Software design **Name and surname:** _____
Final written exam **Student number:** _____
Time Limit: 1 hour

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 large 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	

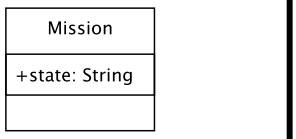
Q1. (1 point) Which of the following statements is TRUE?

- √ **An abstract class can have relationships with other classes.**
- ◯ An abstract class has no relationships with other classes.
- ◯ An abstract class can be instantiated.
- ◯ An abstract class has no attributes.

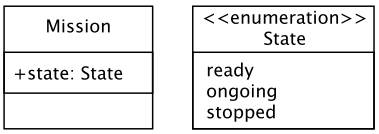
Q2. (1 point) How do you model the following situation with a UML class diagram?

A robotic mission can be exclusively in one of the three following states: ready, ongoing, or stopped.

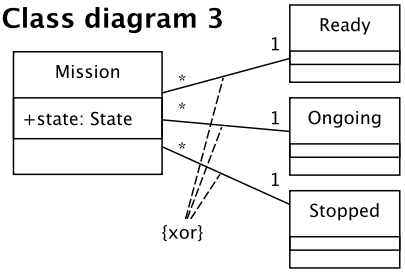
Class diagram 1



Class diagram 2



Class diagram 3



Class diagram 4

- ◯ Class diagram 1
- √ **Class diagram 2**
- ◯ Class diagram 3
- ◯ Class diagram 4

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

- ◯ An association represents the fact that instances of a class are special types of instances of another class.
- √ **An association may be identified by a unique association name.**
- ◯ An association can have multiplicities, but no visibility.
- ◯ An association may have navigable, non-navigable, and partially navigable association directions.

Q4. (1 point) Which of the following statements about the UML generalization relationship is TRUE?

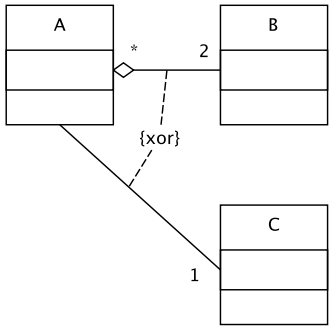
A. A generalization relationship may have navigable, non-navigable, and partially navigable directions.

B. A generalization relationship may be identified by a unique association name.

C. A generalization relationship does not have multiplicities and visibility.

D. A generalization relationship does not represent the fact that instances of a class are special types of instances of another class.

Q5. (1 point) Given the following fragment of class diagram, which of the following statements is TRUE?



A. One object of A may contain only two or more objects of B.

B. One object of B may be associated with multiple objects of A.

C. One object of A is associated with exactly one object of C and two objects of B.

D. If an instance of A is deleted, all contained instances of B are deleted as well.

Q6. (1 point) Which of the following statements about naming variables in your code is TRUE?

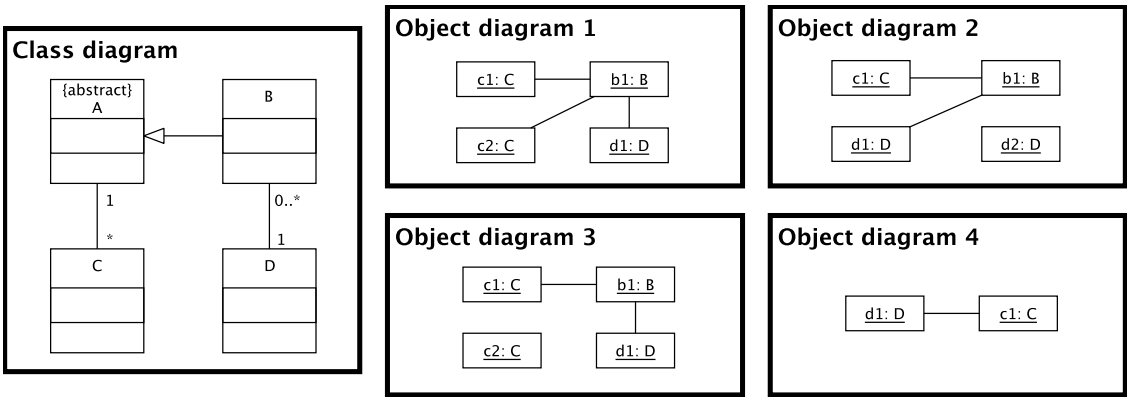
A. Variable names should be as long as possible.

B. Variable names should be as short as possible.

C. Variable names should convey as much information as possible.

D. When using a temporary variable, a good practice is to always name it *temp*.

Q7. (1 point) Which of the following object diagrams is NOT consistent with the class diagram?



A. Object diagram 1

B. Object diagram 2

C. Object diagram 3

D. Object diagram 4

Q8. (1 point) What is the relationship between a class diagram and an object diagram?

A. An object diagram represents the concrete instances of classes that are modelled in the class diagram.

B. An object diagram represents the internal elements of classes that are modelled in the class diagram.

C. An object diagram represents the interaction between classes that are modelled in the class diagram.

D. An object diagram represents the overall behaviour of all the objects conforming to classes that are modelled in the class diagram.

