

	<b>Course</b>	CS4384.001 CS4384.501 CS5349.001
	<b>Professor</b>	Dr. Richard Min (Ph.D., MBA, MS, M.Div, STM)
	<b>Term</b>	Spring 2015
	<b>Meetings</b>	001 Tuesday & Thursday 2:30pm – 3:45pm. ECSS2.311 501 Tuesday & Thursday 7:00pm – 8:15pm. ECSS2.410

### Professor's Contact Information

<b>Office Phone</b>	972-883-4522
<b>Office Location</b>	ECSS 4.609
<b>Email Address</b>	Richard.Min@utdallas.edu
<b>Office Hours</b>	Tuesday & Thursday 9am – 1pm, 8:15pm – 9:15pm (or by appointment)

### General Course Information

<b>Pre-requisites</b>	CS 3305 (Discrete Math II) or equivalent (for CS4384) CS5333 (Discrete Structure) or equivalent (for CS5349)
<b>Course Description</b>	<p>A review of the abstract notions encountered in machine computation. Topics include finite automata, regular expressions, PDAs, and context-free languages. [We will also introduce Turing Machines and Undecidability.]</p> <ol style="list-style-type: none"> <li>Brief review of mathematical background. (Sipser Chapter 0) Binary relations, digraphs, strings, languages, induction, types of proof, ...</li> <li>Finite Automata and Regular Expressions. (Sipser Chapter 1) (Deterministic and nondeterministic finite automata, regular expressions and regular sets, Kleene's Theorem.)</li> <li>Properties of Regular Sets (Sipser Chapter 1, in particular Section 1.4) (Pumping Lemma, closure properties, decision algorithms)</li> <li>Context-Free Grammars and Languages. (Sipser Chapter 2) (Context-free grammars, regular grammars)</li> <li>Simplified Forms and Normal Forms. (Sipser Chapter 2) (Useful symbols, productions, unit productions, Chomsky normal form)</li> <li>Pushdown Automata. (Sipser Section 2.2) (Pushdown automaton, equivalence between PDA &amp; CFL)</li> <li>Properties of Context-Free Languages. (Sipser Section 2.3) (Pumping Lemma, closure properties, the CYK algorithm)</li> <li>Turing Machines. (Sipser Chapters 3, 4) (Turing machines, their variants and the undecidability of the halting problem)</li> </ol>
<b>Learning Outcomes</b>	<p><b>Course Objective:</b> The goal of this course is to introduce students to the theory of computation. We will discuss several basic computational models including the finite automata (FA), pushdown automata (PDA) and Turing machines (TM) as well as the corresponding classes of regular languages, context-free languages and recursively enumerable languages. The classes of regular grammars and context-free grammars (CFG) will be introduced. We will show the equivalence between regular grammars and finite automata, and between context-free grammars and pushdown automata. We will also discuss various properties of regular languages and context-free languages, including the Pumping Lemma, several closure properties as well as some decision algorithms. We will discuss the Turing machine model, the notion of decidability/undecidability, the halting problem for TMs and its undecidability.</p> <p>The Learning Objectives include:</p> <p>(1) Ability to design finite automata and regular expressions,</p>

	(2) Ability to convert among DFAs, NFAs, and regular expressions, (3) Ability to show that certain languages are not regular, (4) Ability to design PDAs and CFGs, (5) Ability to convert PDAs to CFGs and vice versa, (6) Ability to show that certain languages are not context-free.
<b>Required Text</b>	Sipser, M., Introduction to the Theory of Computation, Thomas Course Technology, (3rd edition) 2013.
<b>Supplemental Text &amp; Online Resources</b>	<ul style="list-style-type: none"> <li>• Theory of Computatoin by Anil Maheshwari &amp; Michiel Smid, available online <a href="http://cg.scs.carleton.ca/~michiel/TheoryOfComputation/TheoryOfComputation.pdf">http://cg.scs.carleton.ca/~michiel/TheoryOfComputation/TheoryOfComputation.pdf</a></li> <li>• Introduction to Automata Theory, Languages, and Computation, 3e. by John E. Hopcroft, Rajeev Motwani, and Jeffrey D. Ullman. © Prentice Hall 2006. ISBN: 978-0321455369</li> <li>• Introduction to Languages and the Theory of Computation, by J. Martin. McGraw-Hill, 2010.</li> <li>• Autotama, Computability and Complexity by E. Rich, Prentice Hall, 2008.</li> <li>• Languages and Machines by Sudkamp, Addison Wesley, 2005.</li> </ul> <p><b>Internet Online Materials:</b></p> <ul style="list-style-type: none"> <li>• Theory of Computation – ppts by Dr. Costa Busch. <a href="http://csc.lsu.edu/~busch/courses/theorycomp/fall2008/">http://csc.lsu.edu/~busch/courses/theorycomp/fall2008/</a></li> <li>• Automata - class ppts and notes by Dr. Moorthy: <a href="http://www.cs.rpi.edu/~moorthy/Courses/modcomp/">http://www.cs.rpi.edu/~moorthy/Courses/modcomp/</a></li> <li>• Class Notes by Dr. Huynh, and by Pervin <a href="https://www.utdallas.edu/~pervin/cs4384.html">https://www.utdallas.edu/~pervin/cs4384.html</a></li> <li>• "Automata Theory" web-course by Dr. Jeffrey Ullman on <a href="https://www.coursera.org/">https://www.coursera.org/</a></li> <li>• JFLAP computer program and tutorial on <a href="http://www.jflap.org/">http://www.jflap.org/</a></li> <li>• Tutorials on parsing, Yacc/Lex or Bison/Flex:</li> <li>• Lex&amp;Yacc or Flex/Bison tutorials on <a href="http://dinosaur.compilertools.net/">http://dinosaur.compilertools.net/</a></li> <li>• Dr. Jonathan Engelsma (Youtube 2parts) <a href="http://www.youtube.com/user/batwingd">http://www.youtube.com/user/batwingd</a></li> <li>• Dr. Tom Niemann on <a href="http://epaperpress.com/lexandyacc/">http://epaperpress.com/lexandyacc/</a></li> </ul>

