CDA 5416 Computer System Verification

Instructor:	Dr. Hao Zheng
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Office Hour:	$1 - 2{:}30am$, Mon. & Wed. or by appointment.
Class Meeting Time/Location:	MW $9:30 - 10{:}45pm$ at BSN 2200.
Credit Hours:	3

Course Description

This course introduces basic concepts on verifying functional correctness of some aspects of computing systems including hardware, software and communication protocols. Topics includes system modeling, specification, and algorithms for analysis and verification of complex systems. This course focuses on *logic model checking*, a mathematically rigorous approach for hardware/software/protocol verification. The objectives of this course include

- Understanding of modeling computation and communication of concurrent systems with variants of finite state automata,
- Understanding of formal correctness specification using temporal logics,
- Knowledge of basic model checking algorithms
- Hands-on experiences of using two widely-used open-source model checkers to verify a number of examples and case studies.

Prerequisites and Desired Background:

- CDA 3201 Logic Design
- COT 3100 Intro. to Discrete Structures
- COT 4400 Analysis of Algorithm
- COP 4530 Data Structures

Textbook: *Principles of Model Checking*, Christel Baier and Joost-Pieter Katoen, The MIT Press, ISBN $026202649X$ (*Free on-line access through USF Library*).

Another good reference book is *Handbook of Model Checking*, edited by Edmund M. Clarke, Thomas A. Henzinger, Helmut Veith, and Roderick Bloem, Springer, 2018, ISBN $978 - 3 - 319 - 10574 - 1$ (*Free on-line access through USF Library*).

Attendance: Required.

Last Day to Drop with 'W':   October 27th, 2018.

Evaluation

Homework/Exams	Grades
Homework	40%
Quizzes	5%
Midterm Exam	25%
Final Project	30%

Final grading scale: Suppose your final grade percentage is x. The following table defines the mapping from x to a letter grade.

$x < 60\%$	$60\% \leq x < 70\%$	$70\% \leq x < 80\%$	$80\% \leq x < 90\%$	$x \geq 90\%$
F	**D**	**C**	**B**	**A**

- The instructor reserves the right to give +/- letter grades for the final grades.

Homework Assignments

- Approximately $6 - 8$ homework assignments will be given throughout this semester.
- Your homework solutions must be submitted electronically via Canvas
- All assignments are individual, and the final submission must be your own work.
- Late homework submissions will **NOT** be accepted.
- Requests for re-grading must be submitted via email or in writing **within one week since a graded assignment is returned**.
- Additional specific requirements may be imposed for individual assignments. Read carefully each homework description when it is distributed.
- Some assignments require to run certain software programs on a computer. Therefore, you need to secure access to a laptop or desktop throughout the semester.

Quizzes

- Throughout this semester, a number of quizzes will be given from time to time.
- These quizzes will not be announced in advance.
- There will be NO makeup for any missed quizzes.

Final Project At the end of the semester, you are required to successfully complete a substantial final project to exercise the knowledge gained in the semester. More details on the final project will be discussed later.

Main Topics (tentative)

The following is a tentative list of topics to be covered.

- Overview of computer system verification
- Background review (first-order logic, set theory, relations, etc)
- System modeling
- Introduction to model checker SPIN
- System specification and temporal logics
- Basic explicit model checking algorithms
- Symbolic encoding of systems
- Binary decision diagrams
- Introduction to symbolic model checker SMV.
- Basic symbolic model checking algorithms

If time allows, the following topics will also be introduced.

- Boolean satisfiability solving
- Bounded model checking

Course Communication

Canvas will be the major means for communications. Homework and project assignments, grades, announcements, and other related materials will be posted only on Canvas. The following locations on Canvas will be used often during this semester.

- **Announcements** where all course related announcements are posted.

- **Assignments** where assignments are posted and your solutions are submitted. *Anything sent to anywhere else is ignored.*

- **Grades** where grades for assignments, exam(s), and the final project are posted.

- **Discussions** where questions and answers that are of interest to the entire class are posted.

Other course material, including slides, will be posted on the webpage pointed by the link below.

<div align="center">http://www.cse.usf.edu/~haozheng/teach/cda5416</div>

In addition, your email inbox needs to be cleared because messages broadcast to the whole class will be sent out via announcements and/or emails. *You are responsible for not receiving emails due to the overflow of your email inbox.*

Academic Integrity/Academic Dishonesty

Students are expected to be honest and not cheat on their assignments/examinations/project. Collaborations by forming study groups and having discussions with fellow students are highly encouraged, but copying each other's work is forbidden. You must write *your own solutions* in *your own words*. If you are unable to find the solutions to problems without step-by-step help from your study partners, you do not understand the solutions.

Every student should read the University's policies on student conduct, academic integrity, etc. Please see the University's Undergraduate Catalog regarding these policies at http://regulationspolicies.usf.edu/regulations/pdfs/regulation-usf3.027.pdf. Students caught cheating in any form will receive an **FF** grade for the course.

General Policies

- All announcements and assignments will be posted through Blackboard. Students are required to look in Blackboard for course material and related information.

- Class Attendance is required although not monitored. Students are responsible for all information communicated during class. This information will not be necessarily duplicated in the class webpages.

- Academic dishonesty will not be tolerated and the student, in question, will be dealt with in accordance with the University policies.

- Cell phones may not be used as calculators. Cell phones must be turned off at all times including exams and lectures.

- The communication functions including text messaging on all devices must be turned off during exams.

- Students are not allowed to sell or distribute notes provided for this class.

- Students in need of academic accommodations for a disability may consult with the office of Students with Disabilities Services to arrange appropriate accommodations. Students are required to give reasonable notice to the instructor prior to requesting an accommodation. If accommodations are needed, a letter from the Office of Student Disability Services (SVC 1133) is required.

- Students who anticipate the necessity of being absent from class due to the observation of a major religious observance must provide notice of the date(s) in writing by the second class meeting.

- The instructor reserves the right to interpret the class policies if confusions may occur.