SYLLABUS: CEN 4072/6070,
SOFTWARE TESTING AND VERIFICATION
Spring 2017

Description: Software Testing and Verification is a survey course on concepts, principles, and techniques related to software testing and verification for the development of dependable systems. Students will become acquainted with both the strengths and limitations of various functional and structural testing methods, as well as techniques for reasoning about the functional correctness of sequential programs. It focuses primarily on issues relevant to software engineers (especially dependable systems software engineers) as opposed to system-level testers, QA personnel, web services/agile business software developers, etc.

Topics include: black-box and white-box test case design strategies, incremental integration testing techniques, inspections and reviews, axiomatic verification, predicate transforms, and function-theoretic verification. Students will have the opportunity to explore the ideas and practice the techniques presented in class via group/individual 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 currently or recently employed as software engineering professionals automatically meet this requirement.)
(2) Familiarity with programming using a high-level language (C, C++, Java, etc.).
(3) Basic knowledge of algorithms, data structures, object-oriented design principles, and discrete math.
(4) An interest in the V&V processes used to develop long-lifetime, high-dependability software systems, and/or a desire for deeper insights into programming and program semantics.

Notes: Item (1) will be strictly enforced. If you do not meet this prerequisite, please plan to do so before enrolling in Software Testing and Verification. Please see the instructor for additional information.

Students who have earned credit for CEN 4072 may NOT take CEN 6070 for credit.

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, CSE 330, E-mail: smt AT cise DOT ufl DOT edu
Office Hours: Monday and Wednesday, 3-4 PM or by appointment

Teaching Assistant:
Bo Ma, CSE 335, E-mail: bbo AT cise DOT ufl DOT edu
Office Hours: Tuesday and Thursday, 2-3 PM or by appointment

Course Meeting Times and Location:
M/W/F: 7th (1:55-2:45 PM)
Room: CSE 222

Course Website: www.cise.ufl.edu/class/cen6070/sp17.html
Course Materials: There is no required textbook. Reference sources will be identified in class.

Lecture Notes (in both "student" and "instructor" formats) will be made available (often on a just-in-time basis) on the course website in PPT format, along with Lesson Plans, Practice Exams, Problem Sets, Course Announcements, etc.

A Canvas course shell will be made available via E-Learning to access posted grade information.

Required readings will be made available on-line via the UF Libraries website. Select the Course Reserves tab at http://www.uflib.ufl.edu.

Examinations and Grades: Course grades will be based SOLELY on (i) the four highest scores of five equally weighted 25-minute in-class quizzes (50%), and (ii) two equally weighted 50-minute in-class exams (50%). (There is no comprehensive "final exam" for this course.) A histogram of numeric scores will be provided on the course website with Solution Notes for each exam. A histogram of final quiz scores (based on your 4 highest scores) will also be provided. Course letter grades will be determined at the end of the semester based on separate "curves" (to be determined) for CEN 4072 and CEN 6070 students.

Exam and Quiz Schedule:

Exam 1: (topics through "Testing Tools" + associated readings) -- Wed., March 1 (tentative)
Exam 2: (remaining topics + associated readings) -- Wed., April 19

Quizzes will be held following the posting of Solution Notes for Problem Sets 1+2, 3+4, 5, 6, and 7 (see "Problem Sets" below). Specific dates will be announced in class and posted on the course website.

Make-Up Exam and Quiz Policy: Students are expected to be present for all scheduled quizzes and exams. Please do not schedule conflicting elective activities (family gatherings, job interviews, visa renewal trips, etc.).

Exams: If missing an exam is unavoidable (e.g., due to sickness, accident, or other reasons beyond your control), contact the instructor as far in advance as possible. Make-up exams for excused absences will normally be administered orally.

Quizzes: Except in extreme circumstances (e.g., when multiple quizzes are missed due to an extended illness), there will be no make-up quizzes. However, only a student’s four highest scores will be considered when determining the overall quiz score.

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

- Intro to V&V Techniques and Principles
- Requirements and Specifications
- Black-Box Test Case Design Strategies
  - Partition Testing
  - Combinatorial Approaches
  - Other Strategies
- White-Box Test Case Design Strategies
  - Logic Coverage
  - Dataflow Coverage
  - Path Conditions and Symbolic Evaluation
  - Other Strategies
- Formal Program Specification
- Axiomatic Verification
- Weak Correctness
- Rules of Inference
- Strong Correctness
- Predicate Transforms
- Computing Predicate Transforms
- Predicate Transforms and Loops
- Functional Verification
- Complete and Sufficient Correctness
- Axiom of Replacement
Problem Sets: There are 7 non-graded Problem Sets, covering the areas:

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

A few problems may be non-trivial and/or require the *creative application* of techniques presented in class. You are strongly encouraged to work on the Problem Sets PRIOR TO REVIEWING POSTED SOLUTION NOTES, and to meet with the TA and/or instructor to discuss problem solving strategies as needed. Problem Set introductions, discussions, and solution hints will be provided in class as appropriate.

Problem Sets are an important, independent learning tool, introducing some ideas that may not be presented in lectures; therefore, while you should not *think* of them as being "optional", you are not, in fact, required to submit your work and they will not be graded. However, the in-class quizzes are intended, in part, to assess your familiarity with, and understanding of, both the problems and the suggested solution strategies reflected in the Solution Notes.

Class Attendance Etiquette Policy: You are strongly encouraged to attend class whenever your circumstances allow you to be "fully present" (in the Zen sense)! But please do NOT come to class for the purpose of reading newspapers, communicating with others via messaging or e-mail, checking Facebook, etc. If you bring a laptop to class, please limit its use to class related activities only. And please turn your cell phone off.

Finally, please avoid coming to class late or leaving early, as this can be a significant distraction for others.

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 and all quizzes in this course:

*On my honor, I have neither given nor received unauthorized aid on this test 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.

**Instructor Biography:** 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. His 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, and Associate Chair of the CISE Department at the University of Florida from 2000 to 2015.