ALVA'S
Education Foundation

ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY

Information Science & Engineering (ISE)

Course Name: Automata Theory and Compiler Design

Course Code: 21CS51

Class / Semester: V

Dr. Sudheer Shetty
Professor & Head

2023-24

ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY

Department of Information Science & Engineering (ISE)

Faculty Details

Name	:	Dr. Sudheer Shetty
Qualification	:	B.E., M.Tech., Ph.D.
Department	:	ISE
Phone Number	:	9986030597
Email ID	:	sudheershetty06@gmail.com
Specimen Signature	:	

ALVA'S INSTITUTE OF ENGINEERING AND TECHNOLOGY

A Unit of Alva's Education Foundation (R)

(Affiliated to Visvesvaraya Technological University, Belagavi

Approved by AICTE, New Delhi & Recognised by Government of Karnataka)

Shobhavana Campus, Mijar, Moodbidri - 574 225, Mangalore, D.K., Karnataka State.

Phone : 08258-262724 (O), 262725 (P), Telefax:08258-262726

Email : principalaiet08@gmail.com, Web:www.aiet.org.in

Date: 10/04/2018

Vision Statement of the Institute:

Transformative education by pursuing excellence in Engineering and Management through enhancing skills to meet the evolving needs of the community.

Mission Statements of the Institute:

M1. To bestow quality technical education to imbibe knowledge, creativity and ethos to students community.

M2. To inculcate the best engineering practices through transformative education.

M3. To develop a knowledgeable individual for a dynamic industrial scenario.

M4. To inculcate research, entrepreneurial skills and human values in order to cater the needs of the society.

Principal
PRINCIPAL
Alva's Institute of Engg. & Technology,
Mijar, MOODBIDRI - 574 225, D.K.

Chairman
CHAIRMAN
ALVA'S EDUCATION FOUNDTION (R)
MOODBIDRI - 574 227 (D.K.)

ALVA'S INSTITUTE OF ENGINEERING AND TECHNOLOGY

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Email : principalaiet08@gmail.com, Web:www.aiet.org.in

Date: 22/06/2018

Department of Information Science and Engineering

Vision Statement:

To Impart quality learning and nurture students to become successful technocrats by achieving excellence in information science and engineering field for addressing the evolving needs of the industry as well as the society.

Mission Statements:

M1. To provide quality technical education and research training for preparing competent professionals in the Information technology field.

M2. To provide the suitable infrastructure and environment that inculcates best engineering practices for the Socio-economic development of the society.

M3. To foster the students to become successful technocrats to meet the global competency in the field of IT industry.

M4. To develop entrepreneurship skills with active research and innovation by inculcating ethical values among students.

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Mijar, MOODBIDRI - 574 225, D.K

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CHAIRMAN
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Date: 22/06/2018

Department of Information Science and Engineering

Program Educational Objectives (PEOs):

PEO1: Apply the principles of Information Science & engineering and fundamentals of mathematics to provide solutions to the societal needs.

PEO2: Pursue higher education and engage in research to meet the challenges of the latest technologies.

PEO3: Design and develop reliable software systems to satisfy the industrial needs through multidisciplinary projects.

PEO4: Able to work in various IT related fields and contribute to the society.

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Date: 22/06/2018

Department of Information Science and Engineering

Program Specific Outcomes (PSOs):

PSO1: Apply the knowledge of computer networking, database and computations to provide the solutions to the real-world engineering problems.

PSO2: Design, develop, test and maintain the software systems that satisfy the needs of the IT industry.

PSO3: Develop programs and projects using different modern software tools for industrial & scientific applications.

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ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY

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Shobhavana Campus, Mijar-574225, Moodbidri, D.K

Affiliated to VTU Belagavi and Approved by AICTE, New Delhi

(Accredited by NAAC with A+ Grade)

CALENDAR OF EVENTS (ODD SEMESTER 2023-24) BE & MBA

VISION

"Transformative education by pursuing excellence in Engineering and Management through enhancing skills to meet the evolving needs of the community"

MISSION

- To bestow quality technical education to imbibe knowledge, creativity and ethos to students community.
- To inculcate the best engineering practices through transformative education.
- To develop a knowledgeable individual for a dynamic industrial scenario.
- To inculcate research, entrepreneurial skills and human values in order to cater the needs of the society.

Week	Month	Days							Activities
		Mon	Tue	Wed	Thu	Fri	Sat	Sun	
1	SEP					15	16	17	11 : Commencement of VII Semester 15 : Commencement of I Semester 29-30 : Student Mentoring 28 : Eid Milad 25 – 30 : Technical Talk/Club and Social Activity
2		18	19	20	21	22	23	24	
3		25	26	27	28	29	30		
6	OCT							1	2 : Gandhi Jayanthi 14 : Mahalaya Amavasye 23 : Ayudhapooja 24 : Vijayadasami 25, 26, 27 - : 1st IA for VII Sem 30-31 : Student Mentoring 25 – 31: Technical Talk/Club and Social Activity
7		2	3	4	5	6	7	8	
8		9	10	11	12	13	14	15	
9		16	17	18	19	20	21	22	
10		23	24	25	26	27	28	29	
11		30	31						
12	NOV			1	2	3	4	5	1 : Kannada Rajyothsava 14 : Balipadyami 15 : Commencement of III Semester 9, 10, 11 - : 1st IA for I Sem 29-30 – Student Mentoring 24– 30 Technical Talk/Club / Social Activity 25 : Commencement of V Semester
13		6	7	8	9	10	11	12	
14		13	14	15	16	17	18	19	
15		20	21	22	23	24	25	26	
16		27	28	29	30				
17	DEC					1	2	3	1: Commencement of III Semester MBA 1, 2, 4 : 2nd IA for VII Sem 12 : Industry Tour for III Sem MBA 25 : Christmas 26, 27, 28 : 1st IA for III Sem & V Sem 29-30 : Student Mentoring 25 - 30 : Technical Talk/Club / Social Activity
18		4	5	6	7	8	9	10	
19		11	12	13	14	15	16	17	
20		18	19	20	21	22	23	24	
21		25	26	27	28	29	30	31	
22	JAN-2024	1	2	3	4	5	6	7	1, 2 3 : 2nd IA for I Sem & 3rd IA for VII Sem 10, 11, 12 : 1st IA for III Sem MBA 14 : Makar Sankranti 26 : Republic Day 27, 29, 30 : 2nd IA for III Sem & V Sem 6 : Last Working Day of I and VII Semester 30-31 : Student Mentoring 25 - 31 : Technical Talk/Club / Social Activity
23		8	9	10	11	12	13	14	
24		15	16	17	18	19	20	21	
25		22	23	24	25	26	27	28	
26		29	30	31					
28	FEB-2024				1	2	3	4	15, 16, 17 : 3rd IA for III Sem 20 : Last Working Day of III Semester 21, 22, 24 : 2nd IA for III Sem MBA 28-29 : Student Mentoring 23 - 29 : Technical Talk/Club / Social Activity
29		5	6	7	8	9	10	11	
30		12	13	14	15	16	17	18	
31		19	20	21	22	23	24	25	
32		26	27	28	29				
33	MAR - 2024					1	2	3	2, 4, 5 : 3rd IA for V Sem. 8 : Maha Shivaratri 9 : Last Working Day of V Semester
34		4	5	6	7	8	9		

