Software design
Final exam – 2022/2023
Time Limit: 1 hour

Name and surname: _____

Student number: _____

Rules:

- **DO NOT open the exam booklet until you are told to begin. You should write your full name (no initials, no abbreviations) and student number at the top and read the instructions.**

- You cannot use any source of information for making the exam (e.g., textbooks, slides, class notes and/or any notes and study guides you have created). You can use a calculator, if needed. You cannot use a cell phone or computer.

- This exam is composed of 20 closed-ended questions; for each question there is always one and only one correct answer.

- You will get **1** point for each *correct* answer, **0** points for each wrong or blank answer. Your final grade for this exam is in the usual [0, 10] range and it is computed by summing the scores of all the answers and dividing it by 2.

- You can use any empty sheet of paper for taking notes or for trying things out. Only the work on the exam paper will be graded. You can take notes on the exam paper and mark the correct answers.

- In the first page of the exam paper there is a table with all the question numbers. There, you have to write down your answer for each question in the A,B,C,D form (e.g., if the correct answer of the first question is the second one, then you have to put a B in the first row of the table). **Do not forget to fill the table, it will be the only part of your exam paper which will be considered when grading it!**

- When you have completed your exam, hand it to anyone in charge of handing it and go have a great evening!

Question	Points	Answer
Q1	1	
Q2	1	
Q3	1	
Q4	1	
Q5	1	
Q6	1	
Q7	1	
Q8	1	
Q9	1	
Q10	1	
Q11	1	
Q12	1	
Q13	1	
Q14	1	
Q15	1	
Q16	1	
Q17	1	
Q18	1	
Q19	1	
Q20	1	
Total:	20	

Q1. (1 point) Which of the following statements about the composition of the following diagram is true?
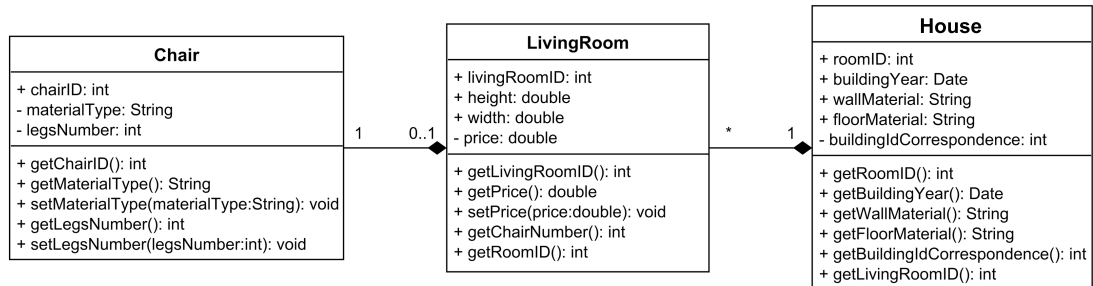
> A. The House class depends on the LivingRoom class.
>
> B. If an instance of the Chair class is located inside an instance of LivingRoom, and that instance of LivingRoom is destroyed, the instance of the Chair class still continues to exist.
>
> **C. If an instance of the Chair class is removed from an instance of the LivingRoom class, then it continues to exist.**
>
> D. An instance of the LivingRoom class can be contained inside multiple instances of the House class.

Q2. (1 point) Which UML relationships are represented in the following class diagram?
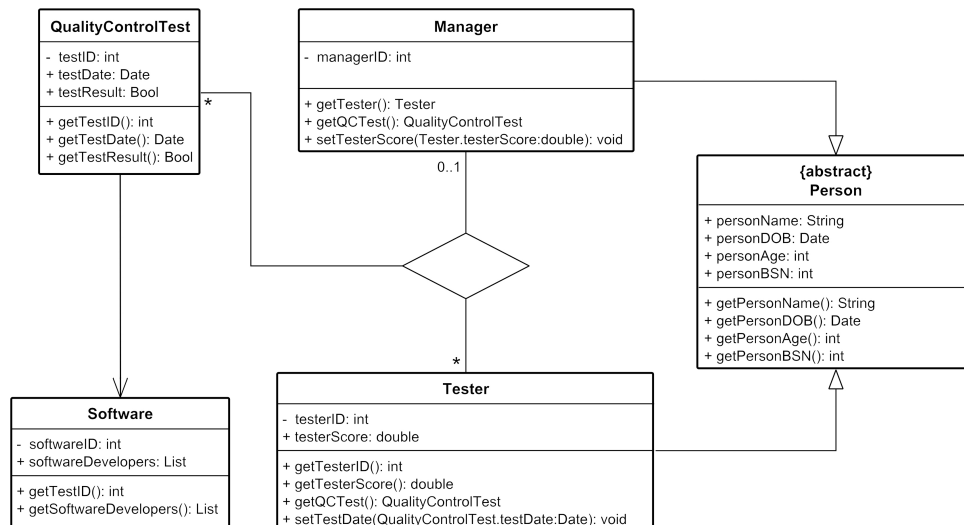
> A. Shared aggregation, Composition, Ternary association.
>
> **B. Ternary association, Generalization, Binary association.**
>
> C. Implementation, Aggregation, Ternary Association.
>
> D. None of the above answers.

