

ICS52 - Introduction to Software Engineering
Final Exam – Winter, 2006

Last Name: ____KEY____ First Name: _____

Row: _____ Seat Number: _____

1. (16 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. Error (in the context of testing).

A human action (mistake) that leads to an incorrect result (fault or failure).

C. Node coverage criterion.

Selecting a set of test cases that causes each node in the control flow graph to be visited / each statement in the code to be executed.

D. Regression testing.

Application of previously developed test cases, applied after software maintenance to make sure new defects have not been introduced.

2. (10 points) The textbook says that "Walkthroughs and inspections are both manual techniques that spring from the traditional desk-checking of program code." Explain the difference between walkthroughs and inspections. Name one benefit these techniques have that test-case based testing does not.

4 pts. Walkthrough: desk-checking of the code guided by a small set of data.

4 pts. Inspection: review of coded statement by statement.

2 pts. benefits: promotes teams spirit and morale; team members learn from each other; process improvement; can be performed at any stage.

3. (16 points) You have been assigned to write test cases for black box testing of a function called `isRightTriangle`. Here is part of that function's documentation:

```
public static boolean isRightTriangle(int f, int g, int h)
Returns true if a triangle exists with sides of length f, g, and h, and if that triangle
is a right triangle. Returns false otherwise. Uses the Pythagorean Theorem.
```

4 pts. for each section

- (a) What is the input domain of `isRightTriangle`?

3 integers

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

lots of possibilities, for example, the sign of the integers

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

**some or all negative;
all positive or 0;
all positive.**

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

some or all negative	-1, -2, 3	false
all positive or 0	4, 0, 10	false
all positive	4, 5, 3	true

4. (10 points) Dijkstra has written, "Program testing can be used to show the presence of bugs, but never to show their absence."

(a) Does this statement hold for structural testing? Explain your answer.

Yes. Even with a test set that meets the node or arc coverage criteria, it is still quite possible to have faults in the code which are not revealed by testing.

(b) If you answered yes to (a), then why do we perform testing?

Thorough but (necessarily) incomplete testing still usually improves the correctness of the software.

5. (10 points) The user, Mary, signs off on a Requirements Specification. When the implementation is delivered, Mary agrees that the software mostly matches the Specification, but says that the system isn't what she had in her mind, because the Specification was incomplete and the programmers interpreted some ambiguous statements in the wrong way. Discuss the relationship between verification and validation, as it pertains to this situation.

In this question we looked for an answer that drew out the distinction between verification and validation, and applied those concepts to this situation. Since the terms were defined slightly differently in lecture and in the textbook, we were not picky about the precise definitions used.

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: _____

Lots of possible answers. Many answers were docked points for not being specific to the model selected.

7. (13 points) Draw and label a diagram of the waterfall process model.

See p. 50 of the textbook; however, any answer that included the major elements of the model was accepted.

7. (3 points) In which quadrant of the spiral model is validation and verification performed? (Choose one.)
- A. north-east.
 - B. **south-east.**
 - C. north-west.
 - D. south-west.
 - E. in all quadrants.
8. (3 points) White box testing and black box testing are identical except for (choose one)
- A. who determines if the output is correct.
 - B. one focuses on errors, the other on faults.
 - C. the color of the box.
 - D. **how the test cases are selected.**
 - E. when the testing is performed.
9. (3 points) In mutation testing, what is mutated? (Choose one.)
- A. **The program source code.**
 - B. The program's control flow graph.
 - C. The test cases.
 - D. The expected output.
 - E. The order in which test cases are run.
10. (3 points) "Fault seeding" means (choose one)
- A. growing faults by planting errors.
 - B. growing failures by planting faults.
 - C. **deliberately inserting known faults into code.**
 - D. ranking certain faults as superior to others.
 - E. stimulating the growth of faults.
11. (3 points) Function point analysis estimates the size of software by (choose one)
- A. counting the number of functions.
 - B. counting the number of function calls.
 - C. **counting the number of data types and data structures.**
 - D. counting the number of functional units per thousand lines of code.
 - E. observing the direction in which the functions point.