Approved by IQAC Chairman/Principal

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TIME TABLE

w.e.f: 7/12/2023

DEPARTMENT: Information Science and Engineering

Academic Year	Scheme	Semester	Section	Class Coordinator	Room No
2023-24	2021	V	-	Ms. Lolakshi P K	302

TIME / DAY	9.00 To 9.50	9.50 To 10.40	10.40 To 11.00	11.00 To 11.50	11.50 To 12.40	12.40 To 1.40	1.40 To 2.30	2.30 To 3.20	3.30 To 5.00
MON	ATC	RMIP	TEA BREAK	CN	DBMS	LUNCH BREAK	AIML	ATC	APT
TUE	ATC	AIML		Soft Skills Training			DBMS	CN	EVS
WED	AIML	ATC		DBMS	CN		CN Lab		
THU	CN	AIML		Soft Skills Training			DBMS Lab		
FRI	RMIP	CN		DBMS	APT		AJS Lab		
SAT	ATC	AIML		ATC	DBMS				

Allocation of Courses

Course Code	Course Initial	Couse Title	Name of the Faculty	Faculty Initial
21CS51	ATC	Automata Theory and Compiler Design	Dr. Sudheer Shetty	SS
21CS52	CN	Computer Networks	Mr. Pradeep Nayak / Mr. Mounesh K Arkachari (Lab)	PN / MKA
21CS53	DBMS	Database Management Systems	Prof. Jayantkumar A Rathod	JAR
21CS54	AIML	Artificial Intelligence and Machine Learning	Mr. Naveen G	NG
21CSL55	DBMS Lab	Database Management Systems Laboratory with Mini Project	Prof. Jayantkumar A Rathod / Mr. Mounesh K Arkachari	JAR / MKA
21XX56	RMIP	Research Methodology & Intellectual Property Rights	Dr. Rahul Pathak	RP
21CIV57	EVS	Environmental Studies	Dr. H G Umeshchandra	HGU
21CSL581	AJS Lab	Angular JS	Ms. Lolakshi P K / Dr. Sudheer Shetty	LPK / SS
	APT	Aptitude	Mr. Pradeep Nayak	PN
	SST	Soft Skills Training	Aerodynamiks	

Timetable Coordinator | HOD | Dean Academics | Principal

H.O.D.
Dept. Of Information Science & Engineering
Alva's Institute of Engg. & Technology

PRINCIPAL
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Individual Faculty Time Table

DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

Academic Year	2023-24	Faculty Name	Dr. Sudheer Shetty
Semester	Odd	Designation	Professor & HoD

Time / Day	9.00 To 9.50	9.50 To 10.40	11.00 To 11.50	11.50 To 12.40		1.40 To 2.30	2.30 To 3.20	3.30 To 5.00
MON	ATC				LUNCH BREAK	~~ATC~~	ATC	
TUE	ATC							
WED		ATC						
THU								
FRI		OS Lab (IoT)				AN Lab		
SAT	ATC		ATC					

UNITS:	Theory: 10	LAB: 6	Others: 10	TOTAL UNITS: 26

Allocation of Subjects

21CS51	Automata Theory and Compiler Design
21CSL581	Angular JS and Node JS
BCS303	Operating Systems (Lab-IoT)

Time Table Coordinator

Head of the Department

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Information Science and Engineering

Scheme of Teaching and Examinations 2021

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2021 - 22)

V SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	BSC 21CS51	Automata Theory and compiler Design	Any CS Board Department	3	0	0		03	50	50	100	3
2	IPCC 21CS52	Computer Networks		3	0	2		03	50	50	100	4
3	PCC 21CS53	Database Management Systems		3	0	0		03	50	50	100	3
4	PCC 21CS54	Artificial Intelligence and Machine Learning		3	0	0		03	50	50	100	3
5	PCC 21CSL55	Database Management Systems Laboratory with Mini Project		0	0	2		03	50	50	100	1
6	AEC 21XX56	Research Methodology & Intellectual Property Rights	TD: Any Department PSB: As identified by university	2	0	0		02	50	50	100	2
7	HSMC 21CIV57	Environmental Studies	TD: Civil/ Environmental /Chemistry/ Biotech. PSB: Civil Engg	1	0	0		1	50	50	100	1
8	AEC 21CS58X/21 CSL58X	Ability Enhancement Course-V	Concerned Board	If offered as Theory courses: 1	0	0		01	50	50	100	1
				If offered as lab. courses: 0	0	2		02				
								Total	400	400	800	18

Ability Enhancement Course - IV

21CSL581	Angular JS and Node JS	21CS583	
21CS582	C# and .Net Framework	21CS584	

Note: BSC: Basic Science Course, PCC: Professional Core Course, IPCC: Integrated Professional Core Course, AEC –Ability Enhancement Course INT – Internship, HSMC: Humanity and Social Science & Management Courses.
L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Integrated Professional Core Course (IPCC): refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). Theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

V Semester

AUTOMATA THEORY AND COMPILER DESIGN			
Course Code	**21CS51**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. Introduce the fundamental concepts of Automata Theory, Formal Languages and compiler design
CLO 2. Principles Demonstrate Application of Automata Theory and Formal Languages in the field of compiler design
CLO 3. Develop understanding of computation through Push Down Automata and Turing Machines
CLO 4. Introduce activities carried out in different phases of Phases compiler
CLO 5. Identify the undecidability problems.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) needs not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different approaches and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction to Automata Theory: Central Concepts of Automata theory, Deterministic Finite Automata(DFA), Non- Deterministic Finite Automata(NFA) ,Epsilon- NFA, NFA to DFA Conversion, Minimization of DFA

Introduction to Compiler Design: Language Processors, Phases of Compilers

Textbook 1: Chapter1 – 1.5, Chapter2 – 2.2,2.3,2.5 Chapter4 –4.4
Textbook 2: Chapter1 – 1.1 and 1.2

Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning

Module-2

Regular Expressions and Languages: Regular Expressions, Finite Automata and Regular Expressions, Proving Languages Not to Be Regular

Lexical Analysis Phase of compiler Design: Role of Lexical Analyzer, Input Buffering , Specification of Token, Recognition of Token.

