

Midterm

EECS 3311 - Winter 2018

Software Design

Section E

Family Name: _____

Given Name(s): _____

Student Number: |__| |__| |__| |__| |__| |__| |__| |__| |__| |

Guidelines and Instructions:

1. This exam contains 10 pages (including this cover page) and 40 questions.
 2. This is a 80-minute test. No aids are allowed.
 3. All questions are weighed equally, but some questions require more time than others, so be strategic about it. Questions are presented in random order, so if you find a question hard, move to the next one.
 4. Answer questions **both** on the scantron sheet (official) and on this paper (backup).
The scantron sheet and this paper must be submitted together.
 5. Use an HB pencil to fill the scantron sheet.
 6. Keep your eyes on your own work. At the discretion of the invigilators, students may be asked to move.
 7. If you need to use the washroom, you must leave your cellphone with the instructor.
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1. (1 point) Which of the following assertions is stronger than $a > 1$ AND $b > 1$?
 - A. $a > 3$
 - B. $a > 0$ AND $b > 1$
 - C. $b > 0$
 - D. All of the above
 - E. None of the above
2. (1 point) Which of the following is always an acceptable implementation for a creation method whose precondition is not satisfied?
 - A. Any implementation that satisfies the method's postcondition and the class invariant (if any)
 - B. An empty implementation
 - C. An infinite loop
 - D. All of the above
 - E. None of the above
3. (1 point) Which of the following is always an acceptable implementation for a non-creation method whose precondition is not satisfied?
 - A. Any implementation that satisfies the method's postcondition and the class invariant (if any)
 - B. An empty implementation
 - C. An infinite loop
 - D. All of the above
 - E. None of the above
4. (1 point) Which of the following is always an acceptable implementation for a non-creation method that has no postcondition?
 - A. Any implementation that satisfies the class invariant
 - B. An empty implementation
 - C. An infinite loop
 - D. All of the above
 - E. None of the above
5. (1 point) What is the Uniform Access Principle?
 - A. All clients of a class must be able to access all its public features
 - B. Attributes and methods with no arguments must be accessed in an identical manner
 - C. Setter and getter methods must have a uniform naming convention
 - D. Methods used in preconditions and postconditions must be accessible by all clients
 - E. None of the above

6. (1 point) Assume that variables `ice` and `fire` are declared to be of type `SONG`, which is a reference type. Is the following true or false?
- `ice = fire` implies that `ice ~ fire`
- A. True
 - B. False
7. (1 point) Assume that variables `ice` and `fire` are declared to be of type `SONG`, which is a reference type. Is the following true or false?
- `ice ~ fire` implies that `ice = fire`
- A. True
 - B. False
8. (1 point) Assume that variables `ice` and `fire` are declared to be of type `SONG`, which is an *expanded* type. Which of the following is true?
- A. `ice ~ fire` implies that `ice = fire`
 - B. `ice = fire` implies that `ice ~ fire`
 - C. `ice = fire` and `ice ~ fire` are equivalent
 - D. All of the above
 - E. None of the above
9. (1 point) In a client-supplier relationship, who must ensure that the precondition of a method is satisfied?
- A. The client
 - B. The supplier
 - C. Both the client and the supplier
 - D. At least one of the client or the supplier
10. (1 point) In a client-supplier relationship, who must ensure that the postcondition of a method is satisfied?
- A. The client
 - B. The supplier
 - C. Both the client and the supplier
 - D. At least one of the client or the supplier
11. (1 point) Which of the following is true?
- A. The precondition of a method is a benefit for the client, and creates an obligation for the supplier
 - B. The postcondition of a method is a benefit for the supplier, and creates an obligation for the client
 - C. Both of the above
 - D. None of the above

12. (1 point) The Command-Query separation principle states that...
- A. Queries and commands must be listed separately in a class
 - B. Queries must return a value, while commands must not return a value
 - C. Queries may have side effects, while commands must not
 - D. Commands may have side effects, while queries must not
13. (1 point) Assume that HOOD is a class that has been defined with no qualifiers, i.e. as just `class HOOD`. Also, assume the following declarations:
- ```
a: attached HOOD
d: detachable HOOD
h: HOOD
```
- Which of the following assignments will result in a syntax error?
- A. `a := d`
  - B. `d := h`
  - C. `h := a`
  - D. `d := a`
  - E. `d := h`
14. (1 point) Which of the following should be used to model subobject or containment relationships between types?
- A. Attached classes
  - B. Detachable classes
  - C. Expanded classes
  - D. Reference classes
  - E. None of the above
15. (1 point) Which of the following should be used to model sharing or “know about” relationships between types?
- A. Attached classes
  - B. Detachable classes
  - C. Expanded classes
  - D. Reference classes
  - E. None of the above
16. (1 point) Which testing phase is concerned with the question: “Are we building the right system?”
- A. Validation
  - B. Verification

