

University of Washington
CSE 331 Software Design & Implementation
Winter 2011

Midterm exam

Monday, January 31, 2011

Name: _____

CSE Net ID (username): _____

UW Net ID (username): _____

This exam is closed book, closed notes. You have **50 minutes** to complete it. It contains 27 questions and 8 pages (including this one), totaling 100 points. Before you start, please check your copy to make sure it is complete. Turn in all pages, together, when you are finished. **Write your initials on the top of ALL pages.**

Please write neatly; we cannot give credit for what we cannot read.

Good luck!

Page	Max	Score
2	14	
3	18	
4	12	
5	8	
6	24	
7	12	
8	12	
Total	100	

1 True/False

(2 points each) Circle the correct answer. T is true, F is false.

1. **T / F** When a client calls a method without meeting the preconditions, the method must throw the exception that is stated in the specification.
2. **T / F** If S1 is a stronger specification than S2, then any implementation that satisfies S1 must also satisfy S2.
3. **T / F** If an ADT is immutable, then its representation cannot change.
4. **T / F** The rep invariant may be satisfied by a concrete state (values of the fields) that cannot occur at run time. (By “cannot occur”, we mean that there is no sequence of method calls and field assignments that will produce that concrete state.)
5. **T / F** The rep invariant is part of an ADT’s specification.
6. **T / F** The abstraction function is part of an ADT’s specification.
7. **T / F** Derived specification fields are part of an ADT’s specification.

2 Multiple choice

Mark each of the following that can be true:

8. (3 points) If you split a revealing subdomain, then:
- (a) each piece is revealing
 - (b) each piece is non-revealing
 - (c) some pieces may be revealing, and some pieces may be non-revealing
 - (d) some pieces may be revealing, some pieces may be non-revealing, and some pieces may be neither revealing nor non-revealing
9. (3 points) If you split a non-revealing subdomain, then:
- (a) each piece is revealing
 - (b) each piece is non-revealing
 - (c) some pieces may be revealing, and some pieces may be non-revealing
 - (d) some pieces may be revealing, some pieces may be non-revealing, and some pieces may be neither revealing nor non-revealing

Circle one of “may”, “must”, or “must not”. The comparison is to the method that is being overloaded/overridden. Use Java’s definitions. For simplicity, assume the method has one formal parameter. (2 points each)

- 10. An overloading method **may / must / must not** change the declared formal parameter types.
- 11. An overloading method **may / must / must not** change the declared return type.
- 12. An overloading method **may / must / must not** return an object of a different class.
- 13. An overriding method **may / must / must not** change the declared formal parameter types.
- 14. An overriding method **may / must / must not** change the declared return type.
- 15. An overriding method **may / must / must not** return an object of a different class.

3 Short answer

16. (4 points) Explain in one sentence why “unit testing” was given that name.

17. (4 points) What is the relationship between the `hashCode` and `equals` methods? (Answer in one sentence or equation.)

18. (4 points) In one sentence, what is a benevolent side effect?

Suppose that you have the following code:

```
public class MyInteger {  
  
    private int val;  
  
    public MyInteger(int val) {  
        this.val = val;  
    }  
  
    public boolean equals(MyInteger other) {  
        return other.val == val;  
    }  
  
}  
  
MyInteger mi1 = new MyInteger(22);  
MyInteger mi2 = new MyInteger(22);  
Object o1 = new MyInteger(22);  
Object o2 = new MyInteger(22);
```

For each of the following four calls to equals, state whether it causes a compile-time error, a run-time error, returns true, or returns false. (2 points each)

19. `mi1.equals(mi2)` _____

20. `o1.equals(o2)` _____

21. `mi1.equals(o2)` _____

22. `o1.equals(mi2)` _____

23. (6 points) Which should you write first, black box tests or clear box tests? In no more than two sentences, explain which, or explain that the order does not matter. Give only one reason. If there are multiple reasons, give the most important reason.

24. (8 points) Give a buggy program of no more than 5 lines and a set of invocations that covers every statement but does not reveal the bug.

25. (10 points) Suppose that you have a `Map`, `m`, and a value being used as a key, `k`. You know that `m.get(k)` returns a non-null value, and you wish to make an argument to that effect. You may assume that `m` is non-null. What are the two necessary facts that your argument will rely upon?

(a) _____

(b) _____

How do you express each of these facts to the Nullness Checker? For each, give one sentence of explanation, and a code snippet as an example.

(a) _____

(b) _____

4 Specifications

26. (12 points) Suppose that you want to change an ADT. In one sentence, under what circumstances is it possible to convert a specification field into a derived specification field (without otherwise changing its meaning)?

In one sentence each, give a benefit and a drawback of making this change.

Benefit: _____

Drawback: _____

27. (12 points) Suppose that you have the following code.

```
class A {
  /**
   * @requires Req1
   * @modifies M1
   * @throws T1
   * @effects E1
   * @returns Ret1
   */
  int m(int arg1, int arg2) { ... }
}

class B extends A {
  /**
   * @requires Req2
   * @modifies M2
   * @throws T2
   * @effects E2
   * @returns Ret2
   */
  int m(int arg1, int arg2) { ... }
}
```

For each clause, write the property that must hold in order for B to be a true subtype of A. Your solution should not use the terms “stronger” or “weaker”.

requires: _____

modifies: _____

throws: _____

effects: _____

returns: _____
