







Course Title: Theory of Computation

Course Code: 422CCS-3

Program: Bachelor of Science in Computer Science

Department: Department of Computer Science

College: Computer Science and Information System

Institution: Najran University

Version: 2.0

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Table of Contents

A. General information about the course:	3
B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods	4
C. Course Content	7
D. Students Assessment Activities	7
E. Learning Resources and Facilities	8
F. Assessment of Course Quality	8
G. Specification Approval	9





A. General information about the course:

1. Course Identification

1. Credit hours: (3)

3 (3, 0, 1) [Theory, Lab, Tutorial]

2. Course type						
Α.	□University	□College	🛛 Depa	artment	□Track	□Others
В.	☐ Required □Elective					
3. Level/year at which this course is offered: (Level 8 / Year 4)						
4. Course General Description:						

Study of abstract models of computers and computation. Finite state automata and regular languages. Pushdown automata and context-free languages. Linear bounded automata and context-sensitive grammar. Turing machines. Un-decidability and intractable problems.

5. Pre-requirements for this course (if any):

None

6. Co-requisites for this course (if any):

None

7. Course Main Objective(s):

Introduce the main concepts of automata and formal languages and the relation among and between them, and apply these concepts to design various models of computation.

2. Teaching mode (mark all that apply)

1Traditional classroom60100%2E-learning	
2 E-learning	
3 Hybrid • Traditional classroom	





No	Mode of Instruction	Contact Hours	Percentage
	• E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	45
2.	Laboratory/Studio	
3.	Field	
4.	Tutorial	15
5.	Others (specify)	
Total		60

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	Knowledge and unders	standing		
1.1	Describe the basic concepts of alphabets, strings, regular expressions, languages, derivation (leftmost and rightmost), finite state machines, pushdown automata, Turing machines, decidability, halting problems and time complexity	Kı	 TS: 1-Interactive Lectures using PowerPoint slides and explaining the essential points in more detail with the help of a whiteboard. TS: 2- Encouraging the students to use the online links to know the concepts in detail. TS: 3 – Recall the topics discussed in the last lecture by asking questions to the students. TS: 4 – Motivating students to be active during class by asking questions regularly during the lecture. TS: 5 – Associating the topics with the course learning outcomes (CLO). 	 Indirect: Students CLO Survey Direct: Quizzes. Midterm exam 1 (Exam consists of multiple- choice questions, true/false, fill in the blanks, and theoretical questions.) Final Exam





Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.2	Explain the relationships between regular expressions, different types of languages defined by grammars and abstract machines.	K ₁ , K ₃	 TS: 1-Interactive Lectures using PowerPoint slides and the whiteboard to explain the essential points in more detail. TS:2- Engaging the students in problem-based learning through tutorials TS: 3- Encouraging the students to use the online links to know the concepts in detail. TS: 4 – Recall the topics discussed in the last lecture by asking questions to the students. TS: 5 – Motivating students to be active during class by asking questions regularly during the lecture. TS: 6 – Associating the topics in each chapter with the CLO. 	Indirect: - Students CLO Survey Direct: - Quizzes. - Assignment. - Midterm exams 1 & 2 (Each exam consists of multiple- choice questions, true/false, fill in the blanks, and theoretical questions.) - Final Exam
2.0	Skills Construct finite automata, push-down automata, Turing machines and regular expressions that model different types of languages.	S1, S2, S4	 TS: 1-Interactive Lectures using PowerPoint slides and the whiteboard to explain the essential points in more detail. TS: 2- Giving students a tutorial related to automata construction. TS: 3- Motivating students to work in the home, to search from the internet, to read related reference books by giving them assignments related to automata. TS: 4 – Let students solve automata problems and give 	 Indirect: Students CLO Survey Direct: Quizzes. Assignment. Midterm exam 2 (Exam consists of multiple- choice questions, true/false, fill in the blanks, and theoretical questions.) Final Exam





Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
			corrections on their solutions during class. TS: 5 – Motivating students to be active during class by asking questions regularly during the lecture. TS: 6 – Associating the topics in each chapter with the CLO.	
2.2	Design various models of computation.	S ₁ , S ₂	 TS: 1-Interactive Lectures using PowerPoint slides and the whiteboard to explain the essential points in more detail. TS: 2- Giving students tutorials related to designing the models of computation. TS: 3- Group discussion. TS: 4 – Let students solve automata problems and give corrections on their solutions during class. 	 Indirect: Students CLO Survey Direct: Quizzes. Assignment. Midterm exams 1 & 2 (Exam consists of multiple- choice questions, true/false, fill in the blanks, and theoretical questions.) Final Exam
2.3	Assess the equivalence of DFA with NFA, PDA with context-free grammars, and regular expressions with automata.	S ₁ , S ₅	 TS: 1-Interactive Lectures using PowerPoint slides and the whiteboard to explain the essential points in more detail. TS: 2- Giving students tutorial related to deterministic automata, non- deterministic automata, automata conversion etc. TS: 3- Asking questions during the lectures to spark the student's curiosity. TS: 4- Group discussion. TS: 5- Let students solve automata problems and 	 Indirect: Students CLO Survey Direct: Quizzes. Assignment. Midterm exam 2 (Exam consists of multiple- choice questions, true/false, fill in the blanks, and theoretical questions.) Final Exam





Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
			giving correction on their solution during class.	
3.0	Values, autonomy, and	d responsibility		
3.1				
3.2				

C. Course Content

No	List of Topics	Contact Hours
1.	Automata: The Methods and the Madness	4
2.	Finite Automata	8
3.	Regular Expressions and Languages	8
4.	Properties of Regular Languages	4
5.	Context Free Grammars and Languages	8
6.	Pushdown Automata	8
7.	Introduction to Turing Machines	8
8.	Leaner bounded automata	8
9.	Un-decidability and intractable problems	4
	Total	60

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	First Assignments	2^{nd}	5%
2.	Second Assignments	5 th	5%
3.	Third Assignment	7 th	5%
4.	First Quiz	4 th	5%
5.	Second Quiz	8^{th}	5%
6.	Third Quiz	11 th	5%
7.	Midterm Exam	9 th	20%
8.	Final Exam	17 th	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).





E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	 J.E. Hopcroft, R. Motwani, J.D: Ullman, Introduction to Automata Theory, Languages, and Computation (3rd Edition), Addison Wesley, 2007.
Supportive References	 Michael Sipser, Introduction to the Theory of Computation (Second Edition), Thomas Course Technology, 2005. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education, (2000)
Electronic Materials	
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	- Classrooms to accommodate 30 students per classroom with desks and chairs
Technology equipment (projector, smart board, software)	- Data show, stationaries, and smart board
Other equipment (depending on the nature of the specialty)	- ACs for labs and classrooms

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Collecting students' suggestions to facilitate more during the class.	Students	Verbal discussion
Student's questionnaire once during the semester about course learning outcomes.	Students	Indirect Survey
Achievement percentage of course learning outcomes, direct evaluation using CLO assessment sheet	Course Instructor	Direct evaluation using CLO achievement calculation
Teaching strategies	Quality unit	Indirect
Assessment methods	Quality unit	Indirect
Instructor performance	Quality unit	Indirect
Course content	Quality unit	Indirect
Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify)		

Assessment Methods (Direct, Indirect)





G. Specification Approval

COUNCIL /COMMITTEE	Computer Science Departmental Council
REFERENCE NO.	14440203-0185-00002
DATE	1st Sep, 2022

