for the combination of user, patient, and type of information.

Also, give one advantage and one disadvantage if we replace use-cases with a set of sequence diagrams instead.

Append a picture of the sequence diagram and write in the text box below which appendix that contains the answer to this question. (10)

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8. *Scenario:* Somewhat simplified you can say that with a Swedish driver's license category B you are allowed to drive cars with a maximal weight of 3500 kg.

You are allowed to hook on a trailer with a maximal weight of 750 kg.

If the trailer weighs more than 750 kg you can still drive the car with the trailer if the sum of the weight of the trailer and the weight of the car is maximally 3500 kg.

Your friend has developed an app where you can calculate if you are allowed to drive the car with or without a trailer given their weights with a driver's license category B. Your job is to test the app.

Task: Identify *input* and *output variables* and *valid* and *invalid equivalence classes*. With valid we mean that you are allowed to drive with a category B driver's license. Invalid classes means that you are not allowed to drive with the category B driver's license. We assume that it is impossible to enter negative numbers.

Create a test table when you perform boundary value testing as it has been taught in the course.

You should be able to answer by using the table editor in Wiseflow. (15)

(For small cars, harder restrictions from the vendor can be applicable, but we do not consider this in this problem. Always drive responsibly in real life!)

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