Q3. (1 point) Which of the following statements about UML associations is FALSE?

A. An association may have navigable, non-navigable, and partially navigable association directions.

B. An association may be identified by a unique association name.

C. An association can have multiplicities and a visibility.

D. An association does not represent the fact that instances of a class are special types of instances of another class.
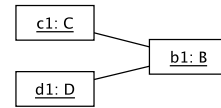
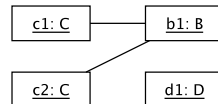Q4. (1 point) Which of the following object diagrams are consistent with the class diagram?
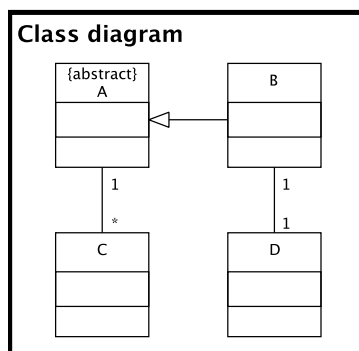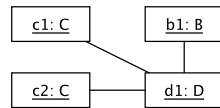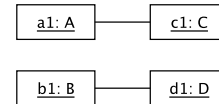

A. Object diagram 1

B. Object diagram 2

C. Object diagram 3

D. Object diagram 4

Q5. (1 point) Which of the following statements about UML state machine diagrams is FALSE?

A. A transition can have one and only one target state.

B. When an event occurs that triggers the transition to another state, the do-activity is aborted.

C. Activities can be executed outside of the states.

D. There can be no state change if no event occurs.

Q6. (1 point) Given the following state machine diagram, which of the following statements is TRUE?
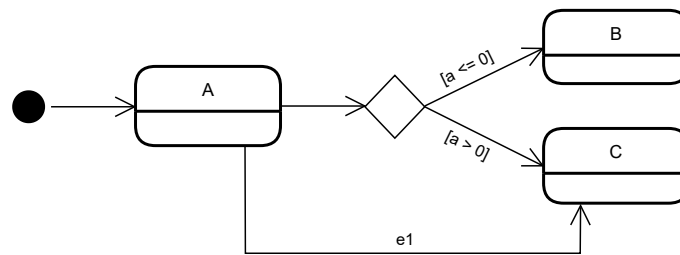
○ State C can only be reached when $a > 0$.

√ **In order for state B to be reached, event e1 cannot happen and a must be smaller than or equal to 0.**

○ It is possible that neither state B nor C can be reached.

○ State B can be reached when a is bigger than 0.

Q7. (1 point) Given the following state machine diagram, what is the value of x after the occurrence of the event chain e2, e5, e3, e5, e2, e1, e4?
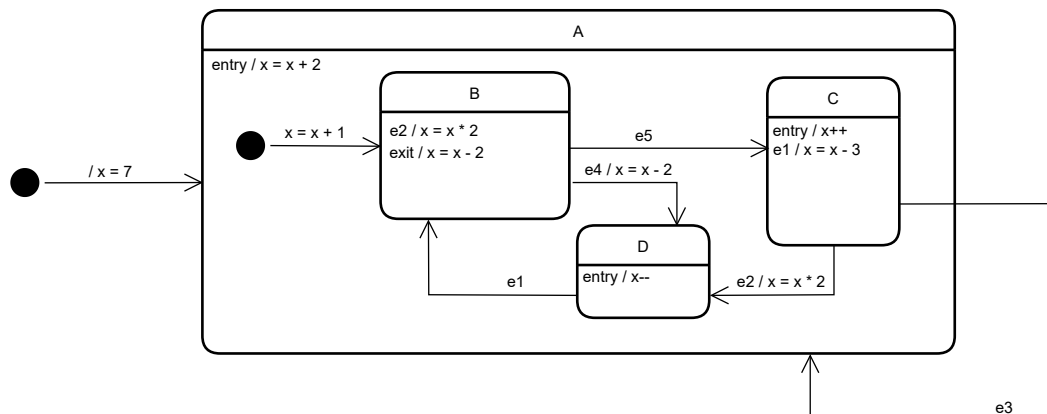
○ 31

