Zarqa University
Faculty: Information Technology
Department of Computer Science
Course Title: Theory of Computation(1501322)

Instructor:
Lecture's time:
Semester:
Office Hours:

Course description:
This course introduces students to the mathematical foundations of computation including deterministic and non-deterministic finite automata, regular expressions, non-regular languages, context free grammars, non-context free language, pushdown automata, Turing machines, decidable and un-decidable problems, and the halting problem.

Aims of the course:

Students are expected to:

- Understand what kind of problems that can be solved by a computation?
- Understand types of finite automata and regular languages
- Understand context-free grammars and pushdown automata
- Be able to distinguish between decidable and un-decidable problems

You will also be aware of some concrete answers to these and related great questions of computer science, the reasons why some questions in this area will remain unanswered forever, and that some answers are still being sought.

Intended Learning Outcomes (ILOs):

Upon successful completion of this course, students will be able to:

A. Knowledge and Understanding

A1.Concepts and Theories:

- Define terminology commonly used in the theory of computing.
- Describe common automata, grammars, and languages, such as deterministic and nondeterministic finite automata, regular languages, context free grammars, pushdown automata, and Turing machines.
- Develop automata and grammars for specific languages.
- Prove that certain problems cannot be solved by computers and prove that certain automata cannot be constructed for specific languages.

A2.Contemporary Trends, Problems and Research:

- Understand the nature of unsolved computational problems
- Prove or disprove correctness of automaton

B. Subject-specific skills

B1. Problem solving skills:

- Find the suitable automaton for a given problem.

B2. Modeling and Design:

- Construct an automaton to accept some given language and prove its correctness.

B3.Application of Methods and Tools:

- Prove that specific problems are possible or impossible for computers to solve.

C. Critical-Thinking Skills

C1. Analytic skills:

- Distinguish between the different techniques of automata.

C2. Strategic Thinking:

- Construct a suitable automaton for a specific problem or construct a logical proof to be impossible for a precise type of automata.

C3. Creative thinking and innovation:

- Plan how to explain different ideas mathematically.

D. General and Transferable Skills (other skills relevant to employability and personal development)

D1. *Communication:* Express and communicate ideas in written and oral forms.
D2. *Teamwork and Leadership:* Be cooperative members of a team
D3. *Organizational and Developmental Skills:* Plan, prioritize, and achieve defined goals

Course Structure:

Week	Hours	ILOs	Topics	Teaching Procedure	Assessment methods
1	3	A1	Introduction, Mathematical Review	Lecturing with active participations. Problem solving. Cooperative Learning Discussion. Activities.	Class Participation and/or quiz or homework
2	3	A1	Alphabet and Languages, Regular Expressions		
3,4	6	A1, B1, B2	Deterministic Finite Automata		
5	3	A1, B1, B2	Nondeterministic Finite Automata		
6	3	A1, B1, B2, B3	Finite Automata and Regular Expressions		
7	3	A1, A2 B1, B2, B3, C1, C2	Languages that are and are not Regular		First Exam
8	3	A1, A2 B1, B2, B3, C1, C2	Context –free Grammars		Class Participation and/or quiz or homework
9	3	A1, A2 B1, B2, B3, C1, C2	Pushdown Automata		
10	3	A1, A2, B1, B2, B3, C1, C2, C3	Pushdown Automata and Context –Free Languages		
11	3	A1, A2 B1, B2, B3, C1, C2, C3	Language that are and not are Context-free		Second Exam
12	3	A1, A2, B1, B2, B3, C1,	The Definition of a Turing		Class

		C2, C3, D1, D2, D3	machine		Participation and/or quiz or homework
13, 14	4	A1, A2 B1, B2, B3, C1, C2, C3, D1, D2, D3	Undecidability		
14, 15	4	A1, A2 B1, B2, B3, C1, C2, C3, D1, D2, D3	Complexity		
16					Final Exam

References:

A. Main Textbook:

Harry R. Lewis and Christos H. Papadimitriou, Elements of theory of computation

B. Supplementary Textbook(s):

An Introduction to Formal Languages and Automata, Peter Linz, Fourth Edition, Jones and Bartlett Publishing 2006.

Assessment Methods:

Methods	Grade	Date
First Exam	20%	
Second Exam	20%	
Assignments	10%	
Final Exam	50%	