

Klausur: Praktische Softwaretechnik

Personal Information

Name:	_____
Matrikelnummer:	_____
Degree programme:	_____
Room & Seatnumber:	_____

Please read the following hints and instructions carefully and confirm your understanding by signing below!

- Please put your student ID and a personal identification (with a picture of you) on the desk and have it ready for check of identity and participation!
- The exam is in English. Answers are allowed in English or German.
- **No tools or resources besides writing equipment are allowed!**
- The solution must be given in the space provided. If the space is not enough for your solution, use the additional space at the end of this printout. Provide a short reference to the pages in the back at the original task. You may ask for additional empty pages, they will be provided by the supervisors and will be stapled to the printout.
You will only be allowed to hand in the stapled printout.
- You may request scrap paper from the supervisors.
These may not be handed in after the test.
- The working time is 90 minutes. You can reach 90 points.
- If you can't continue the test for health reasons, you have to prove this by providing a „*Erweitertes ärztliches Attest*“ to the Prüfungsamt. In this case, signal the supervisor, request the corresponding form, and fill it out before leaving the test.
- **Check the printout for completeness! The printout has 17 pages, and an additional page with task information (not stapled). Check also if the print is readable.**

By my signature, I confirm the receipt of a complete test printout, and acknowledge the reading and understanding of the information given above.

Erlangen, den 09.06.2020

(Signature)

This will be filled out by the teacher, NOT by the student!

Score:

Task	1	2	3	4	5	Σ
Score						

Grade:

In the following:

- Multiple-Choice-Tasks (1.a to 1.f), will be awarded at least 0 points. Generally, each error will result in deduction of a point. In particular, this means, that missing check marks are considered to be errors! In each sub-task (a-g), at least one statement is true, and you have to check all true statements.
- In your answers, especially when drawing diagrams, mind the **readability**. If we can't read the answer, we have to consider it wrong.
- In all tasks, only the final result is relevant, intermediate steps should be left out or put on scrap paper.
- We **strongly suggest** to you to draft all diagrams on scrap paper and transfer the final result as a readable diagram to the printout.

Task 1**[18 points]**

a) Which of the following statements are true?

- A project usually follows or conducts activities which are predefined by a process.
- A workflow usually has input and output artifacts as well as responsible and supporting roles.
- An activity may consist of one or more sequential or parallel sub-activities.
- A process is an endeavor that is limited in time by a defined start- and end date.
- A Practice describes, how the work should be performed.
- An advantage of an iterative process model is, that requirements may change or can be added later.

b) Which of the following statements are true?

- The intra process architecture is defined by the entities and their relationships that are needed to build processes.
- The inter process architecture is defined by the relationships of the processes itself.
- Processes can be composed by a set of projects.
- Variants of processes are needed whenever there are different types of projects that should be guided by these processes.
- Process and product metrics can be captured and evaluated in running projects.
- The team size and the duration of a phase is a product metric.

c) Requirements shall be SMART. Which of the following terms make up the acronym SMART with regards to requirements?

- Specific:** The requirement is focused on a single issue and specified clear enough to be understandable.
- Meaningful:** The requirement is aligned towards the vision of the product
- Authorized:** The requirement is verified by certified requirements engineers.
- Realistic:** The requirement is achievable with the technology available.
- Traceable:** The requirement is identifiable and can be referred to in other development artifacts.
- Time bound:** The requirement expresses the time it takes to be fulfilled.

d) The term software architecture is hard to define. Most definitions share common principles. Which of the following terms are part of the common definitions?

- Interactions
- Requirements
- Principles
- Significant decisions
- (De-)composition
- User experience

e) Which of the following statements regarding Software Architecture Viewpoints are correct?

- The *Process View* of Kruchten's 4+1 system shows the logical component structure of the system
- Viewpoints can be adjusted to stakeholders' concerns.
- The *logical view* in UML visualizes the relationship between physical files and components
- Viewpoints filter the architecture model according to the stakeholders needs.
- Physical nodes and networks are visible in the UML *network view*.
- The *Use Case View* in UML is represented by composite structure diagrams.

f) The Unified Modeling Language (UML)...