Q9. (1 point) Which of the following statements about Java source code is TRUE?

A. Having a class that is mostly accessed through getter and setter methods is always good.

B. It is advised to reduce as much as possible pairwise dependencies across classes.

C. If you foresee that a method will be useful in the future, it is advised to implement it, even if it is never called in the current version of the system.

D. Long chains of calls to getter methods is an indication of good design.

Q10. (1 point) Which of the following statements about source code comments is TRUE?

A. It is a good practice to reiterate what is provided in external documentation as comments in your code.

B. Comments contain information which could not be represented in the code.

C. Good code is self-documenting, in principles you do not need comments.

D. It is a good practice to have someone else write the comments of your code.

Q11. (1 point) Which of the following statements about state machine diagrams is FALSE?

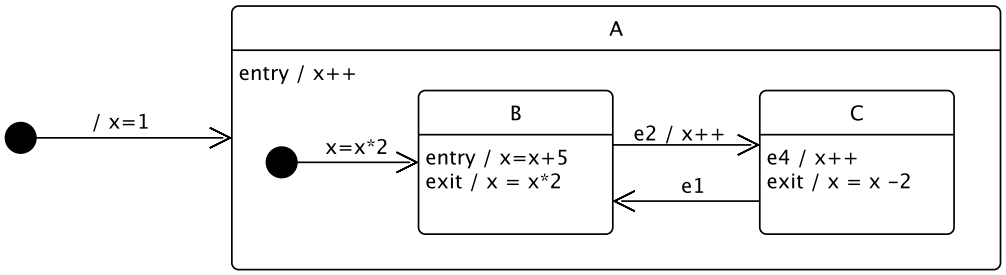
A. Guard conditions are evaluated before executing all the activities of transitions.

B. Transitions can have a list of event triggers, a list of guard conditions, and a list of activities.

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

D. Activities can be executed during transitions.

Q12. (1 point) Given the following state machine diagram, what is the value of x after the occurrence of the event chain $e2, e4, e4, e1, e3, e2$?



A. 65

B. 48

C. 21

D. 49

Q13. (1 point) Which of the following statements about UML state machine diagrams is TRUE?

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

B. When a transition leaving a state S_x has no explicit trigger event specified, then entering S_x triggers the transition.

C. A guard condition of a transition leaving a state S_x is evaluated as soon as S_x is entered.

D. Activities can only be executed within states.

Q14. (1 point) Which of the following statements about source code modules is TRUE?

A. When designing modules you should focus on the order in which tasks occur.

B. The users of the APIs of your class should always know all the methods provided by it.

C. Design decisions should be reflected across as many modules as possible.

D. The design decisions guiding the implementation of a module should not be visible to other modules.

Q15. (1 point) Which of the following properties apply to the *alt* fragment of a UML sequence diagram?

A. The decision which operand should be executed is determined exclusively by the order in which the operands are specified.

B. If more than one operand evaluates to true, it is unclear which operand will be executed.

C. All operands within an alt fragment that do not have guard conditions are executed.

D. All operands are executed in parallel.

Q16. (1 point) Which of the following statements about the *loop* fragment of UML sequence diagrams is TRUE?

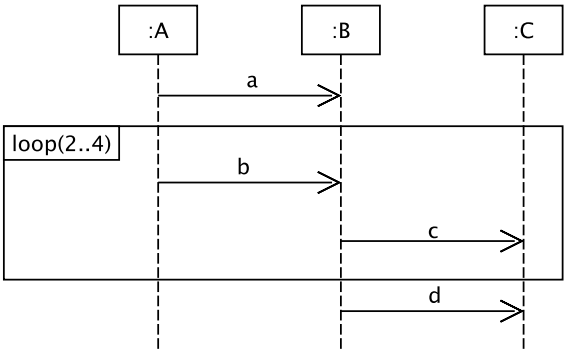
A. Both the minimum and maximum number of iterations must be always defined.

B. If the minimum and maximum number of iterations are not specified, the default value is $(1, *)$, where $*$ denotes an infinite number of iterations.

C. If you model a loop *loop*(8) **with the condition** $[x < 10]$**, the loop is executed exactly** 8 **times, independently of the condition.**

D. The loop fragment has more than one operand.

Q17. (1 point) Given the following sequence diagram, which of the four traces below is possible?



A. $a \to b \to c$

B. $a \to b \to c \to b \to c \to b \to c \to b \to c$

C. $a \to b \to c \to b \to c \to b \to c \to d$

D. $a \to b \to c \to b \to c \to b \to d$

Q18. (1 point) Which of the following statements about synchronous and asynchronous communication in sequence diagrams is TRUE?

A. With asynchronous communication the sender optionally pauses to wait for a response.

B. With synchronous communication the sender optionally pauses to wait for a response.

C. With asynchronous communication the sender pauses to wait for a response.

D. Answer messages are optional.

Q19. (1 point) If you need to model the instances of the entities involved in a specific moment during the execution of your system, which diagram do you use?

A. Object diagram

B. Use case diagram

C. State machine diagram

D. Class diagram

Q20. (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.