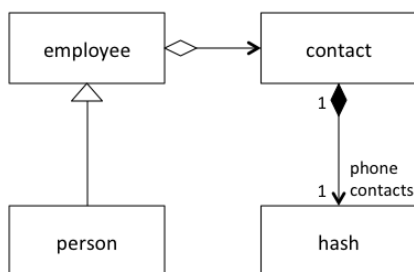


Name:														Study ID:														Study Program:														Result	
																																		[10.0 – 1.0]									
Question:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Total												
Points:	2	4	2	1	2	2	2	2	2	2	2	2	4	4	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	50												
Score:																																											

This is a **closed book** exam; electronic devices or any auxiliary material other than a pen and blank paper are not permitted. You have to **hand in these sheets** with your answers completed (put your name/study id on every sheet). For a multiple choice question, you must mark the right answer on these sheets. For an open question, **you must use no more space for your answers than indicated by the dotted lines**. You should develop your solutions on draft paper and finally copy them onto these answer sheets. **Please also complete the evaluation form attached.**

- (2 points) **Software architecture is** ☐ **relevant ...** ☒ **irrelevant ...** for the user, because ...
... architecture represents the internal organization of a software, to the user the software is a black box.
- (4 points) **Which 4 artifacts should a good architectural model contain?** (1, 2, 3, 4 artifacts)
domain model, package structure, runtime component structure, interactions
- (2 points) **Why is the MVC an adequate architectural pattern for web development?**
Web systems are organized as 3-tier architectures with presentation layer, business logic and data abstraction layer.
- (1 point) **Which statement is true?** Software inspection is concerned with ...
A. ... validation.
B. ... verification.
- (2 points) **The following requirement is** ☐ **adequate ...** ☒ **inadequate ...**, because ...
The user interface shall be based on state-of-the-art web technologies, and it shall make user interactions efficient.
... of 2 ambiguities:
(1) what are state-of-the art web technologies?
(2) what are efficient user interactions?
- (2 points) **What is wrong with this domain model?**



- (1) Confused extension.
- (2) Hash is implementation and not domain.
- (3) Navigability is too much implementation detail for domain.

- (2 points) **How can you improve the following method according to good design principles?**

```

def s(c)
  sc = method(c)
  @c.each_pair do |a,b|
    sc.call(a,b)
  end
end

```

- (1) Proper why-comments.
- (2) Domain-specific identifiers.

8. (2 points) **Given the following SFL-outcome. In which sequence will the components be debugged?**

Comps	Activity	SC
C0	11111111111111111111	0.500
C1	10111110010111011011	0.598
C2	01011000011100010010	0.158
C3	10101011110110111000	0.645
C4	10101011000100010000	0.507
C5	00101001000000010000	0.447
C6	00101001100100011000	0.507
ERR	00100010000010011000	

C3, C1, C4/C6, C0, C5, C2

9. (2 points) **An online diagnosis technique creates 500% runtime overhead. Is this acceptable?**
☒ **YES**, ... ☐ **NO**, ... , because ... *engineering tradeoffs; dependent on the context, e.g. safety considerations.*
10. (2 points) **Why are cohesion and coupling important concepts in software design?**
 (1) *high cohesion: concepts that belong together should be treated together.*
 (2) *low coupling: highly cohesive entities communicate through slender interfaces for better maintenance.*
11. (2 points) **Why can a class be called *inherently/highly cohesive*?**
a class is a highly cohesive entity by definition; it represents a scoping mechanism for entities that are related through an abstract concept.
12. (2 points) **Why does the class concept realize *separation of concerns*?**
it represents an abstract data type, separating the interface of an abstract entity from its internal implementation.
13. (4 points) **Write down 4 *external* software quality attributes.**
e.g., correctness, usability, reliability, efficiency
14. (4 points) **Write down the 4 *types of distances* relevant in globally distributed software engineering.**
geographical, temporal, language, cultural distances
15. (2 points) **How is the *Liskov substitution principle* related to the *design-by-contract approach*?**
LSP represents a contract between a super-class and its associated sub-classes in the inheritance hierarchy.
16. (1 point) **Which of the following statements about *software* is true?**
 A. Software becomes more and more faulty over time.
 B. Software is physical and easy to visualize.
 C. *Software has low manufacturing cost.*
 D. Software is hard to modify.
17. (1 point) **Which of the following statements about *software engineering activities* is true?**
 A. Reverse-engineering refers to the process of improving software.
 B. *Refactoring refers to the improvement of internal software quality.*
 C. Re-engineering refers to the same activities as reverse engineering.
 D. Refactoring is performed before reverse-engineering.