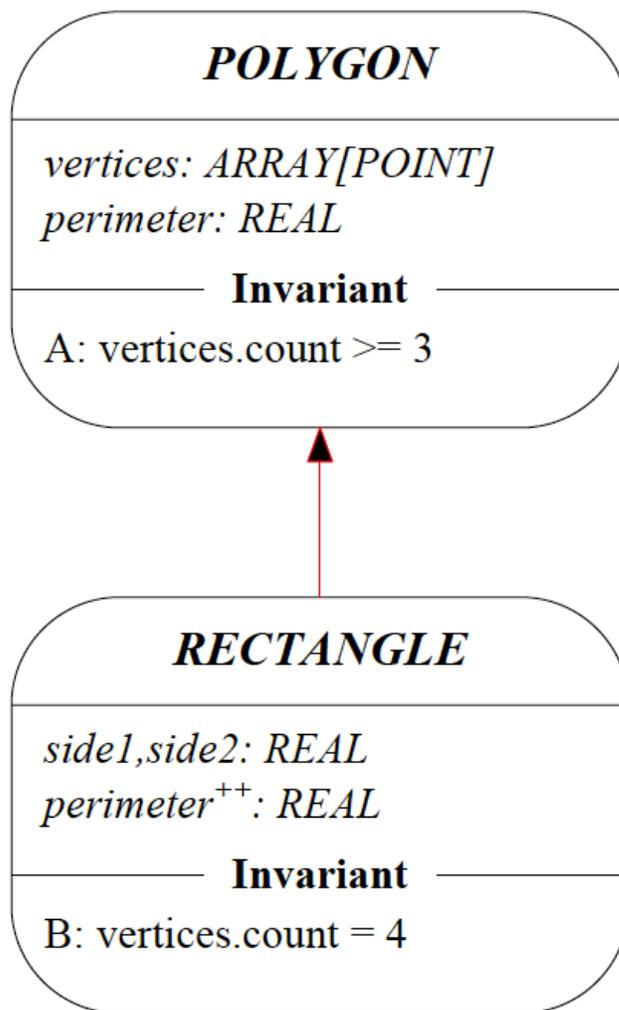
17. (1 point) Which testing phase is concerned with checking that the system will meet the customer's actual needs?
- A. Validation
  - B. Verification
18. (1 point) In MVC, which component is responsible for the business logic of the application?
- A. Model
  - B. View
  - C. Controller
  - D. All of the above
  - E. None of the above
19. (1 point) In MVC, the model refers to the view and manipulates it.
- A. True
  - B. False
20. (1 point) For the following Hoare triple, what would be the weakest possible precondition?
- $$\{?\} x := x*x \{x \geq 9\}$$
- A. True
  - B. False
  - C.  $x \geq 3$
  - D.  $x \geq 81$
  - E. None of the above
21. (1 point) Which of the following is true about class invariants?
- A. Class invariants must be satisfied before and after the execution of every creation procedure
  - B. Class invariants must be satisfied before and after the execution of every exported routine
  - C. Class invariants must be satisfied during the execution of every creation procedure
  - D. Class invariants must be satisfied during the execution of every exported routine
  - E. All of the above
  - F. None of the above