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

Task 2

[18 points]

a) What is the difference between proof reading and a walkthrough?

b) Please explain the three base values of the EVA control method and give the formulas for schedule variance (SV) and cost variance (CV)

c) Name and shortly describe two advantages of *Configuration Management*.

d) Name and shortly describe two resulting artefacts of the *Requirements Definition Phase*

e) Describe the purpose of *Design Patterns* and name two of them.

f) Explain the anti-pattern *Big ball of Mud*.

Task 3**[18 points]**

In times of the COVID-19 crisis, the waiting areas of doctors' surgeries are particularly congested, and patients are exposed to an increased risk of infection if they stay in the waiting area. In order to reduce the risk of infection, a software solution is to be developed that will enable waiting to be carried out digitally. The name for the software has already been found: WaitDigitally

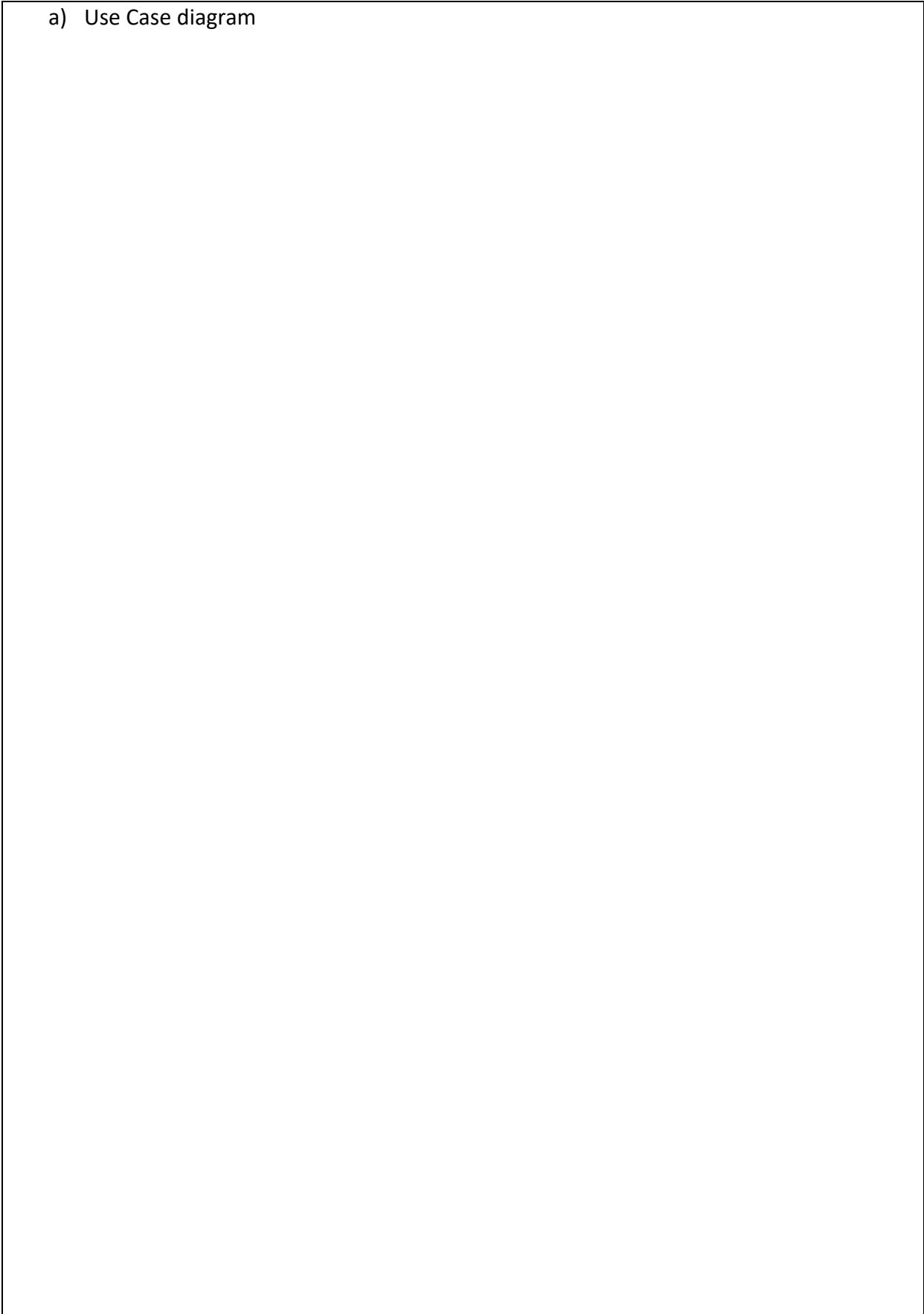
Imagine your development team has to realize the software. Your task is to elaborate an analysis model covering (among others) the following requirements:

