ICS 52 – Introduction to Software Engineering
Final Exam – Winter, 2007

Last Name: ____**KEY**_____ First Name: _____

There were two versions of question #1

1. (8 points, 4 points each) Define the following terms, as used in software engineering:
   A. Testing oracle.
      A mechanism for determining whether a test output is correct / for determining the expected output.
   B. Regression testing
      Application of previously developed test cases, applied after software maintenance to make sure new errors have not been introduced. (OK to use "test" in the definition; 2 pts for clearly indicating the same test cases are used repeatedly.)

1. The other #1: (8 points) In the requirements definition, we focus on "what" not "how." This is an illustration of which Software Engineering principle? (Make sure you name a principle, not a software quality.) Explain your answer briefly.
   4 pts for a principle such as separation of concerns, abstraction, modularity, information hiding; 4 pts for explanation

2. (12 points) Although "testing" is sometimes thought of as a phase in the software life cycle, it can also be viewed as a set of verification and validation activities performed throughout the software life cycle. Match each phase below to one or more activities that would typically be performed as part of that phase.

Phase	Activity
Requirements	**I**check consistency between design and implementation
	R test requirements specification
	I execute tests
Design	**D** test the design
	M repeat other activities as part of redevelopment
	R determine test strategy
Implementation	**D** check consistency between design and requirements
	D evaluate the software architecture
	R generate functional test data
Maintenance	**D, I** generate structural and func. test data (matches 2)
	I test implementation

3. (20 points) You have been assigned to do black box testing of the `remove()` method in java.util.ArrayList. Here is part of that method's documentation:

`public boolean` **`remove`**`(Object o)`
Removes a single instance of the specified element from this list, if it is present. Returns `true` if the list contained the specified element (or equivalently, if the list changed as a result of the call).

5 points for each section

(a) What is the input domain of `remove()`?

an object and the list (-2 for missing "and the list")

(b) What is a basis for dividing the input domain you described into subdomains?

lots of valid answers, e.g. "number of times object is in list"

(c) Using the basis defined in (b), specify 3 or 4 subdomains.

e.g. "0, 1, 2-3, 4 or more"

(d) For each subdomain from (c), give a test case input and the expected output.

assume list is <10, 20, 10, 50, 10, 50, 10, 60, 70>

0: remove(80) → false, <10, 20, 10, 50, 10, 50, 10, 60, 70>

1: remove(70) → true, <10, 20, 10, 50, 10, 50, 10, 60>

2-3: remove(50) → true, <10, 20, 10, 10, 50, 10, 60, 70>

4+: remove(10) → true, <20, 10, 50, 10, 50, 10, 60, 70>

4. (15 points) Since testing is never complete, we need to have some criterion for determining whether a certain amount of testing is adequate. Define the following three categories of test adequacy criteria:

4 points each; see p. 399, p. 440

Coverage-based testing

Fault-based testing

Error-based testing

Which category or categories apply to homework 4? Explain why.

3 pts for this part
white-box: coverage-based
black-box: coverage-based or fault-based.

5. (10 points) According to Dijkstra, "Program testing can be used to show the presence of bugs, but never to show their absence." Is Dijkstra's dictum true if the program testing achieves node coverage? Explain why or why not.

Yes it is true, but we gave some partial credit to "no" answers that were reasonably well-reasoned.

6. (10 points) The software engineering activity of testing is influenced by the general software engineering process. Select one software process model discussed in lecture or in the textbook, other than the waterfall model or the spiral model. What special issues in testing might arise when this model is being followed?

   Process model: _____

   Many possible answers; some lost points because the answer didn't include "special issues" arising from the process model.

7. (10 points) In regards to the testing process, what is the difference between "white-box" testing and "black-box" testing?

   The difference is in how the test cases are created. White-box: test cases selected based on the structure of the source code. Black-box: test cases selected based on the functional requirements.

8. (15 points) This course has had a fair amount of emphasis on "modeling."

Explain what modeling means in the context of Software Engineering. Explain why models are particularly important in this field. (Don't limit your answer to software process models.)

5 pts. Lots of reasons for "why important:" proven approaches lead to better products and less time required; models reduce complexity; models make system visible to users; aid in communication; break up the work. -1 if answer addresses process models only.

Name and describe one type of model discussed in lecture or the textbook. What are its benefits? Its limitations or drawbacks?

5 pts. Most answers were quite good.

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