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22. (1 point) Which of the following best describes the relationship between tests and contracts?
- A. Contracts are not necessary if the system is fully tested
  - B. Testing is not necessary if the system is fully contracted
  - C. Both tests and contracts are necessary to ensure correctness
23. (1 point) Which of the following is an appropriate description for a loop invariant?
- A. A boolean expression that is true for every iteration of the loop
  - B. An arithmetic expression that is unchanged for every iteration of the loop
  - C. An arithmetic expression that decreases in value for every iteration of the loop
  - D. A class invariant that uses the `across` notation
  - E. None of the above
24. (1 point) Which of the following is true?
- A. Preconditions cannot be weakened in a subclass.
  - B. Preconditions in a subclass are effectively ORed with the preconditions in all superclasses
  - C. Preconditions in a subclass are effectively ANDed with the preconditions in all superclasses
25. (1 point) Which of the following is true?
- A. Postconditions cannot be weakened in a subclass.
  - B. Postconditions cannot be strengthened in a subclass.
  - C. Postconditions in a subclass are effectively ORed with the preconditions in all superclasses
26. (1 point) Which of the following is true?
- A. Class invariants cannot be strengthened in a subclass.
  - B. Class invariants in a subclass are effectively ORed with the class invariants in all superclasses
  - C. Class invariants in a subclass are effectively ANDed with the class invariants in all superclasses
27. (1 point) Should class SQUARE inherit from class RECTANGLE?
- A. Yes
  - B. No
  - C. It depends

28. (1 point) Which software engineering concept best matches the following description?  
Hiding details of a module's implementation from the rest of the system, so that those details can be changed later without changing the rest of the system.
- A. Abstraction
  - B. Modularity
  - C. Encapsulation
  - D. Information hiding
  - E. Separation of concerns
29. (1 point) Which software engineering concept best matches the following description?  
Dividing a system into components, each of which can be designed, implemented, tested, reasoned about, and reused separately from the rest of the system.
- A. Abstraction
  - B. Modularity
  - C. Encapsulation
  - D. Information hiding
  - E. Separation of concerns
30. (1 point) Which software engineering concept best matches the following description?  
Building walls around a module so that the module is responsible for its own internal behavior, and bugs in other parts of the system can't damage its integrity.
- A. Abstraction
  - B. Modularity
  - C. Encapsulation
  - D. Information hiding
  - E. Separation of concerns
31. (1 point) Which software engineering concept best matches the following description?  
Omitting or hiding low-level details with a simpler, higher-level idea.
- A. Abstraction
  - B. Modularity
  - C. Encapsulation
  - D. Information hiding
  - E. Separation of concerns

32. (1 point) Which software engineering concept best matches the following description?  
Making a feature the responsibility of a single module, rather than spreading it across multiple modules.
- A. Abstraction
  - B. Modularity
  - C. Encapsulation
  - D. Information hiding
  - E. Separation of concerns
33. (1 point) Which software engineering principle best matches the following description?  
A class must have a fixed API but also be available for extension.
- A. The Open-Closed Principle
  - B. The Single Responsibility Principle
  - C. The Uniform Responsibility Principle
  - D. The Single Choice Principle
  - E. The Singleton Access Principle
34. (1 point) Which software engineering principle best matches the following description?  
Every class should have responsibility over a single part of the functionality provided by the software, and that responsibility should be entirely encapsulated by the class.
- A. The Open-Closed Principle
  - B. The Single Responsibility Principle
  - C. The Uniform Responsibility Principle
  - D. The Single Choice Principle
  - E. The Singleton Access Principle
35. (1 point) Which software engineering principle best matches the following description?  
Whenever a software system must support a set of alternatives, a single module in the system should know their exhaustive list.
- A. The Open-Closed Principle
  - B. The Single Responsibility Principle
  - C. The Uniform Responsibility Principle
  - D. The Single Choice Principle
  - E. The Singleton Access Principle
36. (1 point) Which combination provides both safety and flexibility?
- A. Static typing and static binding
  - B. Static typing and dynamic binding
  - C. Dynamic typing and static binding
  - D. Dynamic typing and dynamic binding

The remaining questions (on the next page) refer to the two classes in the following figure.



Assume that a client has made the following declarations and has populated the `polygons` collection with `RECTANGLE` objects.

```
polygons: LIST[POLYGON]
p: POLYGON
r: RECTANGLE
x: REAL
```

If `polygons.item` returns an element from `polygons`, indicate which of the following statements will result in a compile-time error.

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37. (1 point) `p := polygons.item`
- A. Compile-time error
  - B. No compile-time error
38. (1 point) `r := polygons.item`
- A. Compile-time error
  - B. No compile-time error
39. (1 point) `x := polygons.item.perimeter`
- A. Compile-time error
  - B. No compile-time error
40. (1 point) `x := polygons.item.side1`
- A. Compile-time error
  - B. No compile-time error