Textbook 1: Chapter3 – 3.1, 3.2, Chapter4- 4.1

Textbook 2: Chapter3- 3.1 to 3.4	
Teaching-Learning Process	Chalk and board, Active Learning, Demonstration
Module-3	
Context Free Grammars: Definition and designing CFGs, Derivations Using a Grammar, Parse Trees, Ambiguity and Elimination of Ambiguity, Elimination of Left Recursion, Left Factoring. **Syntax Analysis Phase of Compilers: part-1:** Role of Parser , Top-Down Parsing **Textbook 1: Chapter 5 – 5.1.1 to 5.1.6, 5.2 (5.2.1, 5.2.2), 5.4** **Textbook 2: Chapter 4 – 4.1, 4.2, 4.3 (4.3.2 to 4.3.4) ,4.4**	
Teaching-Learning Process	**Chalk and board, Problem based learning, Demonstration**
Module-4	
Push Down Automata: Definition of the Pushdown Automata, The Languages of a PDA. **Syntax Analysis Phase of Compilers: Part-2:** Bottom-up Parsing, Introduction to LR Parsing: SLR, More Powerful LR parsers **Textbook1: Chapter 6 – 6.1, 6.2** **Textbook2: Chapter 4 – 4.5, 4.6, 4.7 (Up to 4.7.4)**	
Teaching-Learning Process	Chalk & board, Problem based learning
Module-5	
Introduction to Turing Machine: Problems that Computers Cannot Solve, The Turing machine, problems, Programming Techniques for Turing Machine, Extensions to the Basic Turing Machine **Undecidability :** A language That Is Not Recursively Enumerable, An Undecidable Problem That Is RE. **Other Phases of Compilers: Syntax Directed Translation-** Syntax-Directed Definitions, Evaluation Orders for SDD's. **Intermediate-Code Generation-** Variants of Syntax Trees, Three-Address Code. **Code Generation-** Issues in the Design of a Code Generator **Textbook1: Chapter 8 – 8.1, 8.2,8.3,8.4 Chapter 9 – 9.1,9.2** **Textbook2: Chapter 5 – 5.1, 5.2, Chapter 6- 6.1,6.2 Chapter 8- 8.1**	
Teaching-Learning Process	**Chalk and board, MOOC**

Course Outcomes

At the end of the course the student will be able to:

CO 1. Acquire fundamental understanding of the core concepts in automata theory and Theory of Computation

CO 2. Design and develop lexical analyzers, parsers and code generators

CO 3. Design Grammars and Automata (recognizers) for different language classes and become knowledgeable about restricted models of Computation (Regular, Context Free) and their relative powers.

CO 4. Acquire fundamental understanding of the structure of a Compiler and Apply concepts automata theory and Theory of Computation to design Compilers

CO 5. Design computations models for problems in Automata theory and adaptation of such model in the field of compilers

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination

(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

1. First assignment at the end of 4th week of the semester
2. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

1. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have a less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. John E Hopcroft, Rajeev Motwani, Jeffrey D. Ullman," Introduction to Automata Theory, Languages and Computation", Third Edition, Pearson.
2. Alfred V.Aho, Monica S.Lam,Ravi Sethi, Jeffrey D. Ullman, " Compilers Principles, Techniques and Tools", Second Edition,Perason.

Reference:

1. Elain Rich, "Automata,Computability and complexity", 1st Edition, Pearson Education,2018.
2. K.L.P Mishra, N Chandrashekaran , 3rd Edition , "Theory of Computer Science",PHI,2012.
3. Peter Linz, "An introduction to Formal Languages and Automata ", 3rd Edition, Narosa Publishers,1998.
4. K Muneeswaran, "Compiler Design", Oxford University Press 2013.

Weblinks and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/106/106/106106049/#
2. https://nptel.ac.in/courses/106/104/106104123/
3. https://www.jflap.org/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Group Activities, quizzes, Puzzles and presentations

SEMESTER V

Course Code: **21CS51**	Course Name: **Automata Theory and Compiler Design**
Course Teacher: **Dr. Sudheer Shetty**	

Course Outcomes: After studying this course, students will be able to:

CO Numbers	Course Outcomes	Blooms Level	Target Level
21CS51.1	**Explain** the fundamental concepts of automata theory & compilers and **design** & minimize Finite Automata.	L3	2
21CS51.2	**Design** regular expressions, classify the languages as regular or non-regular and **design** lexical analyzers.	L3	2
21CS51.3	**Design** grammars for different language classes and **design** top-down parsers for the grammars.	L3	2
21CS51.4	**Design** push down automata for different language classes and **design** bottom-up parsers for the grammars.	L3	2
21CS51.5	**Develop** computational models using Turing machines for various classes of languages and **design** back end of the compiler including code generator.	L3	2

CO-PO/CO-PSO Mapping Matrix:

CO Numbers	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
21CS51.1	2	1	1	1								1	1		
21CS51.2	2	2	2	2								1	1		
21CS51.3	2	2	2	1								1	2		
21CS51.4	2	2	2	2								1	1		
21CS51.5	2	2	1	1								1	1		
AVG	2	1.8	1.6	1.4								1	1.2		

CO-PO/CO-PSO Mapping Matrix Justification

CO Numbers	PO/ PSO Numbers	Justification
21CS51.1	PO1	The knowledge of mathematical principles will help the students to apply the same to formulate solutions for engineering problems.
	PO2	The knowledge of mathematical principles will help the students to apply the same to identify and analyze engineering problems.
	PO3	Thorough understanding of basic principles of automata will help in the design and development of abstract models for computational problem and also compilers.
	PO4	Study of automata with examples will help in conducting investigation of engineering problems.
	PO12	The basic principles of automata theory and computation helps in life-long learning.
	PSO1	Solve real world problems & design compilers by suitable computational models.
21CS51.2	PO1	The knowledge of mathematical principles will help the students to apply the same to formulate solutions for engineering problems involving regular expressions.
	PO2	The knowledge of mathematical principles will help the students to apply the same to identify and analyze engineering problems involving regular expressions such as design of lexical analyzers.
	PO3	Thorough understanding of basic principles of regular expressions will