### Important Dates\*

<b>01/12 Monday</b>	First Day of Class for Spring 2015
<b>01/19 Monday</b>	Martin Luther King Day Holiday – NO CLASSES
Thursdays * <b>(1) 2/05 (2) 2/26 (3) 3/12 (4) 4/09 and 4/30</b>	4Assignments Due – check eLearning for details & Project (Research/Review Paper)
<b>1/19 Thursday *</b> <b>3/26 Thursday *</b> <b>4/23 Thursday *</b>	Exam 1,2,3 (In TESTING CENTER and not in classroom)
<b>3/16 Monday - 3/21 Saturday</b>	NO CLASSES (Spring Break)
<b>5/02 Saturday</b>	Last Day of class
<b>5/05 – 5/11</b>	Final Examination (To be announced)

\* Note: The dates and the content here are tentatively assigned and are subject to change as needed.

## Course Policies

<b>Grading Criteria</b>	Attendance & Participation	5%	A+ = 97 & above
	4 Assignments (4 x 5%)	20%	A = 93-96
	Quizzes (announced or unannounced)	10%	A- = 90-92
	3 Examination (20+20+20)	60%	B+ = 87-89
	Project (Research/Review Paper)	5%	B = 83-86
			B- = 80-82
			C+ = 77-79
			C = 73-76
			C- = 70-72
			F = below 70
<b>Make-up Exams</b>	Not allowed (or 20% penalty)		
<b>Late Work</b>	10% reduction in grade per day (or partial day) for any late submissions;		
<b>Class Attendance</b>	Required; Attendance will be taken		
<b>Classroom Citizenship</b>	Respect for your classmates is necessary at all times		
<b>All other policies</b>	Please visit <a href="http://go.utdallas.edu/syllabus-policies">http://go.utdallas.edu/syllabus-policies</a> for other policies		

## Spring 2015 Schedule/Plan

\* Note: The dates and the topics are tentatively assigned and are subject to change as needed.

CS5349.001 Masters students will cover additional topics with advanced research project and paper to do.

<b>Week</b>	Sipser Chaper	Topics & ppt	Examination	Assignment	<b>Week</b>
01 - 1/13 T	Sipser ch 0	Syllabus, Introduction			01 - 1/13 T
02 - 1/20 T	Sipser ch1	DFA & JFLAP FSA			02 - 1/20 T
03 - 1/27 T		NFA			03 - 1/27 T
04 - 2/03 T		Reg Exp		(1) 2/05	04 - 2/03 T
05 - 2/10 T		RE pumping Lemma			05 - 2/10 T
06 - 2/17 T	Sipser ch2	RE pumping Lemma	Exam1 2/19		06 - 2/17 T
07 - 2/24 T		CFL		(2) 2/26	07 - 2/24 T
08 - 3/03 T		PDA & JFLAP PDA			08 - 3/03 T
09 - 3/10 T		CFG & PDA		(3) 3/12	09 - 3/10 T
<b>10 - 3/17 T</b>	Spring Break				10 - 3/17 T
11 - 3/24 T	Sipser ch3-4	CFG & PDA	Exam2 3/26		11 - 3/24 T
12 - 3/31 T		CFL Pumping Lemma			12 - 3/31 T
13 - 4/07 T		Lex & Parsing, Flex/Bison		(4) 4/09	13 - 4/07 T
14 - 4/14 T		Lex & Parsing			14 - 4/14 T
15 - 4/21 T	Advanced Topics	TM, JFLAP TM	Exam3 4/23		15 - 4/21 T
16 - 4/28 T	Last Week	Halting Problem & Adv Topics	Project Due	4/30	16 - 4/28 T
5/05 - 5/11	Final Exam Week		TBA		5/05 - 5/11