University of Washington
CSE 403 Software Engineering
Spring 2015

Final Exam

June 08, 2015

Name: _____

CSE Net ID (username): _____

UW Net ID (username): _____

This exam is closed book, closed notes. You have **90 minutes** to complete it. The exam contains 6 pages (including this cover page) and 10 problems.

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**, in case a page gets separated during test-taking or grading.

When you are asked for multiple answers, give answers that are as different as possible, and give the most important answers.

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

Good luck!

Problem	Points	Score
1	10	
2	10	
3	9	
4	12	
5	7	
6	10	
7	8	
8	9	
9	10	
10	25	
Total:	110	

1 Lifecycle and Requirements

1. (10 points) What lifecycle model would you use to develop the following kinds of software? Mark the correct answer by circling the corresponding letter.

   (a) A script that will not need maintenance
   A. waterfall B. spiral C. code-and-fix D. staged delivery E. evolutionary prototyping

   (b) An embedded real time system
   A. waterfall B. spiral C. code-and-fix D. staged delivery E. evolutionary prototyping

   (c) A mobile game
   A. waterfall B. spiral C. code-and-fix D. staged delivery E. evolutionary prototyping

   (d) A tax preparation application to replace an existing one
   A. waterfall B. spiral C. code-and-fix D. staged delivery E. evolutionary prototyping

   (e) An online tutoring application for K-12 students
   A. waterfall B. spiral C. code-and-fix D. staged delivery E. evolutionary prototyping

2. (10 points) Which of the following statements are true about software requirements? Mark the correct answer by circling T (true) or F (false).

   (a) **T / F** Dependability and security are examples of functional requirements.

   (b) **T / F** Requirements serve as a basis for testing and verification.

   (c) **T / F** Requirements describe software architecture.

   (d) **T / F** Behavioral requirements are usually subjective and cannot be measured.

   (e) **T / F** Use cases capture functional requirements.

   (f) **T / F** The number one reason that projects succeed is developer involvement.

   (g) **T / F** A use case represents an example behavior of the system.

   (h) **T / F** Extension scenarios of a use case establish an understanding between the customer and the system developers of the requirements.

   (i) **T / F** An informal use case takes the form of a UML diagram.

   (j) **T / F** In most use cases, nearly every step can fail.

2 User Interfaces

3. (9 points) Usability refers to the effectiveness with which users can accomplish tasks in a software system. List and briefly explain the criteria for evaluating the usability of a system.

   (a) _____

   (b) _____

   (c) _____

4. (12 points) Which UI element is typically best suited for each of the following tasks? Mark the correct answer by circling the corresponding letter.

   (a) Selecting between a large number of fixed choices, such as a state to ship an item to.
   A. button B. checkboxes C. combo box D. list E. radio buttons F. text field G. toolbar

   (b) Toggling between mutually exclusive options, such as a shipping method.
   A. button B. checkboxes C. combo box D. list E. radio buttons F. text field G. toolbar

   (c) Performing a single action on the current screen, such as placing the current order.
   A. button B. checkboxes C. combo box D. list E. radio buttons F. text field G. toolbar

   (d) Toggling between independent options, such as gift receipt, gift wrapping, etc.
   A. button B. checkboxes C. combo box D. list E. radio buttons F. text field G. toolbar

   (e) Entering freeform information, such as the shipping address.
   A. button B. checkboxes C. combo box D. list E. radio buttons F. text field G. toolbar

   (f) Navigating between common options, such as account settings, shopping cart, etc.
   A. button B. checkboxes C. combo box D. list E. radio buttons F. text field G. toolbar

3 UML Diagrams

5. (7 points) Which of the following statements are true about UML diagrams? Mark the correct answer by circling T (true) or F (false).
   (a) **T / F** When designing classes, nouns are methods while objects and fields are verbs.
   (b) **T / F** UML diagrams can be used to auto-generate code.
   (c) **T / F** Composition is a form of aggregation where the parts are removed when the whole is deleted.
   (d) **T / F** Get and set methods should be included on UML class diagrams.
   (e) **T / F** A good sequence diagram should contain all details that would be present in real code.
   (f) **T / F** A dependency arrow in a UML class diagram represents an "is part of" relationship.
   (g) **T / F** A single sequence diagram models a single scenario.

6. (10 points) Consider the class diagram in Figure 1. Answer the following questions about the diagram by writing your answers on the provided lines.
   (a) The `Library Item` class is _____.
   (b) `borrowedBy` is a _____ attribute of type `string`.
   (c) `totalCopies` is a _____ and _____ attribute of `Library Item`.
   (d) How is the `category` attribute stored in a `Library Item` object?