		help in the design and development of lexical analyzers.
	PO4	Study of regular expressions with examples will help in conducting investigation of engineering problems.
	PO12	The concept of regular expressions helps in life-long learning.
	PSO1	Solve real world problems like design of lexical analyzers by suitable computational models like regular expressions.
21CS51.3	PO1	The knowledge of mathematical principles will help the students to apply the same to formulate solutions for engineering problems involving grammars.
	PO2	The knowledge of mathematical principles will help the students to apply the same to identify and analyze engineering problems involving grammars such as design of top-down parsers.
	PO3	Thorough understanding of basic principles of grammars will help in the design and development of abstract models for computational problem.
	PO4	Study of grammars with examples will help in conducting investigation of engineering problems.
	PO12	The basic principles of grammars helps in life-long learning.
	PSO1	Solve real world problems like design of top-down parsers by suitable computational models like grammars.
21CS51.4	PO1	The knowledge of mathematical principles will help the students to apply the same to formulate solutions for engineering problems involving the concept of push down automata.
	PO2	The knowledge of mathematical principles will help the students to apply the same to identify and analyze engineering problems involving the concept of push down automata.
	PO3	Thorough understanding of principles of push down automata will help in the design and development of abstract models for computational problem.
	PO4	Study of push down automata with examples will help in conducting investigation of engineering problems.
	PO12	The concepts of push down automata requires for life-long learning.
	PSO1	Solve real world problems like design of bottom-up parsers by suitable computational models.
21CS51.5	PO1	Understanding the different categories of basic computational problems will aid in applying the knowledge to find solutions of problems.
	PO2	Different computational problems can be identified, formulated, reviewed and conclusions can be reached.
	PO3	Complexity study of the basic computational problems will help in design and development of solutions for real time computational problems.
	PO4	Study of Turing machine and their associated complexity will help to provide valid conclusions of real time computational problems.
	PO12	Knowledge of different models of Turing machine helps in life-long learning.
	PSO1	Design of back end of the compiler by suitable computational models.

25/10/23
Course Teacher
Signature with date

25/10/23
IQAC Member
Signature with date

25/10/23
IQAC Chairman
Signature with date

ALVA'S INSTITUTE OF ENGINEERING AND TECHNOLOGY

SHOBHAVANA CAMPUS, MIJAR, MOODBIDRI – 574 225

DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

Student List **V Semester** **Academic Year 2023-24**

SN	USN	NAME	Scheme
1	4AL21IS001	ADITHYA TEJASWI D	2021
2	4AL21IS002	AFIZA A	2021
3	4AL21IS003	AISHWARYA SALIMATH	2021
4	4AL21IS004	AKASH DEVADIGA	2021
5	4AL21IS005	AMAR B M	2021
6	4AL21IS006	ANAGHA UDUPA Y N	2021
7	4AL21IS007	ANANYA	2021
8	4AL21IS008	ANIRUDH KAMATH K	2021
9	4AL21IS009	ANKITHA B	2021
10	4AL21IS010	BHAGYASHREE R PUJARI	2021
11	4AL21IS011	BHARATH J	2021
12	4AL21IS012	BHUMIKA SUNIL KULKARNI	2021
13	4AL21IS013	CHAITRA S KODDADDI	2021
14	4AL21IS014	CHANDAN M N	2021
15	4AL21IS015	CHINDAN B V	2021
16	4AL21IS017	GOWRISH N	2021
17	4AL21IS018	HARSHITHA B	2021
18	4AL21IS019	JAHNAVI	2021
19	4AL21IS020	KARTHIK MADAKARI T P	2021
20	4AL21IS021	KELVIN DMELLO	2021
21	4AL21IS022	KOUSHIK ACHAR	2021
22	4AL21IS023	KRUPASHREE R	2021
23	4AL21IS024	LAYA R	2021
24	4AL21IS025	MANIKANTA	2021
25	4AL21IS026	MANISH K	2021
26	4AL21IS027	MANJUNATH R	2021
27	4AL21IS029	MANOJ M U	2021
28	4AL21IS030	MOHAMMED ADIL	2021
29	4AL21IS031	MOHAMMED RIHAN	2021
30	4AL21IS032	MUHAMMED YAMIN SHARFUDDIN	2021
31	4AL21IS033	NANDAN S	2021
32	4AL21IS034	NISHANT KUMAR	2021

33	4AL21IS035	PRAGATHI G GOWDA	2021
34	4AL21IS036	PRAJNA	2021
35	4AL21IS037	PRAJWAL GOWDA H G	2021
36	4AL21IS038	PRASHANTH KUMAR B C	2021
37	4AL21IS039	PREETHAM BYADAGI	2021
38	4AL21IS040	R SREEJITH	2021
39	4AL21IS041	RANJITH	2021
40	4AL21IS042	SANJAY G K	2021
41	4AL21IS043	SANNIDHI K S	2021
42	4AL21IS044	SAPTHAMI	2021
43	4AL21IS045	SARTHAK K JAIN	2021
44	4AL21IS046	SATEESH DYAVAPPA SATYANNAVAR	2021
45	4AL21IS047	SATHWIK K D	2021
46	4AL21IS048	SHARAVI R RAI	2021
47	4AL21IS049	SHASHIDHAR MAHADEV PATGAR	2021
48	4AL21IS050	SHRAVAN R POOJARY	2021
49	4AL21IS051	SHRAVITHA	2021
50	4AL21IS052	SHREYA RAI	2021
51	4AL21IS053	SHRUJAN KUMAR H V	2021
52	4AL21IS054	SOORAJ	2021
53	4AL21IS055	SRIDEEKSHA G	2021
54	4AL21IS056	SRIKANTH RAJU SRINIVAS	2021
55	4AL21IS057	SRUJAN K M	2021
56	4AL21IS058	SRUSTI P S	2021
57	4AL21IS059	SUVAN P KEDILAYA	2021
58	4AL21IS060	SUVARNA ARVINKANTH HARISH	2021
59	4AL21IS061	SYED SALEHA	2021
60	4AL21IS062	VASAVI RAI C	2021
61	4AL21IS063	VITHIKA SHETTY	2021
62	4AL21IS064	CHANDANA N M	2021
63	4AL22IS400	ANKITH	2021
64	4AL22IS401	CHARAN S V	2021
65	4AL22IS402	CHETAN BYAHATTI	2021
66	4AL22IS403	LOHITH H	2021
67	4AL22IS404	NAMRATHA J SHETTY	2021
68	4AL22IS405	RAHUL P SHETTY	2021

USN | | | | | | | | | | |

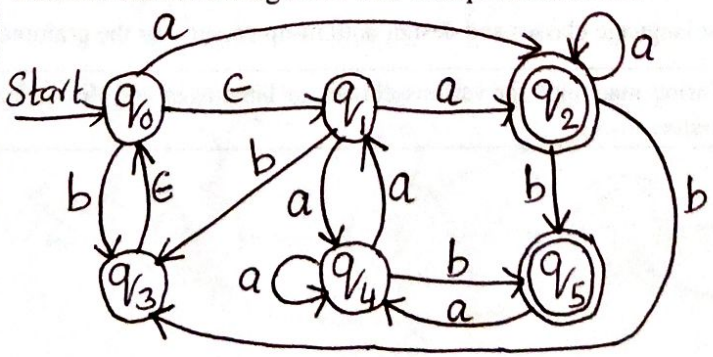
Alva's Institute of Engineering & Technology, Moodbidri

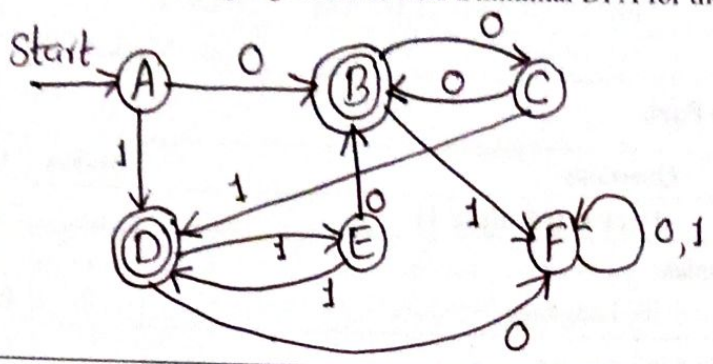
Department of Information Science & Engineering

Continuous Internal Evaluation Test-I ODD Semester 2023-24

Course Title : Automata Theory and Compiler Design		Course Code: 21CS51
Date: 01/01/2024	Time: 9.30 AM- 11.00 AM	Semester: V
Faculty: Dr. Sudheer Shetty		Max. Marks: 20

Note: Answer ONE question from each Part.

