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FORMAN CHRISTIAN COLLEGE (A Chartered University)
Fall 2023
COMP302 – Theory of Automata (3 Credit Hours)
Section – A & B
Course Outline and Lesson Plan
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Instructor Information:
Name: Akheem Yousaf
Email: akheemyousaf@fccollege.edu.pk
Office: S016-D
Office Hours: by email
Pre-requisites: COMP 200

Introduction: The course introduces fundamental concepts in automata theory and formal languages including grammar, finite automaton, regular expression, formal language, pushdown automaton, and Turing machine. Not only do they form basic models of computation, they are also the foundation of many branches of computer science, e.g. compilers, software engineering, concurrent systems, etc. The properties of these models will be studied and various rigorous techniques for analyzing and comparing them will be discussed, by using both formalism and examples.

Outcomes:
At the end of this course students will be able to understand the concepts of formal languages and their identifications and applicability through their computational expressions and machines.

Course Group:
Moodle is the platform that will be used for all material uploads from instructor and for submissions of assignments and quizzes from students.

Text Book and Reference Reads:
- John C. Martin. Introduction to Languages and the Theory of Computation. Third Edition. 2003. McGraw-Hill. ISBN: 0-07-115468-X (International Students Edition).
- P. Linz. Introduction to Formal Languages and Automata, 6th edition, 2017.
- Michael Sipser, Introduction to the Theory of Computation, 3rd edition (or 1st edition), 2013, Cengage Learning.
- Automata, Computability and Complexity: Theory and Applications, by Elaine Rich, 2011.

Important to Know:

- Due Dates: All assignments are to be submitted on time. Late activities will not be graded, unless previous accommodations have been made with the course instructor.
- Missed Quizzes: There will be no retake for the quiz, unless previous accommodations have been made with the course instructor. All quizzes will be announced quizzes.
- Attendance: Students are advised to attend all lectures. It is entirely the students' responsibility to recover any information or announcements presented in the classes they have missed.

- Academic Honesty: All work that you submit in this course must be your own. University policy will be applied in case of cheating or violation of academic integrity in any assessment.

Assessment Criteria: (Tentative*)

Quizzes	**15%**
Assignments	**15%**
Mid	**30%**
Final	**40%**

In on-campus mode one group quiz and one take home group-quiz will also be taken. Few Optional* bonus activities will be given.

Tentative Lesson Plan:

Week 01	Lec 01: The Basic Concepts: Alphabet, Concatenation, Strings, Words, Languages. Lec 02: Recursive definition of languages	
Week 02	Lec 03: Operations on languages, Kleene Closure. Lec 04: Regular Languages: Regular Expressions, Languages defined by Regular Expressions.	
Week 03	Lec 05: Kleene's Theorem. Formal Proofs. Lec06: Connection between Regular Expressions and Regular Language	Assignment 01
Week 04	Lec 07: Closure Properties of Regular Languages Lec 08: Finite Automata: States, Transitions, Acceptance / Rejection, Representation by transition table.	Quiz 01
Week 05	Lec 09: Languages defined by Finite Automata. Lec 10: DFA Design Practice Session.	
Week 06	Lec 11: Nondeterministic Finite Automata Lec 12: NFA Practice Session.	
Week 07	Lec 13: NFA-null Lec 14: DFA, NFA, NFA equivalence	
	Revision and Mid-term Exam	
Week 09	Lec 17: Identifying Nonregular Languages: Pumping Lemma Lec 18: Elementary Questions about Regular Languages.	

Week 10	Lec 19: Context Free Languages: Formal definition of context-free grammar. Lec 20: Practice Session CFG's.	Assignment 02
Week 11	Lec 21: Right linear Grammars, Left Linear Grammars. Relationship with NFA and regular languages. Lec 22: Pushdown Automata and their equivalence to Context-free grammars.	Quiz 02
Week 12	Lec 23: Push Down Automata. Deterministic and Non-Deterministic. Lec 24: PDA's practice session.	
Week 13	Lec 25: Normal Forms: Chomsky Normal Form Lec 26: Properties of Context Free Languages:Pumping Lemma	Assignment 03
Week 14	Lec 27: Parsing and Ambiguity, LL and LR Parsing Lec 28: Closure Properties of Decision Algorithm for Context Free Languages	Quiz 03
Week 15	Lec 29: Turing Machines: Standard Turing Machines Lec 30: Some Algorithms (MAX, MULIPLY, ADD, etc.). Multitrack TM version introduction.	

Disclaimer: Course plan can be changed over the course of the semester. Students will be informed of the change as far in advance as possible.