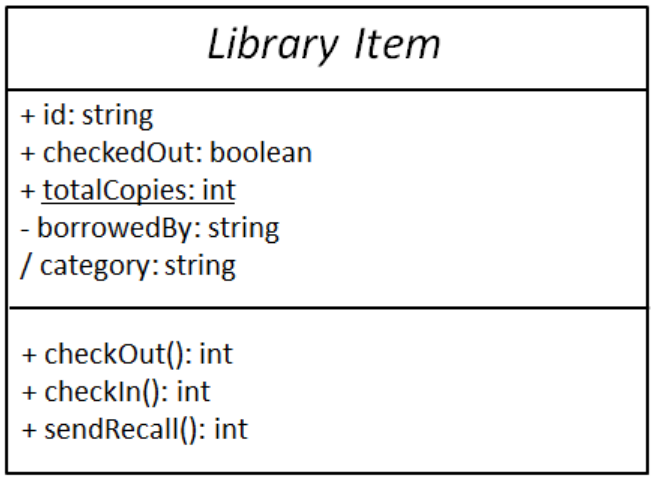

Figure 1: A simple class diagram

4 Code Reviews and Testing

7. (8 points) Select the style of code review that is best described by the following statements. Mark the correct answer by circling the corresponding letter.

   (a) Interleaves reviewing with development, providing instant and continuous feedback.
   A. tool-assisted B. formal inspection C. walkthrough D. pair programming

   (b) Includes checklists as a key component of the review process.
   A. tool-assisted B. formal inspection C. walkthrough D. pair programming

   (c) Allows the reviewers to review the code on their own time.
   A. tool-assisted B. formal inspection C. walkthrough D. pair programming

   (d) Runs the risk of reviewers not following up on defects uncovered during review.
   A. tool-assisted B. formal inspection C. walkthrough D. pair programming

8. (9 points) Which of the following statements are true about testing? Mark the correct answer by circling T (true) or F (false).

   (a) **T / F** It is possible (though expensive) to achieve 100% statement coverage for any program.

   (b) **T / F** Branch coverage is easier to achieve than path coverage.

   (c) **T / F** Regression testing is a form of white-box testing.

   (d) **T / F** An error is a mechanical or algorithmic cause of a software fault.

   (e) **T / F** A white-box test suite is specific to a given implementation.

   (f) **T / F** Stubs are useful for interaction testing, as opposed to state testing.

   (g) **T / F** Given a perfect partition of the input space, testing can prove the absence of errors.

   (h) **T / F** Both mocks and stubs can be used as part of the same integration test.

   (i) **T / F** Acceptance testing is a form of performance testing.

5 Static Analysis

9. (10 points) Mark each of the static analysis tools in the following list as sound, complete, or neither by circling the correct answer.

   (a) A tool that raises a warning for every program.
   A. sound B. complete C. neither

   (b) A tool that raises no warning for any program.
   A. sound B. complete C. neither

   (c) A tool that either raises no warning or produces an input on which the program fails.
   A. sound B. complete C. neither

   (d) A verification tool for safety-critical systems.
   A. sound B. complete C. neither

   (e) A tool that may produce a false positive or miss a defect.
   A. sound B. complete C. neither

10. (25 points) Recall the sign analysis presented in class. The goal of the analysis is to soundly determine the sign of each expression in a program. The analysis operates over the abstract domain $\{\bot, \ominus, \circledcirc, \oplus, \top\}$, where the given abstract values represent the empty set ($\bot$), negative integers ($\ominus$), zero ($\circledcirc$), positive integers ($\oplus$), and all integers ($\top$). Specify the transfer function for subtraction by filling in the blanks in the following list:

$\bot - \bot =$ _____
$\bot - \ominus =$ _____
$\bot - \circledcirc =$ _____
$\bot - \oplus =$ _____
$\bot - \top =$ _____

$\ominus - \bot =$ _____
$\ominus - \ominus =$ _____
$\ominus - \circledcirc =$ _____
$\ominus - \oplus =$ _____
$\ominus - \top =$ _____

$\circledcirc - \bot =$ _____
$\circledcirc - \ominus =$ _____
$\circledcirc - \circledcirc =$ _____
$\circledcirc - \oplus =$ _____
$\circledcirc - \top =$ _____

$\oplus - \bot =$ _____
$\oplus - \ominus =$ _____
$\oplus - \circledcirc =$ _____
$\oplus - \oplus =$ _____
$\oplus - \top =$ _____

$\top - \bot =$ _____
$\top - \ominus =$ _____
$\top - \circledcirc =$ _____
$\top - \oplus =$ _____
$\top - \top =$ _____