Q. No.		Questions	Marks	COs	BTL
		Part A (Module 1)			
1	a)	Define the following with examples. i) Alphabet ii) Language	2	CO1	L2
	b)	Design DFAs to accept the following languages. i) The set of strings containing the substring 'ab' on $\sum = \{a, b\}$. ii) $L = \{w \in \{0, 1\}^*$: w has even number of 0's and odd number of 1's$\}$. iii) The set of strings not ending with '101'.	7	CO1	L3
	c)	Design NFAs or ϵ-NFAs to accept the following languages. i) Set of strings whose third symbol from the right end is 'a' on $\sum=\{a, b\}$ ii) $L = \{w \in \{0, 1\}^* \mid w = 1101$ or $\lvert w\rvert$ is odd$\}$.	3	CO1	L3
		OR			
2	a)	Define the following with examples. i) String ii) Power of an alphabet	2	CO1	L2
	b)	Design DFAs to accept the following languages. i) The set of strings ending in '01' on $\sum = \{0, 1\}$. ii) $L = \{w \in \{a, b\}^*: n_b(w) \bmod 3 = 0\}$. iii) $L = \{w \in \{0, 1\}^*$: every '0' is immediately followed by a '1'$\}$.	7	CO1	L3
	c)	Design NFAs or ϵ-NFAs to accept the following languages. i) The set of strings beginning with 'ab' on $\sum = \{a, b\}$. ii) $L = \{w \in \{0, 1\}^* \mid$ w is made up of an optional '1' followed by '01' followed by zero or more 0's$\}$.	3	CO1	L3
		Part B (Module 1 & 2)			
3	a)	Convert the following NFA into an equivalent DFA.  	5	CO1	L3

	b)	Design Regular Expressions to accept the following languages. (i) Third character from the right end is '0' and fifth one is '1' (ii) L = {w ∈ {a, b}* | |w| mod 3 = 0}. (iii) L = {w ∈ {0, 1}* | w has no pair of consecutive zeroes}.	3	CO2	L3
		OR			
4	a)	Use the table-filling algorithm to find a minimal DFA for the following.  	3	CO1	L3
	b)	Write the Block diagram of the Language Processing system and briefly explain the function of each component of it.	2	CO1	L2
	c)	Design Regular Expressions to accept the following languages. i) Strings of 0's and 1's ending with either '01' or '00'. ii) L = {$a^n b^m$ | n ≥ 4, m ≤ 3} iii) L = {w ∈ {0, 1}* | w has exactly one pair of consecutive zeroes}.	3	CO2	L3

Levels of Bloom's Taxonomy

No.	L1	L2	L3	L4	L5	L6
Level	Remember	Understand	Apply	Analyze	Evaluate	Create

Course Outcomes

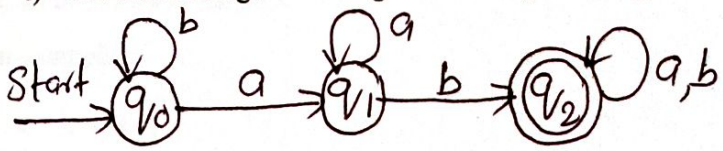
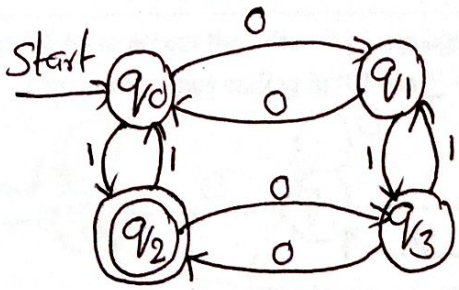
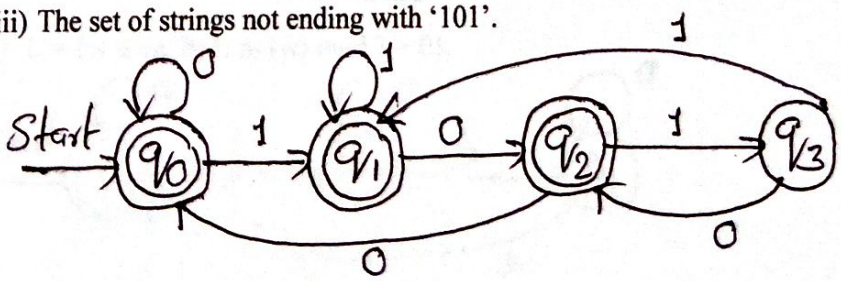
CO1	Explain the fundamental concepts of automata theory & compilers and design & minimize Finite Automata.	L3
CO2	Design regular expressions, classify the languages as regular or non-regular and design lexical analyzers.	L3
CO3	Design grammars for different language classes and design top-down parsers for the grammars.	L3
CO4	Design push down automata for different language classes and design bottom-up parsers for the grammars.	L3
CO5	Develop computational models using Turing machines for various classes of languages and design back end of the compiler including code generator.	L3

Alva's Institute of Engineering & Technology, Moodbidri

Department of Information Science & Engineering

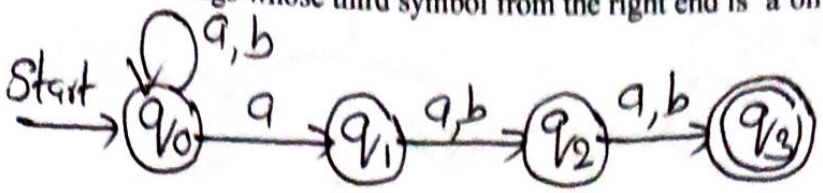
Scheme of Evaluation CIE Test-I ODD Semester 2023-24

Course Title : Automata Theory and Compiler Design		Course Code: 21CS51
Date: 01/01/2024	Time: 9.30 AM- 11.00 AM	Semester: V
Faculty: Dr. Sudheer Shetty		Max. Marks: 30

