UTD

Software Testing, Verification, Validation, and Quality Assurance

Dr. Mark C. Paulk

SE 4367 – Software Testing, Verification, Validation, and Quality Assurance

SE 4367.001, Spring 2018
Software Testing

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- **if you send me email, include the class in the body or subject**

Office hours

- **Tue/Thur 2:30-3:30**
- **by appointment**

Course Prerequisites:

- **SE 3306 (Mathematical Foundations of Software Engineering)**
- **CE/CS/SE 3354 (Software Engineering)**

SE 4367 Description

Methods for evaluating software for correctness and reliability, including code inspections, program proofs and testing methodologies.

Formal and informal proofs of correctness.

Code inspections and their role in software verification.

Unit and system testing techniques, testing tools and limitations of testing.

Statistical testing, reliability models.

SE 4367 Learning Outcomes

1) **Ability to understand the goals and different types of software testing**

2) **Ability to understand and apply functional testing**

3) **Ability to understand and apply structural testing**

4) **Ability to understand and apply GUI testing**

5) **Ability to understand and apply security-related testing**

6) **Ability to understand and apply software testing tools**

SE 4367 Textbook

Required (recommended)

- **A.P. Mathur, <u>Foundations of Software Testing, 2nd Edition</u>, 2013.**
  - **you may use the first edition (2008), but it has many typos that need to be corrected**
  - **there is an on-line errata sheet for the first edition at https://www.cs.purdue.edu/homes/apm/foundationsBook/errata.html**
- **IEEE 29119 Part 4 (Testing Techniques)**

Additional material (and the presentations) will be posted on the eLearning website.

Recommended

- P. Ammann and J. Offutt, Introduction to Software Testing, Second Edition, 2017
- D.G. Firesmith, Common System and Software Testing Pitfalls, 2014
- C. Kaner, J. Falk, and H.Q. Nguyen, Testing Computer Software, Second Edition, 1999
- C. Kaner, J. Bach, and B. Pettichord, Lessons Learned in Software Testing, 2002
- G.J. Myers, T. Badgett, T.M. Thomas, and C. Sandler, The Art of Software Testing, Second Edition, 2004
- R.A. Radice, High Quality Low Cost Software Inspections, 2002
- G.M. Weinberg, Perfect Software and Other Illusions About Testing, 2008

Software Testing Topics

Part I: Preliminaries

1. Software Testing

2. Mathematical

+ misc topics: χSuds, SQA, V&V, peer reviews, formal methods, test driven development, etc.

Part II: Test Generation

3. Domain Partitioning

4. Predicate Analysis

5. Test Generation from Finite State Models (overview)

6. Test Generation from Combinatorial Designs (overview)

Part III. Test Adequacy Assessment and Enhancement

7. Test Adequacy Assessment Using Control Flow and Data Flow

8. Test Adequacy Assessment Using Program Mutation

Part IV. Phases of Testing

9. Test Selection, Minimization, and Prioritization for Regression Testing

10. Unit Testing

11. Integration Testing

SE 4367 Schedule

Class meets Tue/Thur 11:30-12:45 in ECSS 2.201

- **you are expected to attend class**

Tue, Jan 9	**Classes begin**
Tue, Feb 27	**Midterm exam**
March 12-18	**Spring Break (no classes)**
Thur, April 26	**Last day of class**
May 1-7	**Finals**

Lecture sequence: see eLearning Presentations folder

Grading

Quizzes	**10%**
Homework	**10%**
Midterm exam	**40%**
Final exam	**40%**

Quizzes

Typically 8-15 true/false, fill-in-the-blank type questions

Randomly scheduled and not announced in advance

Cannot makeup a missed quiz

Drop lowest quiz grade

Homework

Typically about a week until due

All individual work

Multiple submissions allowed

No late assignments

- students adding the course may turn in late assignments during the Add period

Drop lowest homework grade

Formatting Submissions

In the file name, include:

- **class**
- **assignment identifier**
- **your name (or team's name)**
    - **e.g., se4367a01jdoe**

In the file (or hardcopy) submitted, include the class, assignment, and name information at the top (preferably as a single file).

- **preferred document formats are Word and PowerPoint**
- **acceptable formats include RTF, JPG, and PDF**

Minus 5 points per violation. Potentially 30 points off for formatting mistakes!

