

EEE 4701/5702- Automated HW/SW Verification

1. Catalog Description – (3 credits) Develop modeling, formal specification, and automated verification skills for analyzing complex hardware and/or software systems. Hands-on experience with model checking tools.
2. Pre-requisites: EEL 4744C (or equivalent) and COP 3530 (or equivalent).
3. Course Objectives – To devise formal models for reasonably complex systems, to learn various property specification formalisms, and how to use automated verification tools to reason about the correctness properties and the behavior of hardware and/or software systems.
4. Contribution of course to meeting the professional component (ABET only – undergraduate courses) 3 credits of Engineering Science.
5. Relationship of course to program outcomes: Skills student will develop in this course (ABET only undergraduate courses) Outcomes a and k.
6. Instructor –Dr. Tuba Yavuz
 1. Office location: 321 Benton Hall
 2. Telephone: (352) 846 0202
 3. E-mail address: tuba@ece.ufl.edu
 4. Class Web site: E-learning CANVAS <http://lss.at.ufl.edu>
 5. Office hours: Tuesdays and Thursdays 1:30 pm – 2:30 pm
7. Teaching Assistant - None
 1. Office location:
 2. Telephone:
 3. E-mail address:
8. Meeting times: MWF 10:40 am – 11:30 am
9. Class/laboratory schedule - 3 class periods consisting of 50 minutes each
10. Meeting Location – Benton 328.
11. Material and Supply Fees - None
12. Textbooks and Software Required – None.
13. Recommended Reading –
 - Theoretical Background on Model Checking
 1. Title: Model Checking.
 2. Author: Edmund M. Clarke, Orna Grumberg, Daniel Kroening, Doron A. Peled, and Helmut Veith.
 3. Publication date and edition: 2018, 2nd edition.
 4. ISBN number: ISBN-13: 978-0262038836
 - Theoretical Background on SAT/SMT Solvers
 1. Title: Decision Procedures, An Algorithmic View
 2. Author: Daniel Kroening and Ofer Strichman
 3. Publication date and edition: 2016, 2nd
 4. ISBN number: 978-3662504963

- Practical book on SPIN model checker
 1. Title: The SPIN Model Checker
 2. Author: Gerard J. Holzmann
 3. Publication date and edition: 2003.
 4. ISBN number: 0-321-22862-6
- A list of research papers to be provided by the instructor.

14. Course Outline –

- (1 class) Introduction
- (1 class) Propositional Logic
- (1 class) Modeling with Propositional Logic and the SAT Problem
- (2 classes) SAT Solving using Conflict Resolution
- (2 classes) SAT solving using Binary Decision Diagrams (BDDs)
- (1 class) Predicate/First-order logic
- (2 classes) Uninterpreted functions and equality logic
- (1 class) Linear Arithmetic
- (1 class) Bit-vector Logic
- (1 class) DPLL(T)
- (1 class) Symbolic Execution - KLEE
- (3 classes) Linear-Time Temporal Logic (LTL)
- (3 classes) SPIN (an explicit-state model checking tool for high-level models)
- (2 classes) Explicit-state Model Checking Algorithms
- (3 classes) Computation Tree Logic (CTL)
- (1 class) NuXmv (a symbolic model checking tool)
- (3 classes) Symbolic Model Checking Algorithms
- (2 classes) Infinite-state Model Checking (ALV model checker)
- (2 classes) Bounded Model Checking (BMC)
- (2 classes) Predicate Abstraction
- (1 class) Counter-example Guided Abstraction Refinement (CEGAR)
- (~7 classes) Research Paper presentations
- (1 class) Wrap-up

15. Attendance and Expectations - Attendance is expected. Cell phones and other electronic devices are to be silenced. No text messaging during class or exams.

Requirements for class attendance and make-up exams, assignments, and other work are consistent with university policies that can be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

16. Grading –

Assignments (30% for both sections): Written assignments as well as hands-on experience with some of the model checking tools.

A final exam on December 11th from 12:30 pm to 2:30 pm (30% for both sections): This will include questions on the theory of automated verification as well as research problems that will require a basic understanding of the fundamental problems in the model checking field and various solutions to these problems and the ability to compare and contrast them.

Research paper presentations (15% - EEE 5702 only): Each student in EEE 5702 will choose a research paper, preferably related to their term project, in the field of automated verification and present it in class. The presentations will be graded based on 1) the presenter's ability to clearly describe the problem, explain the solution, and evaluate the (experimental) results, 2) the quality of answers provided to the questions, and 3) the content of the slides.

Written Questions about Research Papers (15% - EEE 4701 only): Each student in EEL 4701 will prepare at least one non-trivial question for each of the three different papers that will be presented in class. To get full credit, the question should reveal that the paper has been read carefully and the answer to the question must not be explicitly stated in the paper. Each question should be submitted on CANVAS prior to the presentation.

Term Project (20% for both sections): A semester long project that will involve analysis of a reasonably complex hardware or software system using a verification tool. Students will choose from a list of project topics that will be provided by the instructor.

Participation (5%, for both sections): Class participation. You are encouraged to keep a participation log of any activity along with the date of participation and other information (e.g., the specific question asked or answered) and submit it by the end of the semester.

17. Grading Scale –

A C- will not be a qualifying grade for critical tracking courses. In order to graduate, students must have an overall GPA and an upper-division GPA of 2.0 or better (C or better).” Note: a C- average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit:
<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

18. Make-Up Exam Policy - If you have a University-approved excuse and arrange for it in advance, or in case of documented emergency, a make-up exam will be allowed

A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E
93-100	90-92	87-89	83-86	80-82	77-79	73-76	70-72	67-69	63-66	60-62	0-59

and arrangements can be made for making up missed work. University attendance policies can be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

Otherwise, make-up exams will be considered only in extraordinary cases, and must be taken before the scheduled exam. The student must submit a written petition to the instructor two weeks prior to the scheduled exam and the instructor must approve the petition.

19. Honesty Policy – 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.

“...failure to comply with this commitment will result in disciplinary action compliant with the UF Student Honor Code Procedures
(<http://www.dso.ufl.edu/sccr/procedures/honorcode.php>)

20. Accommodation for Students with Disabilities – Students Requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.
21. UF Counseling Services – Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:
 - · UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, psychological and psychiatric services.
 - · Career Resource Center, Reitz Union, 392-1601, career and job search services.
22. Software Use – All faculty, staff and student 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.
23. Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these

assessments are available to students at <https://evaluations.ufl.edu/results/>.

24. Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.