√ **38**

○ 36

○ 41

Q8. (1 point) Given the following state machine diagrams, after the occurrence of the event chain e1, e1, e2, e2, e2, e1, e1, in which diagram do we end up in state B?
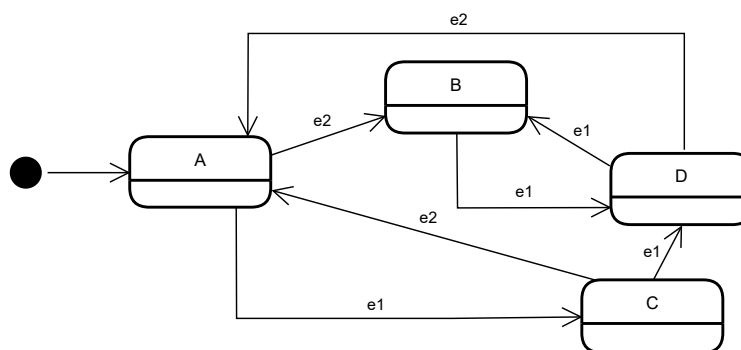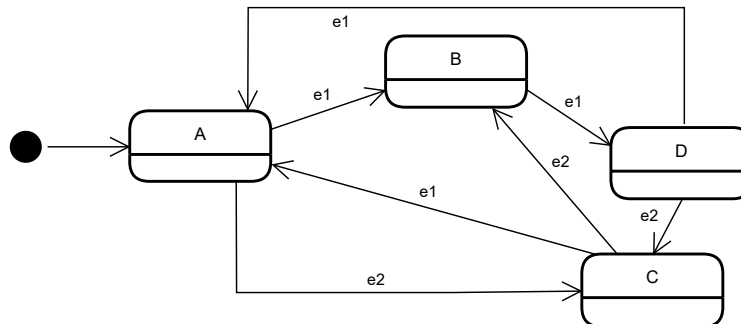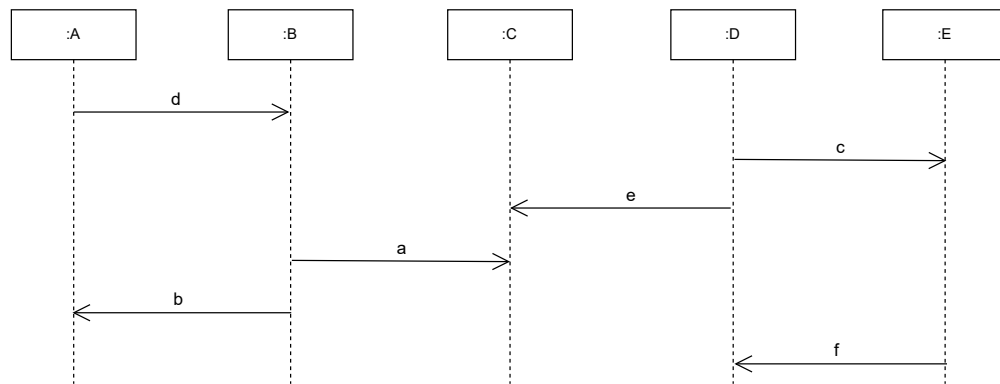

  A. In both diagrams.

  B. Only in the first diagram.

  C. Only in the second diagram.

  D. In neither diagram.

Q9. (1 point) Which of the following properties DO NOT apply to the *loop* fragment of a UML sequence diagram?

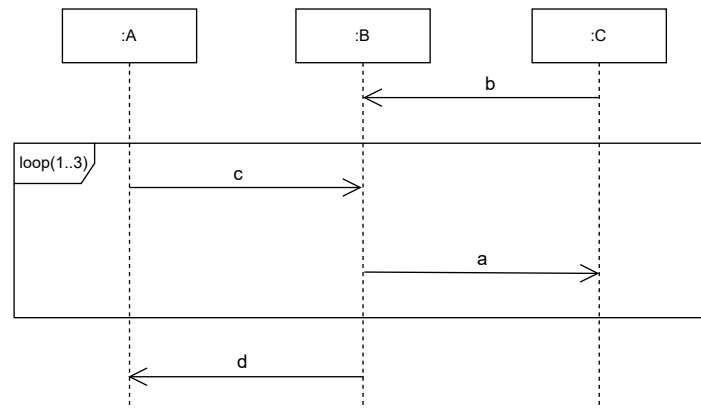 A. The minimum and maximum number of iterations may be defined.