18. (1 point) Which of the following statements about the *V-model* is true?

- A. Verification is concerned with whether we build the right system.
- B. Validation is concerned with whether we build the system right.
- C. Acceptance is a concern of the customer.
- D. Integration is a concern of the analyst.

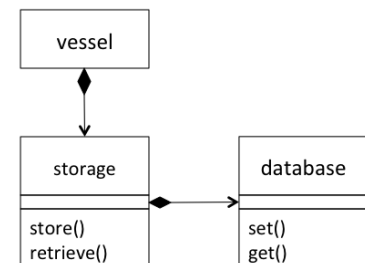
19. (1 point) Which of the following associations is realized by this code fragment?

- A. Aggregation.
- B. Composition.
- C. Generalization.
- D. Navigation.

```
class Vessel
    attr_accessor :position
    def initialize(lat, lon)
        @position = Position.new(lat, lon)
    end
end
```

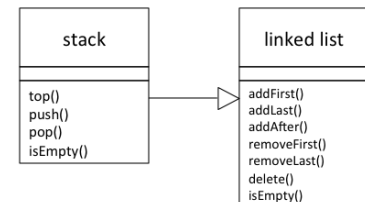
20. (1 point) Which of the following statements about this class diagram is true? It represents a potential violation of the ...

- A. ... single responsibility principle.
- B. ... liskov substitution principle.
- C. ... interface segregation principle.
- D. ... dependency inversion principle.



21. (1 point) Which of the following statements about this class diagram is true? It should be refactored according to the ...

- A. ... player - role pattern.
- B. ... delegation pattern.
- C. ... observer pattern.
- D. ... facade pattern.



22. (1 point) Which of the following statements about *Scrum* is true?

- A. Project management is performed by the team members.
- B. Quality assurance is performed by the test team.
- C. Backlogs are evaluated in retrospectives.
- D. Burndown indicates project progress.

23. (1 point) Which of the following statements about *software quality attributes* is true?

- A. Interoperability measures how well software can be executed on another platform.
- B. Integrity measures how well accidental access to software can be controlled.
- C. Testability measures how correct and complete software is.
- D. Reliability measures how fast a software executes.

24. (1 point) Which of the following statements about *software metrics* is true?

- A. Cyclomatic complexity expresses testability of software.
- B. Cyclomatic complexity represents cognitive complexity of software.
- C. Cyclomatic complexity denotes the number of loop cycles in software.
- D. Cyclomatic complexity measures the number of dependent blocks in a program.

25. (1 point) **Which of the following statements about *dead code and quality attributes* is true?**
- A. Dead code affects usability.
 - B. Dead code affects efficiency.
 - C. Dead code affects correctness.
 - D. Dead code affects maintenance.
26. (1 point) **Which of the following statements about *faults, errors, and failures* is true?**
- A. A fault is an erroneous state of the system.
 - B. A fault is the root cause of a failure.
 - C. An error is the same as a fault.
 - D. A failure is identified through debugging.
27. (1 point) **Which of the following statements about *spectrum-based fault localization* is true?**
- A. SFL uses the component topology as model in order to debug a system.
 - B. SFL calculates a diagnosis from an activity matrix and an error vector.
 - C. The activity matrix and the component topology are used in order to calculate similarity coefficients.
 - D. An error vector represents involvement of components in system executions.
28. (1 point) **Which of the following statements about *search-based software engineering* is true?**
- A. Mutation is applied in order to exploit the search space.
 - B. Recombination is applied in order to explore the search space.
 - C. Meta-heuristics help solve software engineering problems.
 - D. The fitness function represents a solution to the problem.
29. (1 point) **Which of the following statements about *cloud computing* is true?**
- A. Using the cloud leads to zero hardware cost.
 - B. It is more efficient to use services instead of the cloud.
 - C. The cloud is specifically targeted at large organizations.
 - D. Using the cloud reduces scalability.
30. (1 point) **Which of the following statements about the term *domain specific languages (DSL)* is true?**
- A. DSL is an alternative term for high-level programming languages.
 - B. DSL concepts are derived from the principles of domain-specific modeling.
 - C. DSL extends programming languages through linguistic pattern concretization.
 - D. DSL cannot be used for building embedded systems.