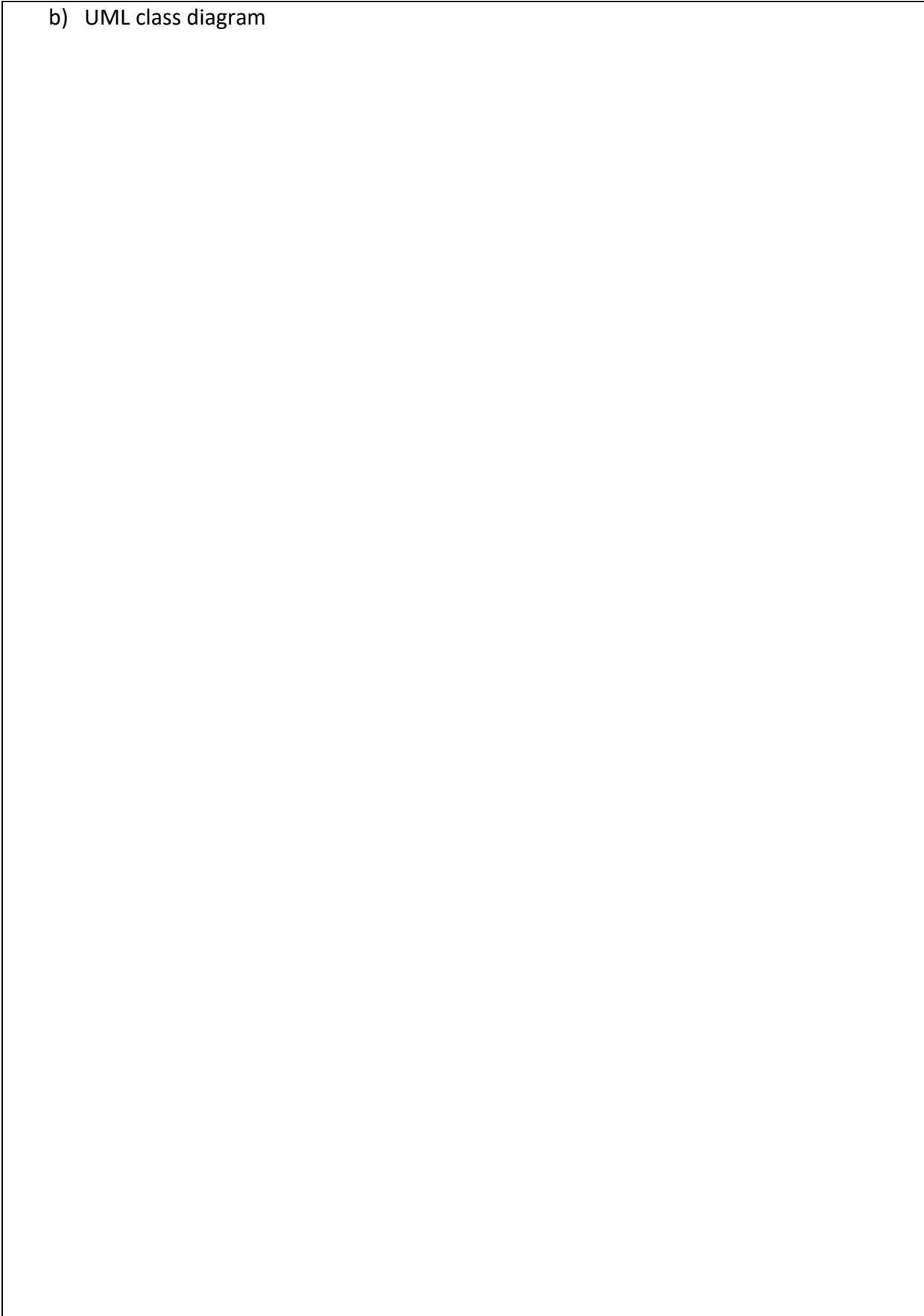
- REQ.1. Each organisation can have multiple waiting areas with distinct locations. Possibly spread across the whole world.
- REQ.2. Patients can register for waiting areas even if they are not already at the location of the waiting area.
- REQ.3. Patients have to provide contact information, at least a cell phone number, to allow contact tracking if necessary.
- REQ.4. Patients arriving at the physical waiting area inform the medical staff about their arrival via the WaitDigitally system.
- REQ.5. Only customers physically present at the waiting area can be asked to enter the doctor's office.
- REQ.6. Patients, which are physically present, wait within their cars and are informed via push notification when they should come to the reception.
- REQ.7. Patients, who already visited the doctor, may be re-added to the waiting area if they have to wait for other tasks to be executed by medical staff.
- REQ.8. After leaving the waiting area information about the patient's stay is kept for 14 days to allow contact tracking if necessary.
- REQ.9. Information about waiting areas is maintained by the staff present at the waiting area.