  B. If the minimum and maximum number of iterations are not specified, the default value is $(0, *)$, where $*$ denotes an infinite number of iterations.

  C. If you model a loop $loop(8)$ with the condition $[x < 8]$, the loop is executed exactly 8 times, independently of the condition.

  D. The loop fragment has more than one operand.

Q10. (1 point) Given the following UML sequence diagram, what is the only possible trace among the four traces below?

- ○ $d \rightarrow a \rightarrow b \rightarrow c \rightarrow e \rightarrow f$
- ○ $c \rightarrow d \rightarrow a \rightarrow e \rightarrow b \rightarrow f$
- ○ $d \rightarrow c \rightarrow b \rightarrow e \rightarrow a \rightarrow f$
- √ $c \rightarrow d \rightarrow e \rightarrow a \rightarrow f \rightarrow b$

Q11. (1 point) Given the following UML sequence diagram, which of the four traces below is NOT possible?

- ○ $b \rightarrow c \rightarrow a \rightarrow c \rightarrow a \rightarrow d$
- ○ $b \rightarrow c \rightarrow a \rightarrow d$
- √ $b \rightarrow c \rightarrow a \rightarrow b \rightarrow c \rightarrow a \rightarrow d$
- ○ $b \rightarrow c \rightarrow a \rightarrow c \rightarrow a \rightarrow c \rightarrow a \rightarrow d$

Q12. (1 point) Which type of UML diagram is appropriate to describe the following scenario: "A student registers for taking a course in the VU administration system (VUnet), and you want to represent the chronological order of the messages exchanged within the VUnet system"?

> A. Activity Diagram
>
> **B. Sequence Diagram**
>
> C. Object Diagram
>
> D. Class Diagram

Q13. (1 point) Which of the following statements about naming variables in your code is TRUE?

> A. Variable names should be as broad as possible.
>
> **B. Variable names should convey as much information as possible.**
>
> C. Variable names should be as short as possible.
>
> D. When using a temporary variable, a good practice is to always name it *temp*.

Q14. (1 point) Which of the following statements about complexity is TRUE?

> A. It is a good practice to have the same piece of code appearing in many parts of your system.
>
> B. One method should perform as many tasks as possible.
>
> **C. It is more important for a module to have a simple interface than a simple implementation.**
>
> D. It is more important for a module to have a simple implementation than a simple interface.

Q15. (1 point) What is the main purpose of the Singleton design pattern?

> A. To ensure that all instances of a certain class share the same state.
>
> **B. To ensure that at any time a class can have only one and only one instance.**
>
> C. To make a certain class thread-safe.
>
> D. To facilitate the serialization and deserialization of a certain class.

Q16. (1 point) Which of the following best describes the Observer design pattern?

> A. A design pattern that allows objects to copy the behavior of another object.
>
> B. A design pattern that allows objects to encapsulate a family of algorithms.

C. A design pattern that allows objects to delegate tasks to other objects.

D. A design pattern that allows objects to notify other objects when their state changes.

Q17. (1 point) Which of the following statements is TRUE about the Decorator design pattern?

A. It allows developers to add new functionality to an object at runtime, without affecting the behavior of other objects in the same class hierarchy.

B. It is only useful when you need to modify the behavior of an object at compile-time.

C. It is primarily used for creating new instances of an object, rather than modifying existing instances.

D. It requires to modify the source code of the original object.

Q18. (1 point) Which of the following statements is TRUE about the Visitor design pattern?

A. It is used to decouple an algorithm from an object structure, allowing developers to add new operations without modifying the objects themselves.

B. It is used to create a centralized place to perform common operations on an object hierarchy.

C. It is a creational pattern that allows you to create new objects from existing ones.

D. The Visitor pattern is only useful when you need to modify the behavior of an object at compile-time.

Q19. (1 point) If you need to create a set of objects that can handle requests, and each object in this set either handles the request or passes it to the next object according to a certain order, which design pattern would you use?

A. Command

B. Flyweight

C. Decorator

D. Chain of responsibility

Q20. (1 point) If you need to abstract the process of object creation so that the type of the created objects can be determined at run-time, which design pattern would you use?

A. Template method

B. Decorator

C. Factory Method

D. Singleton

IMPORTANT: Remember to fill the table on page 1!