Q. No.		Solutions	Marks
1	a)	Define the following with examples. i) Alphabet ii) Language An **alphabet** is a finite, nonempty set of symbols. Typically, we use the symbol Σ to refer to an alphabet. Example ∑ = {a, b, c, d} is an alphabet set where 'a', 'b', 'c', and 'd' are symbols. A set of strings all of which are chosen form some ∑*, where ∑ is a particular alphabet, is called a **language.** Example: • The language of all stings consisting of n 0's followed by n 1's, for some n ≥ 0: {ε, 01, 0011, 000111, ...}. • The set of strings of 0's and 1's with an equal number of each: {ε, 01, 10, 0011, 0101, 1001, 1010, ...}.	02
	b)	Design DFAs to accept the following languages. i) The set of strings containing the substring 'ab' on ∑ = {a, b}.  ii) L = {w ∈ {0, 1}*: w has even number of 0's and odd number of 1's}.  iii) The set of strings not ending with '101'. 	02 02 03

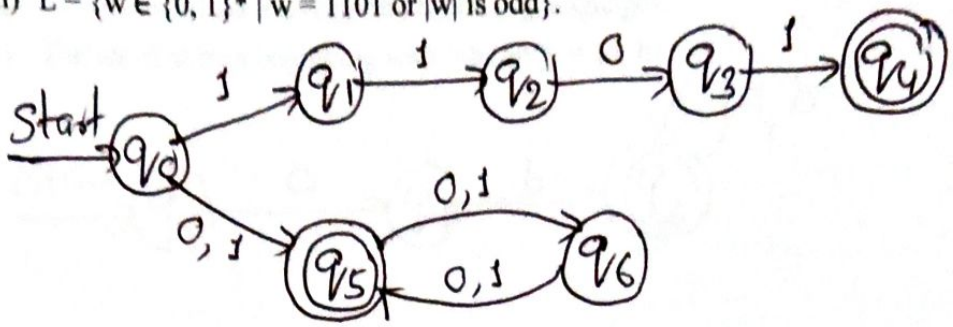
c) Design NFAs or ϵ-NFAs to accept the following languages.

i) Set of strings whose third symbol from the right end is 'a' on $\Sigma = \{a, b\}$



1·5

ii) $L = \{w \in \{0, 1\}^* \mid w = 1101 \text{ or } |w| \text{ is odd}\}$.



1·5

2 a) Define the following with examples.

i) String ii) Power of an alphabet

02

A **string** is defined as a sequence of symbols of finite length. A string is denoted by w in automata. Example, 000111 is a binary string over binary alphabet.

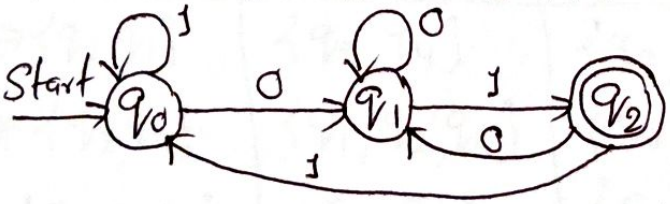
If Σ is an alphabet, the set of all strings can be expressed as a certain length from that alphabet by using exponential notation. The **power of an alphabet** is denoted by Σ^k and is the set of strings of length k.

For example,

- $\Sigma = \{0,1\}$
- $\Sigma^1 = \{0,1\}$
- $\Sigma^2 = \{00,01,10,11\}$
- $\Sigma^3 = \{000,001,010,011,100,101,110,111\}$

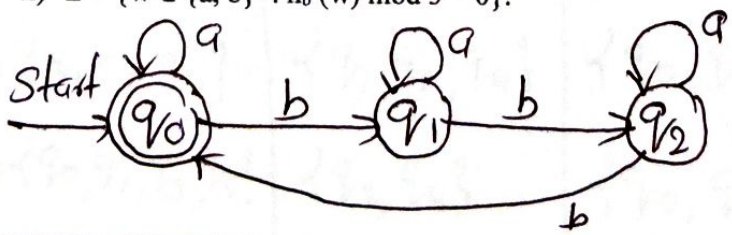
b) Design DFAs to accept the following languages.

i) The set of strings ending in '01' on $\Sigma = \{0, 1\}$.



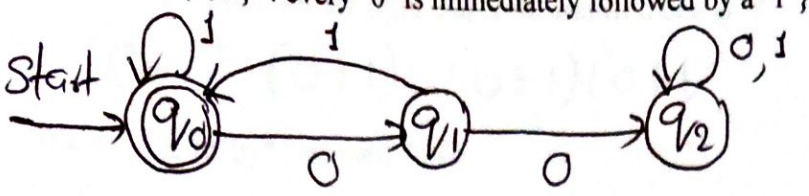
02

ii) $L = \{w \in \{a, b\}^* : n_b(w) \bmod 3 = 0\}$.



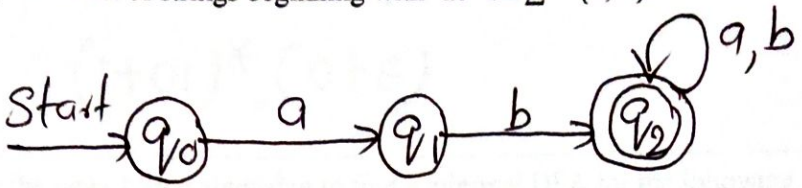
02

iii) L = {w ∈ {0, 1}*: every '0' is immediately followed by a '1'}. 03

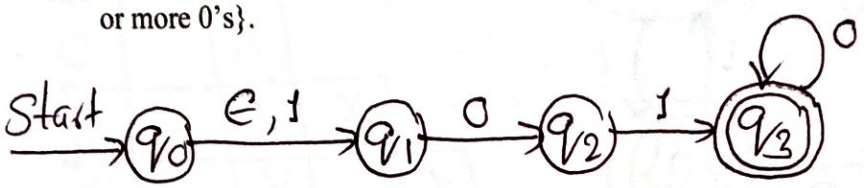


c) Design NFAs or ϵ-NFAs to accept the following languages.

i) The set of strings beginning with 'ab' on ∑ = {a, b}. 1.5

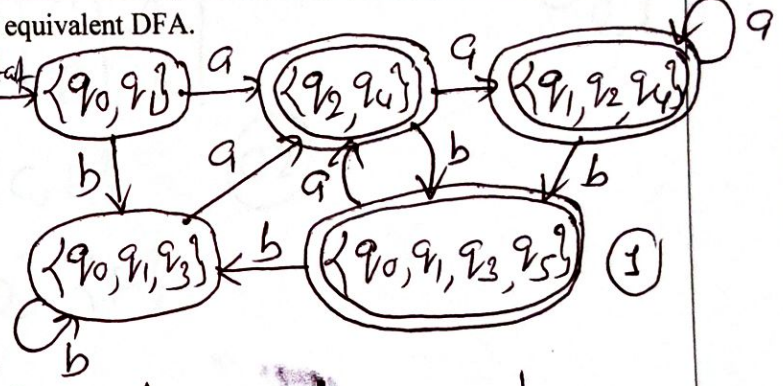


ii) L = {w ∈ {0, 1}* | w is made up of an optional '1' followed by '01' followed by zero or more 0's}. 1.5



3 a) Convert the following NFA into an equivalent DFA.