During a CRC Card Session, your team colleagues identified the class candidates: *WaitingSlot, WaitingArea, Queue, Organisation, Doctor, Patient, Notification*

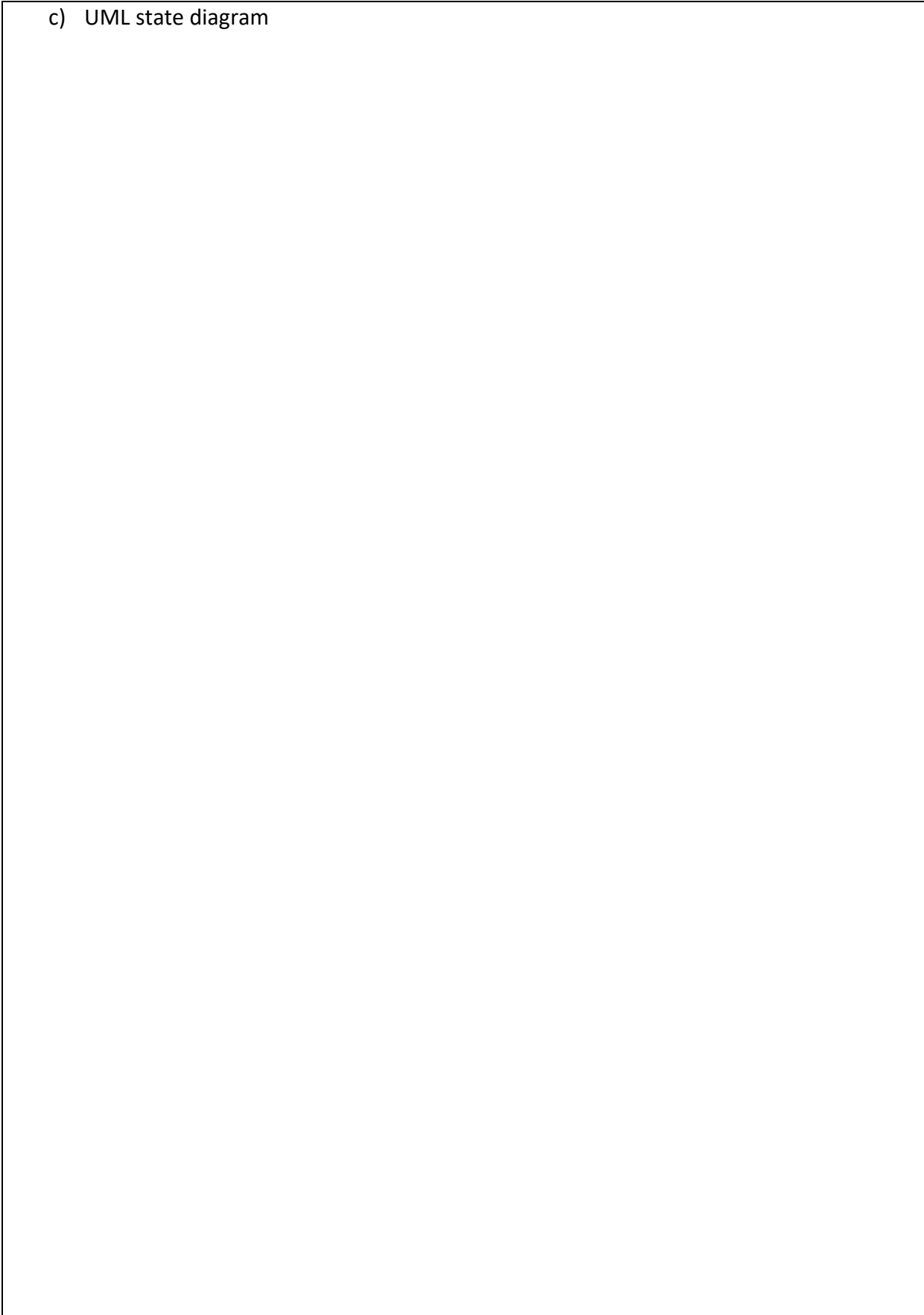
- a) Draw a Use Case diagram for the WaitDigitally system.
- b) Draw a UML class diagram for the WaitDigitally system, using the class candidates and specify them with attributes, operations, associations, multiplicities and gen/spec-relationships!
- c) Draw a UML state diagram representing the object life cycle of the *WaitingSlot* Object!
- d) Draw an interaction diagram, which represents whole workflow of the software! The interaction should include the following actions: enrol at home, confirm arrival at waiting area, ask patient to come to the reception, information about patient's stay is deleted.

