

Task 1**[21 points]**

a) The Unified Modeling Language ...

- supports the whole development life cycle.
- enforces the usage of a certain development process.
- implies the usage of a certain modeling notation.
- implies the usage of a certain modeling methodology.
- enforces the usage of a certain programming language.
- enforces the usage of a certain tooling environment.

b) The following artefacts should be under configuration management:

- Code
- Documentation
- Deployment scripts
- Compiler
- Initial system data
- Tools

c) Which of the following items are parts of an overall project plan:

- Milestone plan
- WBS
- Schedule
- Resource plan
- List of closed points
- Communication plan

d) Which of the following terms describe countermeasures for risks in projects:

- Prevention
- Transfer
- Compliance
- Cross over
- Acceptance
- Mitigation

e) The following statements are true:

- A milestone trend analysis can show the 90% syndrome.
- The earned value analysis can show deviation from schedule.
- Project monitoring can only control what was planned before.
- The earned value analysis can show deviation of costs.
- The earned value analysis is based on the WBS.
- The earned value analysis can show deviation of product quality.

f) In a UML state diagram ...

- a transition is a change from one state to another.
- all transitions must be deterministic.
- events have no duration.
- the represented finite automaton can execute forever.
- a state can consist out of nested sub states.
- regions can define implicit fork / join mechanisms.

g) Design Patterns ...

- are specific solutions for functional requirements.
- need to be adapted to the context of their application.
- can describe the creation of objects.
- are not re-usable outside of their context.
- define potential negative consequences when used.
- are typically used for intra-component design.

Task 2

[19 points]

a) Describe 5 product metrics (name – definition – goal)

b) Enumerate 3 integration strategies for integration tests!

c) Enumerate four typical review variants, sorted by increasing effort of preparation and execution!

d) Describe the two structuring elements “Tiers” and Layers” in the context of Software Architectures:

Tiers:

Layers:

e) Describe the Anti Pattern “Poltergeist”:

Task 3**[25 points]**

Imagine your development team has to realize the control for a NextGeneration lecture hall. The lecture hall system consists out of two subsystems: subsystem light control and subsystem board control. Your task is to elaborate an analysis model covering (among others) the following requirements:

- REQ.1. The lecture hall light system has two different areas for the hall: one for the blackboard in the front and one for the auditorium.
- REQ.2. The lights for the black board can be switched on and off.
- REQ.3. The lights for the auditorium are specified like the lights for the black board and additionally can be dimmed.
- REQ.4. The lecture hall board system has a motor control. There are two blackboards, which can be operated independently from each other.
- REQ.5. The board system can be controlled manually with 6 buttons which start the following actions by a single press:
 - a. Button B1UP: move blackboard 1 up, until the upper border is reached
 - b. Button B1DOWN: move blackboard 1 down, until the lower border is reached
 - c. Button B1STOP: stop any movement of blackboard 1 immediately
 - d. Button B2UP: move blackboard 2 up, until the upper border is reached
 - e. Button B2DOWN: move blackboard 1 down, until the lower border is reached
 - f. Button B2STOP: stops any movement of blackboard 1 immediately
- REQ.6. The students can attach mobile devices to the board system, when they are in the lecture hall.
- REQ.7. The lecturer can send the current content of the blackboards as PDF to all attached mobile devices by pressing the button "SENDCONTENT" at the board system.
- REQ.8. Whenever a student leaves the lecture hall, his/her attached mobile devices will be detached automatically.
- REQ.9. The light system can be controlled with 4 buttons which start the following actions by a single press:
 - a. Button LON: switch light on for blackboard and auditorium
 - b. Button LOFF: switch light off for blackboard and auditorium
 - c. Button LSLEEP: switch light on for blackboard and dim light in auditorium to 20% light intensity
 - d. Button LPRESENT: switch light off for blackboard and dim light in auditorium to 60% light intensity

During a CRC Card Session, your team colleagues identified the class candidates:

**BoardController, MotorControl,
LightController, BoardLight, AuditorialLight,
MobileDevice
and different sorts of Buttons.**

They also identified the following stakeholders:

Lecturer, Student

- a) Draw a UseCase diagram for the lecture hall system.
- b) Draw a UML class diagram for the lecture hall light system (only the subsystem light control!), using the class candidates and specify them with attributes, operations, associations, multiplicities and gen/spec-relationships!
- c) Draw a UML state diagram representing the object life cycle of the BoardController Object!
Hint: The two black boards can be handled independently!
- d) Your architect decided to use the Observer Design Pattern to handle the distribution of board content via mobile devices. Draw a corresponding class diagram with attributes, operations, associations, multiplicities and gen/spec relationships!
- e) Draw an interaction diagram, which represents the usage of a mobile device under respect of the Observer Design Pattern! The interaction should include the following actions:
 - start of lecture,
 - lecturer distributes board content to mobile devices and
 - end of lecture.

Task 4

[10 points]

Map the following agile principles to the Scrum process. In which artefacts, activities and roles of the Scrum process are these realized? Describe the implementation of the principle.

- a) Simplicity the art of maximizing the amount of work not done is essential.

- b) Working software is the primary measure of progress.

- c) Welcome changing requirements, even late in development.
Agile processes harness change for the customer's competitive advantage.

Task 5**[15 points]**

You are the project manager of a traditional software development project.

Your team consists of the following people with their respective skills

- *Daniel*: software requirements engineering and software architecture
- *Huey and Louie*: software development and unit testing
- *Dewey*: software integration
- *Donald*: software testing

You plan for the following activities (estimated effort [days] in parentheses):

- A. Requirements Analysis (3)
- B. Software Architecture (5)
- C. Development Component A (5)
- D. Development Component B (7)
- E. Unit Testing A (6)
- F. Unit Testing B (7)
- G. Integration (5)
- H. Software Test (5)

- a) Draw a WBS for the project.
- b) Draw a Gantt chart and mark the critical path.
- c) Calculate the shortest time this project will take.
- d) During development, you discover that C is more complicated.
You and your team re-estimate C, and conclude that its effort is 10 days.
How long is the critical path after re-estimation?

Shortest time of project (5.c):

Length of critical path after re-estimation (5.d):