ECLOSE(q_0) = {q_0, q_1}
ECLOSE(q_1) = {q_1}
ECLOSE(q_2) = {q_2}
1 ECLOSE(q_3) = {q_0, q_1, q_3}
ECLOSE(q_4) = {q_4}
ECLOSE(q_5) = {q_5}



δ	a	b
→ {q_0, q_1}	{q_2, q_4}	{q_0, q_1, q_3}
* {q_2, q_4}	{q_1, q_2, q_4}	{q_0, q_1, q_3, q_5}
{q_0, q_1, q_3}	{q_2, q_4}	{q_0, q_1, q_3}
* {q_1, q_2, q_4}	{q_1, q_2, q_4}	{q_0, q_1, q_3, q_5}
* {q_0, q_1, q_3, q_5}	{q_2, q_4}	{q_0, q_1, q_3}

3 marks

b) Design Regular Expressions to accept the following languages.

(i) Third character from the right end is '0' and fifth one is '1'

$(0+1)^* 1 (0+1) 0 (0+1)(0+1)$ 01

(ii) L = {w ∈ {a, b}* | |w| mod 3 =0}.

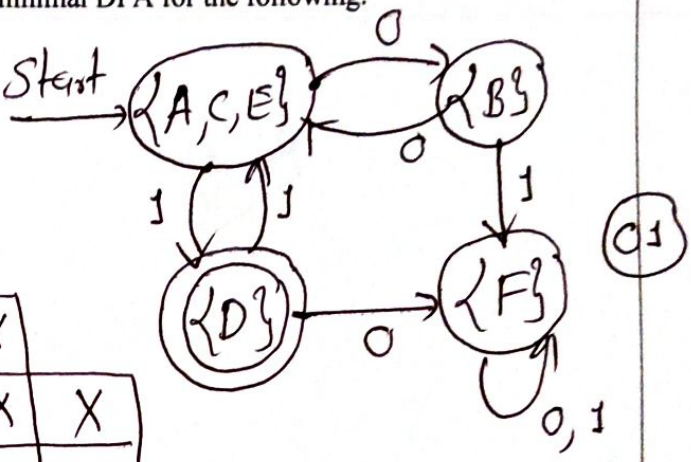
$((a+b)(a+b)(a+b))^*$ 01

(iii) L = {w ε {0, 1}* | w has no pair of consecutive zeroes}.

$(1+01)^* (0+\epsilon)$ 01

4 a) Use the table-filling algorithm to find a minimal DFA for the following.

* B	X				
C		X			
* D	X	X	X		
E		X		X	
F	X	X	X	X	X
	A	B	C	D	E



01

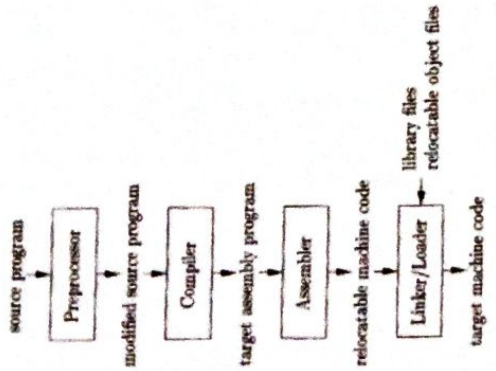
02

{A,C}, {A,E}, {C,E}

{A,C,E}, {B}, {D}, {F}

Blocks

b) Write the Block diagram of the Language Processing system and briefly explain the function of each component of it.



01

Explanation – 01 mark

b)	Design Regular Expressions to accept the following languages. i) Strings of 0's and 1's ending with either '01' or '00'. $(0+1)^*(01+00)$		01
	ii) $L = \{a^n b^m \mid n \geq 4, m \leq 3\}$ $aaaaa^*(\epsilon + b + bb + bbb)$		01
	iii) $L = \{w \in \{0, 1\}^* \mid w$ has exactly one pair of consecutive zeroes$\}$. $(1+01)^* 00 (10+1)^*$		01

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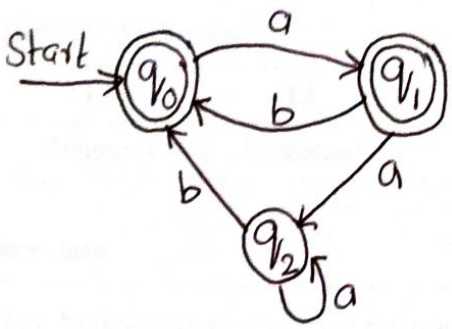
Alva's Institute of Engineering & Technology, Moodbidri

Department of Information Science & Engineering

Continuous Internal Evaluation Test-II ODD Semester 2023-24

Course Title : Automata Theory and Compiler Design		Course Code: 21CS51
Date: 08/02/2024	Time: 9.30 AM- 11.00 AM	Semester: V
Faculty: Dr. Sudheer Shetty		Max. Marks: 20

Note: Answer ONE question from each Part.

Q. No.		Questions	Marks	COs	BTL
		Part A (Module 2)			
1	a)	Prove that if L = L(A) for some DFA A, then there is a regular expression R such that L = L(R).	4	CO2	L2
	b)	Show that the language $L = \{ww^R : w \in (0+1)^*\}$ is not regular.	3	CO2	L3
	c)	Build the transition diagram that recognizes the lexemes matching the token relop (relational operator).	2	CO2	L2
		OR			
2	a)	State and prove the pumping lemma for regular languages.	4	CO2	L2
	b)	Build regular expression for the following finite automaton using state elimination technique. 	3	CO2	L3
	c)	Explain the concept of input buffering in building the lexical analyzers.	2	CO2	L2
		Part B (Module 3)			
3	a)	Build the Context-free Grammars (CFG) for the following languages. i) $L = \{ a^i b^j c^k \mid j = i + k, i, k \geq 0 \}$ ii) Strings containing exactly one '0' on $\Sigma = \{0, 1\}$	3	CO3	L3
	b)	Given the following CFG. $S \rightarrow AaAb \mid BbBa$ $A \rightarrow aAb \mid bAB \mid d$ $B \rightarrow aB \mid bBa \mid \varepsilon$ Construct the left most derivation (LMD), rightmost derivation (RMD) and parse tree for the sentence 'badbabaadb'.	3	CO3	L3

	c)	Design LL(1) parser for the following grammar after eliminating the left recursion if any from it. $E \rightarrow E + T \mid T$ $T \rightarrow T * F \mid F$ $F \rightarrow (E) \mid id$	5	CO3	L3
		OR			
4	a)	Build the Context-free Grammars (CFG) for the following languages. i) $L = \{ a^i b^j c^k \mid k = i + j, i, j \geq 0 \}$ ii) Strings having substring '01'.	3	CO3	L3
	b)	Given the following CFG. $E \rightarrow E + T \mid T$ $T \rightarrow T * F \mid F$ $F \rightarrow (E) \mid a \mid b \mid c$ Construct the left most derivation (LMD), rightmost derivation (RMD) and parse tree for the sentence (a) + b * c.	3	CO3	L3
	c)	Design LL(1) parser for the following grammar after eliminating the left recursion if any from it. Also, show the sequence of steps involved in parsing the string ((a , a) , a). $S \rightarrow (L) \mid a$ $L \rightarrow L , S \mid S$	5	CO3	L3