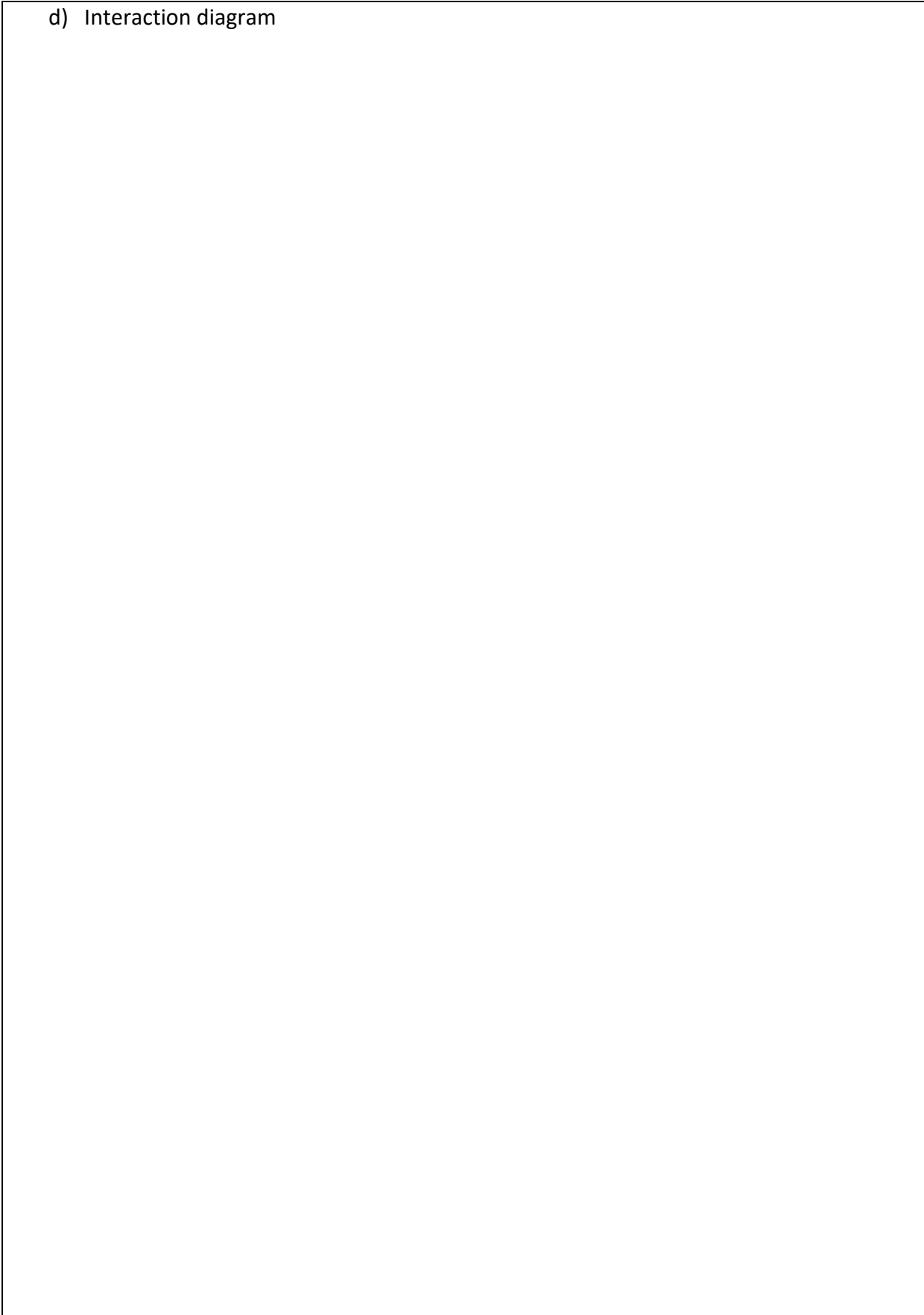
a) Use Case diagram





c) UML state diagram





Task 4**[18 points]**

Scrum is based on three pillars:

- **Transparency:** Giving visibility to the significant aspects to those responsible for the outcome.
- **Inspection:** Timely checks on the progress towards a Sprint Goal to detected undesirable variances.
- **Adaptation:** Adjusting a process as soon as possible to minimize any further deviation or issues.

a) Describe how **Inspection** influences three of the five Scrum phases (also called: activity or event).

Name of Scrum phase	Influence of Inspection on Scrum phase

b) Describe how **Adaption** is reflected in the responsibilities of two of the three Scrum roles.

Name of Scrum role	Influence of Adaptation on responsibilities of Scrum role

c) A lot of Scrum team use Burndown charts to increase **Transparency**. Describe the information visible in a Burndown chart

Task 5**[18 points]**

You are responsible for the planning of a software project. The milestones of your project are defined by the deliverables of the following phases: Requirements Analysis, Design, Implementation and Test.

During the Requirement Analysis you conduct a Use-Case-Workshop and the Requirements Engineer Victor documents all Use-Case and creates a Requirements Specification.

During the Design Phase your Chief Architect Vladimir creates an object-oriented design by UML and two sets of Test Cases, one for Integration Tests and one for System Tests.

During Implementation Phase your Chief Programmer Donald creates the Storage Components using MySQL. Your Expert Programmer Jaroslaw creates the Web-Front-End and the Expert Programmer Boris creates the Exit Routines. All three programmers also deliver unit test cases and the test records for their components.

During the Test Phase the Chief Architect Vladimir executes the integration test cases as well as the system test cases to provide Integration Test Records and System Test Records.

- a) Please create a milestone-oriented Work Break Down Structure with at least 16 work packages.
- b) Please create a 3-Point-Estimation-Table for the 16 work packages. Assume that in the best case your smallest work package takes at least one day and in the worst case your largest work package takes no more than 5 days.
- c) Please create a schedule as a Gantt-Chart with all the 16 work packages showing the duration from the 3-Point-Estimation and the responsibility of the work package. The duration should always be rounded up to full working days per work package.
- d) Please indicate the critical paths in the Gantt-Chart and write down its lengths in working days.

WBS

3-Point-Estimation Table

Schedule including critical Path