Exams

Primarily problems similar to the homework assignments

- **may include true/false, fill-in-the-blank, multiple choice, matching questions**
- **may include discussion questions – require concise answers <u>that are related to the question asked</u>**
  - **“extraneous” material may result in points off**

Make-up exams may be scheduled before or after the regular exam

- **may <u>not</u> be the same as the regular exam**

Exam Groundrules

In classroom at scheduled class time

No cell phones or laptops

Closed book

One-page set of notes may be used

- **front and back, typed or handwritten**

Entire class period will be allowed

Bring a writing implement (#2 pencil preferred)

Bring your Comet ID

Grading Curve

I may choose to curve the grades at the end of the term.

Asking for a higher grade because you need it to graduate, keep your scholarship, etc., will have no influence on curving or your grade.

97-100	**A+**
93-97	**A**
90-93	**A-**
87-90	**B+**
83-87	**B**
80-83	**B-**
77-80	**C+**
73-77	**C**
70-73	**C-**
67-70	**D+**
63-67	**D**
60-63	**D-**
under 65	**F**

Classroom Behavior

You are expected to turn in assignments on time (preferably on eLearning).

You are expected to silence mobile phones and not talk during class except as part of class discussions.

You are expected to cite the work of others when appropriate using an acceptable citation style.

- **You are expected to do your own work!**

Attendance Policy

You are expected to attend class.

By CS Department policy, if you miss three (3) consecutive classes, your grade drops one letter grade.

By CS Department policy, if you miss four (4) consecutive classes, you fail the class.

A sign-in sheet will be passed around each class that you are to initial.

http://cs.utdallas.edu/education/undergraduate/attendance-policy/

Code of Conduct

UTD has a policy on student conduct

- **http://policy.utdallas.edu/utdsp5003**

that addresses

- **plagiarism**
- **fabrication**
- **collusion**
- **etc.**

For your individual assignments, you are expected to do your own work.

- **academic integrity issues will be referred to Judicial Affairs**
- **automated tools such as TurnItIn and Moss**

The work of others must be appropriately cited.

Using eLearning to Check Grades

- **Login to elearning.utdallas.edu using your NetID and password**
- **Click on the relevant course under Course List**
- **On the left-hand pane, click on My Grades / All**

My Grades is also available under the small pull-down menu in the upper right-hand side of the page.

You should now be able to see your grades for the course.

At the bottom of the main eLearning page, there are Student Links, including Getting Started with eLearning and Video Tutorials for Students.

Learning Resources

eLearning

- **elearning.utdallas.edu**
- **see “eLearning Demo for Students”**

The Student Success Center (MC 1.302)

- **Writing Center (MC 1.206)**
- **Math Lab (MC 3.606)**
- **Supplemental Instruction**
- **Tutoring**
- **Success Coaching**
- **and so forth…**

Student AccessAbility

- **http://www.utdallas.edu/studentaccess/**

ISO/IEC/IEEE 29119-4:2015
(Software Testing, Part 4: Test Techniques)

Specification-based test design techniques

- **equivalence partitioning**
- **classification tree method**
- **boundary value analysis**
- **syntax testing**
- **combinatorial test design techniques**
- **decision table testing**
- **cause-effect graphing**
- **state transition testing**
- **scenario testing**
- **random testing**

Structure-based test design techniques

- **statement testing**
- **branch testing**
- **decision testing**
- **branch condition testing**
- **branch condition combination testing**
- **modified condition decision coverage (MCDC) testing**
- **data flow testing**

