CS314 Exam 1 Review

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Topics on Exam: Notes 1, Text Chapter 1

Software product and process.

- What is software?
  - Information, not media.
  - Requirements, designs, code, …
- Is it malleable?
- Software quality:
  - Quality attributes.
  - Different perspectives on software quality.
- Software classifications: COTS, custom, hybrid, stand-alone, embedded, real-time, network.

Notes 1, Text: Ch. 1 (cont)

- Historical trends: from expensive hardware and few users to cheap hardware and many users.
- The Software Problem:

  We need formal solutions to informally described problems.
- SW development myths: adding people to late projects, changing software is easy, …

Notes 1, Text: Ch. 1, and Ch. 2, Assignment 1

- Software processes:
  - Waterfall model: phases and limitations.
  - Evolutionary model.
  - Incremental development.
  - Agile development, for example
    - Extreme programming.
    - SCRUM
- A1: Using SW Development Tools – Git, GitHub, and Eclipse.
- Software disasters and successes.

Notes 2, Text Ch. 3-8 (pp. 67- 238) Assignment 2

OO Design and Implementation Concepts.

- Review object-oriented concepts.
  - Objects:
    - Hidden: state representation and method implementation.
    - Public: behavior access through public interfaces.
- UML class diagrams.

Notes 2, Text Ch. 2, 5, 11 Assignment 2

- Associations:
  - Non-hierarchical.
  - Composition/aggregation – whole-part.
  - Specialization/generalization (inheritance), polymorphism.
  - Use dependencies.
- A2: Refactoring a design.
  - Model-View Separation design pattern.
  - Façade design pattern.
- Relationship between designs and code.
  - Creating objects and their associations.
- Designing and implementing.

Notes 3, Text Ch. 11, A1, DS1, & A3: Verification & Validation

- V&V terminology:
  verification, validation, testing, static analysis, formal verification, inspections, failure, fault, unit testing, beta testing, regression testing, …
- Test scaffolding/harnesses: test drivers, stubs, oracles.
  JUnit
- Testing theory: why is testing hard.
  - Why is perfect testing impossible?
  - Other hard testing problems.
  - The notion of subdomains, equivalence classes, and boundary testing.

Verification & Validation

- Notes 3, Text Ch. 8 (pp. 240-269), A3.
- Black-box class or cluster testing.
  - Test based on ordering of class objects.
  - Test based on operations.
  - Test multiplicity.
  - Use a test oracle.
- Test plans: test names, strategy, description, verification.
- Test driver design: oracles, catching exceptions, reporting results.
- Use of *fault models* in testing.

Notes 3, Text (pp. 240-269), A1 (& A3): Verification & Validation

Fault & Failure RIP Model:

Conditions necessary for a failure to be observed

1. Reachability: Program location that contain the fault must be reached.
2. Infection: The state of the program must be incorrect.
3. Propagation: The infected state must propagate to cause some output of the program to be incorrect.

Notes 3, Text (pp. 258-279), A3: Verification & Validation

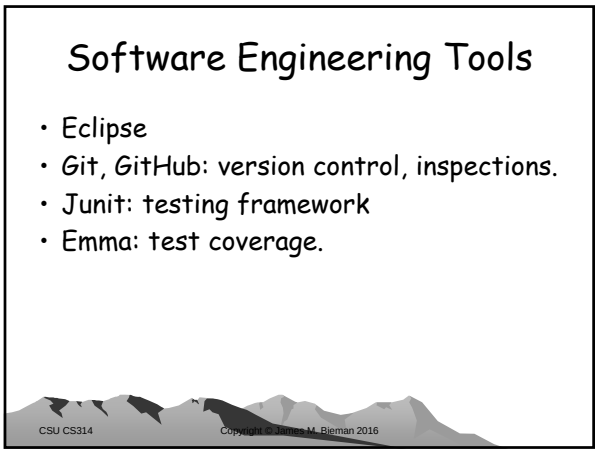
- White-box test coverage:
  - Statement/node coverage.
  - Branch coverage/edge coverage/decision coverage.
  - Condition coverage.
  - Definition/Use (DU) pair coverage, or the "all uses" criteria.
  - (Coverage tools: Emma)
- Coverage subsumption or "strength".

Verification & Validation

- Tests and test paths:
  Many tests can "cover" one test path.
- Inspections:
  - Performed on all kinds of software documents.
  - Focus on goals --- finding errors.
  - Participant roles.
  - Procedures.
- The need for simplicity in all software documents: code, designs, specifications, …

Design Studios

- DS1: Code Inspection
- DS2: Agile Scrum User Stories
- DS3: Black Box Testing


Software Engineering Tools
• Eclipse
• Git, GitHub: version control, inspections.
• Junit: testing framework
• Emma: test coverage.
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