COT 6908 Independent Study

Satisfiability Solving (3 credits)

Instructor: Dr. Sumit Kumar Jha,
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1 Content

The course provides a self-contained introduction to satisfiability (SAT) solving. We will focus on both classical approaches to sat solving such as the DPLL algorithms and its more recent avatars as implemented in the ZCHAFF and MiniSAT solvers. The course will provide students the ability to engineer their own satisfiability solvers.

2 Required Background

Undergraduate course work in discrete structures or computational logic is sufficient preparation for this course. All graduate students in computer science, computer engineering and electrical engineering programs have the required background.

3 Office Hours and Class Interaction

Appointments with the instructor can be requested by email. Meetings will be organized periodically to answer questions from the student(s).

4 Course Content & Required Reading

Introduction to Satisfiability; Applications to Practical Problems; Local Search and Look-ahead Techniques; Preprocessing; DPLL & Conflict-Driven Clause Learning; Quantification in Boolean Formula; Proof of Satisfiability and Unsatisfiability.

Required book: Logic in Computer Science: Modelling and Reasoning about Systems, Michael Huth and Mark Ryan, 2nd Edition, ISBN-13: 978-0521543101

Duration	Topics Covered
Week 1-2	Propositional Logic (Chapter 1) of Huth & Ryan book Particular emphasis on 1.3-1.6.
Week 3-4	Predicate Logic (Chapter 2) of Huth & Ryan book Particular emphasis on 2.2, 2.4 and 2.7
Week 5-6	Marques-Silva, J., 2008, May. Practical applications of boolean satisfiability. In *Discrete Event Systems, 2008. WODES 2008. 9th International Workshop on* (pp. 74-80). IEEE.
Week 7-9	Loveland D., Sabharwal A., Selman B. (2016) DPLL: The Core of Modern Satisfiability Solvers. In: Computability, Computational Logic, and Mathematical Foundations. Outstanding Contributions to Logic, vol 10. Springer.
Week 10-11	Moskewicz, M.W., Madigan, C.F., Zhao, Y., Zhang, L. and Malik, S., 2001, June. Chaff: Engineering an efficient SAT solver. In *Proceedings of the 38th annual Design Automation Conference* (pp. 530-535). ACM.
Week 12-13	Zhang, L. and Malik, S., 2003, March. Validating SAT solvers using an independent resolution-based checker: Practical implementations and other applications. In *Proceedings of the conference on Design, Automation and Test in Europe-Volume 1* (p. 10880). IEEE Computer Society.

Week 14-15	Balyo, T., Heule, M.J. and Järvisalo, M., 2017, February. SAT Competition 2016: Recent Developments. In *AAAI* (pp. 5061-5063).

5 Evaluation

Performance in this course will be evaluated on the basis of two take-home midterms (30% each) and a take-home final (40%).

Assessment	**Percent of Final Grade**
Mid-Term I	30%
Mid-Term II	30%
Take-home Final	40%
	100%

Grading Scale (%)

90-100	A
80 - 89	A-
70 - 79	B+
60 - 69	B
50 - 59	B-
0 - 50	F