Experience-based test design techniques

- **error guessing**

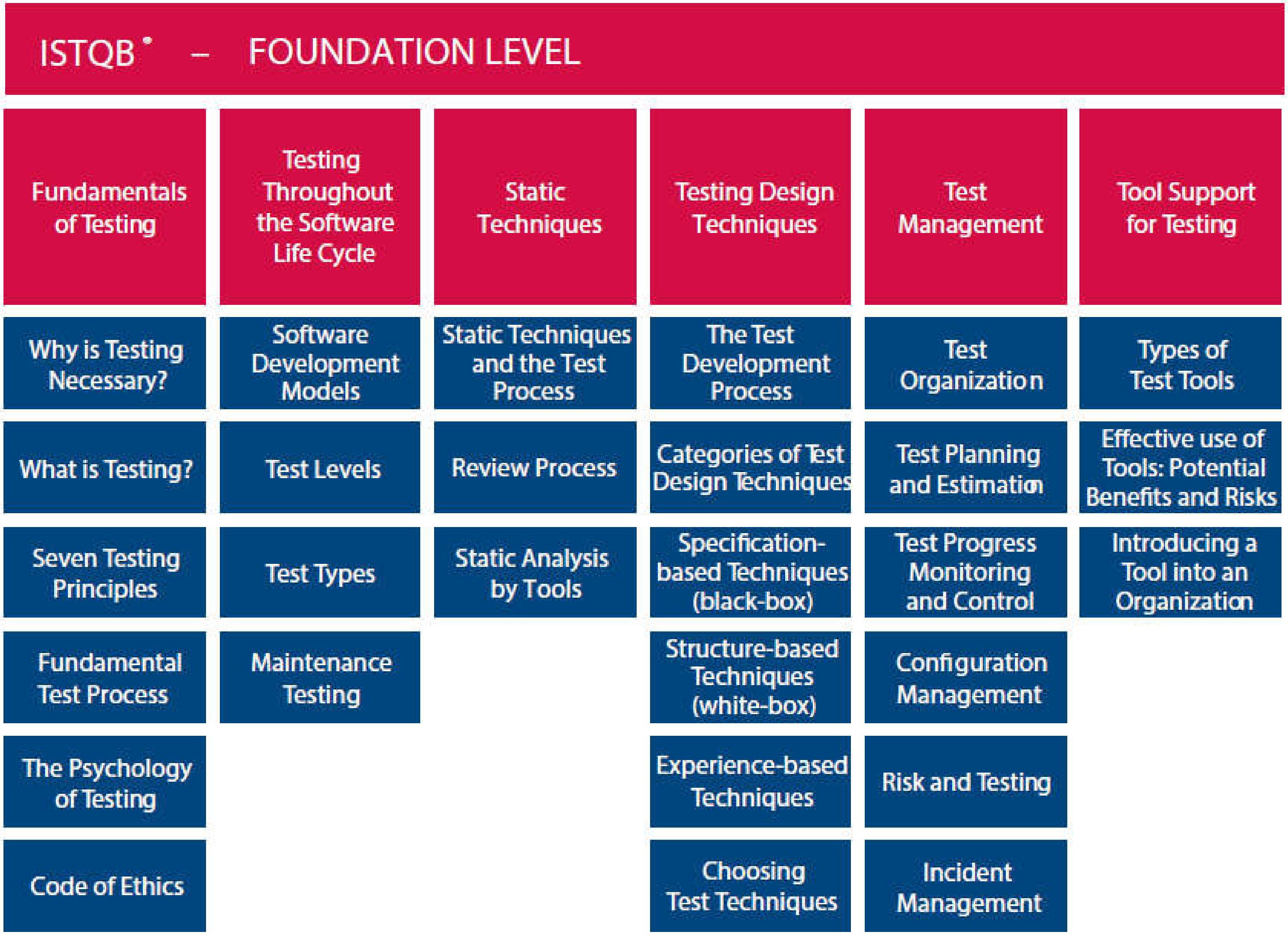
Software Testing Body of Knowledge

International Software Testing Qualifications Board (ISTQB)

- **Certified Tester Foundation Level Syllabus**
- **Advanced Level**
  - **Test Manager, Test Analyst, Technical Test Analyst**
- **Expert Level**
  - **Test Manager, Strategic Test Management, Operational Test Management, Managing the Test Team, Improving the Testing Process, Assessing Test Processes, Implementing Test Process Improvement**
- **Certified Tester Foundation Level Extension Syllabus Agile Tester**
- **www.istqb.org**

Also… textbooks, SWEBOK (and other BOKs), TPI, TMM, ISEB, ISO & IEEE standards, …

ISTQB® FOUNDATION LEVEL



ISTQB® – FOUNDATION LEVEL

Fundamentals of Testing	Testing Throughout the Software Life Cycle	Static Techniques	Testing Design Techniques	Test Management	Tool Support for Testing
Why is Testing Necessary?	Software Development Models	Static Techniques and the Test Process	The Test Development Process	Test Organization	Types of Test Tools
What is Testing?	Test Levels	Review Process	Categories of Test Design Techniques	Test Planning and Estimation	Effective use of Tools: Potential Benefits and Risks
Seven Testing Principles	Test Types	Static Analysis by Tools	Specification-based Techniques (black-box)	Test Progress Monitoring and Control	Introducing a Tool into an Organization
Fundamental Test Process	Maintenance Testing		Structure-based Techniques (white-box)	Configuration Management	
The Psychology of Testing			Experience-based Techniques	Risk and Testing	
Code of Ethics			Choosing Test Techniques	Incident Management	

Professional Societies

You may want to take advantage of student memberships to try out various professional societies… frequently there are local chapters.

- **Institute of Electrical and Electronics Engineers (IEEE) Computer Society**
- **Association for Computing Machinery (ACM)**
- **Project Management Institute (PMI)**
- **Society of Women Engineers**

You can access journals and conference proceedings from professional societies via the McDermott Library (for free).

Questions and Answers