of National University
Computer & Emerging Sciences

FAST School of Computing - Department of Computer Science

CS 301 – Theory of Automata

Fall 2020

Instructor Name: Muhammad Kamran Lodhi
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TA Name:
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Course Information

Program: BS **Credit Hours:** 3 **Type:** Core
Pre-requisites: CS-211 Discrete Structures
Course Website: Google Class / Slate
Class Meeting Time: T, Th 8 – 9.30 (Section 5B), 9.30 – 11 (Section 5A)
Class Venue: CS – 11

Course Objectives:

Course Learning Outcomes (CLOs):		
At the end of the course students will be able to:	**Domain**	**BT* Level**
Understand the different concepts in automata theory and formal languages such as formal proofs, automata, regular expressions, Turing machines etc;		
Understand properties of languages, grammars and automata with rigorously formal mathematical methods		
Design of automata, RE and CFG		
Transform between equivalent NFAs, DFAs and Res		
Define Turing machines performing simple tasks.		
Differentiate and manipulate formal descriptions of languages, automata and grammars with focus on regular and context-free languages, finite automata and regular expressions		
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain. **Bloom's taxonomy Levels:** 1. Knowledge, 2. Comprehension, 3. Application, 4. Analysis, 5. Synthesis, 6. Evaluation		

Grading Criteria

1. 3-4 Hand-written Assignments (10%)
2. 1-2 Coding Assignments (5%)
3. 5-6 Quizzes (15%)
4. 2 Midterm Exams (30%)
5. Final Exam (40%)

Course Textbook

1. Michael Sipser. *Introduction to the Theory of Computation.* 1997. PWS Publishing Company.

Reference Materials

1. John E. Hopcroft. Jeffery D. Ullman. *Introduction to Automata Theory, Languages, and Computation*. 1979. Addison-Wesley. ISBN 0-201-02988
2. John C. Martin. *Introduction to Languages and the Theory of Computation*. Third Edition. 2003. McGraw-Hill. ISBN: 0-07-115468-X (International Students Edition)
3. Harry R. Lewis, Christos H. Papadimitriou: Elements of The Theory of Computation, Second Edition, 1998.
4. Daniel I. A. Cohen. *Introduction to Computer Theory*. Second Edition. 1997. John Wiley & Sons. ISBN: 0-471-13772-3.

Tentative Weekly Schedule

Week	Topics to be covered	Readings	Assignments
1	Basic concepts of Sets, Revision of Discrete.	Chapter 0 from Sipser	
2-3	Deterministic/Non Deterministic Finite Automata	Chapter 1 from Sipser	Assignment 1 Programming Assignment 1
3	Conversion of NFA to DFA NFA-null Conversion of null-NFA to NFA	Chapter 1 from Sipser	
4	Properties of Regular Languages Regular Expressions Conversion of RE to NFA (Kleene's Theorem – I)	Chapter 1 from Sipser	
5	Conversion of DFA to RE using state elimination method (Kleene's Theorem – II) Minimization of DFA	Chapter 1 from Sipser	Assignment 2
6	Midterm week - **NO CLASSES**		
7	Pumping Lemma for Regular Languages		
8-9	Context Free Languages and Grammars Derivations of Parse Trees Push Down Automata	Sipser Chapter 2	Assignment 3
10	Conversion of Chomsky Normal Form CYK Algorithm	Sipser Chapter 2 Sipser Chapter 7	Programming Assignment 2
11	Properties of Context Free Languages Pumping Lemma for CFL	Sipser Chapter 2 **Add Reading: Martin Chapter 6**	
12	Midterm week		
13-14	Turing Machines Variants of Turing Machines	Chapter 3 from Sipser	Assignment 4
15-16	Decidability and Advanced Topics	Chapter 4 and 7 from Sipser	

Course Policies

1. All students are expected to attend all lectures from beginning to end.

2. Attendance will be marked at the start of the class. Late comers will be marked LATE.

3. Students can contest their grades on quizzes and assignments ONLY within a week of the release of grades. Exams will be available for review according to the policies of university.

4. To pass this course, students should get at least 80% attendance.

5. Quizzes may be unannounced, covering the contents of last two lectures. You are only allowed to take quiz in your own section.

6. There is no make-up for a missed quiz or assignment. At the end of semester, one quiz will be dropped **IF** total quizzes are **more than** 5. If number of quizzes exceed 7, 2 quizzes will be dropped.

7. In this course, you may get 1 or 2 Programming assignments, along with multiple hand-written assignments. Coding assignments need to be done in C++ or python.

8. Your assignments will be evaluated through quizzes. This means the quiz will take place whenever an assignment is due.

9. Hand-written assignments should be submitted on due date and time. The students can submit assignments within 48 hours with a 25% penalty. The assignment may not be accepted after 48 hours. Programming assignments may not be accepted late.

10. Cheating is strictly not allowed. If first instance is caught, you will be awarded negative marks. If the practice continues, the case will be referred to DC Committee for further action.

11. This course will have absolute grading. Following is the breakdown as announced by the CS department.

Total Marks%	**Grade**
90+	A+
86 – 89	A
82 – 85	A-
78 – 81	B+
74 – 77	B
70 – 73	B-
66 – 69	C+
62 – 65	C
58 – 61	C-
54 – 57	D+
50 – 53	D
<50	F