

SYLLABUS: CEN 6070 SOFTWARE TESTING AND VERIFICATION

Summer 2009 Pre-Recorded EDGE Offering

Description: Software Testing and Verification is a survey course on concepts, principles, and techniques related to software testing and formal program verification. Students will become acquainted with both the strengths and limitations of various functional and structural testing methods, as well as techniques for proving the functional correctness of sequential programs. Topics include: black-box and white-box test case design strategies, incremental integration testing techniques, inspections and reviews, axiomatic verification techniques, predicate transforms, and function-based verification. Students will have the opportunity to practice the techniques presented in lectures via optional exercises.

Prerequisites:

- (1) Successful completion of an upper division undergraduate or graduate-level software engineering survey course (such as CEN 3031/5035), or comparable professional experience. (Students who have been employed as software professionals automatically meet this requirement.)
- (2) Familiarity with programming using a high-level language (C, C++, Java, etc.), and
- (3) Basic knowledge of algorithms, data structures, object-oriented design principles, and discrete math.

Note: if you do not meet prerequisite (1), please plan to enroll in CEN 5035 next Fall and then register for CEN 6070 in the Spring. Contact the instructor for additional information.

A self-assessment *pre-test* is available at the course website to assist students in determining their preparedness for the course vis-a-vis coverage of a small subset of prerequisite knowledge.

Instructor: Steve Thebaut, CSE314-A, E-mail: smt AT cise DOT ufl DOT edu, Phone: (352) 392-1496. See contact info on course website for office hours.

Course Logistics: All 40 lectures are pre-recorded from the fall 2008 offering of the course and available for viewing at any time during the summer via UF's E-Learning System at <http://lss.at.ufl.edu> (You will need your GatorLink account and password to access this site.) Note that the summer term is compressed compared to the fall/spring terms, and the two exam dates (see below) are firm. **Plan to view about 4 lectures/week, on average.**

Course Web Site: Available via the E-Learning System at <http://lss.at.ufl.edu>
During the first week of the term only, you may also access the website directly at:
www.cise.ufl.edu/class/cen6070/temp_su09

Course Materials: Lecture notes are available on the course web site in PDF format. A collection of required readings may be purchased as a packet from *University Copy & More*, 1620 W. University Avenue, (352) 372-7436. An *optional* textbook, Pezze and Young's *Software Testing and Analysis*, Wiley, 2008, is recommended only for students who wish to have additional software testing and analysis reference material at their disposal.

Examinations and Grades: Course grades will be based *SOLELY* on two equally weighted 90-minute exams. A histogram of numeric scores will be provided with solution notes for each exam. Course letter grades will be determined at the end of the semester.

Note that effective with the Summer 2009 term, UF's grading scale has been changed to include minus grades. The intent is to provide instructors with more options for assigning grades. Please see www.registrar.ufl.edu/DDD.doc for details.

Exam Procedures for ALL Students: Exam proctors will be asked to schedule a SINGLE EXAM TIME during normal working hours convenient for all students at each site or location on the two specified exam dates. If this is not possible for any reason, exams may be scheduled outside normal working hours (e.g., in the evening). Proctors are encouraged to return electronic copies of completed exams directly to the instructor ASAP, but are also asked to return ORIGINALS via US Mail or overnight delivery.

Make-Up Exam Policy: Students are expected to make every effort to be available at scheduled exam times. If missing an exam is unavoidable, please contact the instructor as far in advance as possible. Depending on the circumstances, it may NOT be possible to administer a make-up exam during the summer term. In such cases, a grade of "I" (incomplete) may be assigned. Make-up exams may be administered orally.

Outline of Course Topics: The following topical areas will be covered in the order listed.

Intro to V&V Techniques and Principles	Formal Program Specification
Requirements and Specifications	Axiomatic Verification
Black-Box Test Case Design Strategies	Weak Correctness
Partition Testing	Rules of Inference
Combinatorial Approaches	Strong Correctness
Other Strategies	Predicate Transforms
White-Box Test Case Design Strategies	Proving Strong Correctness
Logic Coverage	Computing Weakest Pre-conditions
Dataflow Coverage	Functional Verification
Path Conditions and Symbolic Evaluation	Complete and Sufficient Correctness
Other Strategies	Axiom of Replacement
Integration and Higher Level Testing	Correctness Conditions
Testing Object-Oriented Software	Iteration Recursion Lemma
Reviews and Inspections	Revisiting Loop Invariants
Testing Tools	Cleanroom Software Engineering

Exam schedule:

Exam 1: Monday, June 29. Covers class material through lecture 24 (topics "Intro to V&V Techniques" through "Testing Tools") + associated readings.

Exam 2: Friday, August 7. Covers remaining class material through lecture 40 (topics "Formal Program Specification" through "Cleanroom Software Engineering") + associated readings.

All students residing in Gainesville are required to take the exams at the same time and location (to be posted on the course website) on these dates. Students NOT residing in Gainesville should also plan to take the exams on these dates if possible, and should make prior arrangements with their EDGE-approved proctors to do so well in advance.

Problem Sets: There are 7 non-graded problem sets covering the areas:

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| (1) Black-box Testing | (5) Axiomatic Verification |
| (2) Logic Coverage | (6) Predicate Transforms |
| (3) Dataflow Coverage | (7) Functional Verification |
| (4) Path Conditions and Symbolic Evaluation | |

Some problems may be non-trivial and/or require the *creative application* of techniques presented in lectures. You are encouraged to work on the problem sets either alone or in groups, and to seek assistance from the TA and/or instructor as needed, but **you are NOT required to submit your solutions for grading**. Problem set introductions, discussions, hints, and solution reviews will be provided in the lectures. Solution notes will also be available on the course website, but students are strongly encouraged to attempt all problems before viewing them. Note that exams assume a *thorough* understanding of the problem sets and their solutions.

Computer Facilities: Access to e-mail and the WWW is required.

Academic Integrity: All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course

and all others.

You will be asked to sign the following statement on both exams in this course:

On my honor, I have neither given nor received unauthorized aid on this exam and I pledge not to divulge information regarding its contents to those who have not yet taken it.

UF Counseling Services: Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:

- University Counseling Center, 301 Peabody Hall, 392-1575: personal and career counseling.
- SHCC Mental Health, Student Health Care Center, 392-1171: personal and counseling.
- Center for Sexual Assault/Abuse Recovery and Education (CARE), Student Health Care Center, 392-1161: sexual assault counseling.
- Career Resource Center, Reitz Union, 392-1601: career development assistance and counseling.

Software Use: All faculty, staff and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Instructor Bio: Steve Thebaut received the BA in Mathematics from Duke University in 1977, and the MS and PhD in Computer Science from Purdue University in 1979 and 1983, respectively. He is currently Associate Chair of the CISE Department. Dr. Thebaut's research interests include software requirements engineering, testing and verification, and software engineering technology transfer. He has received funding from the National Science Foundation, IBM, the Florida Department of Education, the Florida High Technology and Industry Council, the Sino-Software Research Center at HKUST, the Software Engineering Research Center, and the Software Engineering Institute (SEI) at Carnegie Mellon University, where he was an invited lecturer in the SEI production of "Software Project Management," a nationally distributed video-based continuing education course. He has been a course developer and consultant for IBM's IS&PG Technical Education program, and has served on the program committee of the Conference on Software Engineering Education. He was Associate Editor of the International Journal of Computer and Software Engineering from 1990-1996.