Levels of Bloom's Taxonomy

No.	L1	L2	L3	L4	L5	L6
Level	Remember	Understand	Apply	Analyze	Evaluate	Create

Course Outcomes

CO1	Explain the fundamental concepts of automata theory & compilers and design & minimize finite automata.	L3
CO2	Design regular expressions, classify the languages as regular or non-regular and design lexical analyzers.	L3
CO3	Design grammars for different language classes and design top-down parsers for the grammars.	L3
CO4	Design push down automata for different language classes and design bottom-up parsers for the grammars.	L3
CO5	Develop computational models using Turing machines for various classes of languages and design back end of the compiler including code generator.	L3

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Alva's Institute of Engineering & Technology, Moodbidri

Department of Information Science & Engineering

Continuous Internal Evaluation Test-III ODD Semester 2023-24

Course Title : Automata Theory and Compiler Design		Course Code: 21CS51
Date: 11/03/2024	Time: 9.30 AM- 11.00 AM	Semester: V
Faculty: Dr. Sudheer Shetty		Max. Marks: 20

Note: Answer ONE question from each Part.

Q. No.		Questions	Marks	COs	BTL
		Part A (Module 4)			
1	a)	Define a Push Down Automata (PDA). Also, design a PDA to accept the Language $L = \{a^n b^n \mid n \geq 0\}$. Draw the transition diagram for the constructed PDA. Show the moves made by this PDA for the input string 'aabb'.	5	CO4	L3
	b)	Design an SLR(1) parsing table for the following grammar. $E \rightarrow E + T \mid T$ $T \rightarrow T * F \mid F$ $F \rightarrow (E) \mid id$	8	CO4	L3
		OR			
2	a)	Design an NPDA to accept the Language $L = \{ww^R \mid w \in \{0, 1\}^*\}$. Draw the transition diagram for the constructed NPDA. Also, show the moves made by this NPDA for the input string '0110'.	5	CO4	L3
	b)	Design a Canonical LR(1) parsing table for the following grammar. $S' \rightarrow S$ $S \rightarrow C C$ $C \rightarrow c C \mid d$	8	CO4	L3
		Part B (Module 5)			
3	a)	Explain the working of Turing Machine with a neat block diagram. Also, design a Turing Machine to accept the language $L = \{0^n 1^n \mid n \geq 1\}$. Draw the transition diagram. Show the moves made by the Turing Machine for the input string '0011'.	7	CO5	L3
		OR			
4	a)	Design a Turing Machine to accept the language $L = \{a^n b^n c^n \mid n \geq 1\}$. Draw the transition diagram. Also, show the moves made by the Turing Machine for the input string 'aabbcc'.	7	CO5	L3

Levels of Bloom's Taxonomy

No.	L1	L2	L3	L4	L5	L6
Level	Remember	Understand	Apply	Analyze	Evaluate	Create

Course Outcomes

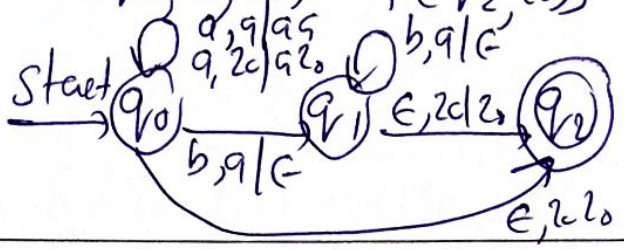
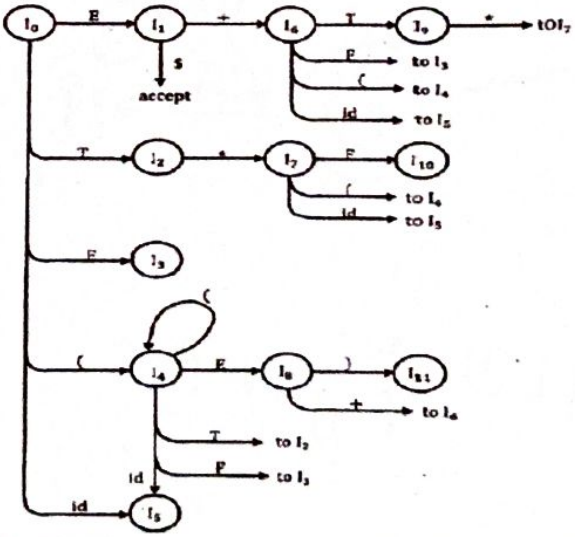
CO1	Explain the fundamental concepts of automata theory & compilers and design & minimize finite automata.	**L3**
CO2	Design regular expressions, classify the languages as regular or non-regular and design lexical analyzers.	**L3**
CO3	Design grammars for different language classes and design top-down parsers for the grammars.	**L3**
CO4	Design push down automata for different language classes and design bottom-up parsers for the grammars.	**L3**
CO5	Develop computational models using Turing machines for various classes of languages and design back end of the compiler including code generator.	**L3**

Alva's Institute of Engineering & Technology, Moodbidri

Department of Information Science & Engineering

Scheme of Evaluation CIE Test-III ODD Semester 2023-24

Course Title : Automata Theory and Compiler Design		Course Code: 21CS51
Date: 11/03/2024	Time: 9.30 AM- 11.00 AM	Semester: V
Faculty: Dr. Sudheer Shetty		Max. Marks: 20

Q. No.		Questions	Marks
1	a)	Define a Push Down Automata (PDA). Also, design a PDA to accept the Language $L = \{a^n b^n \mid n \geq 0\}$. Draw the transition diagram for the constructed PDA. Show the moves made by this PDA for the input string 'aabb'.	
		Definition of PDA	01
		$\delta(q_0, a, z_0) = \{(q_0, az_0)\}$ $\delta(q_0, a, a) = \{(q_0, aa)\}$ $\delta(q_0, b, a) = \{(q_1, \epsilon)\}$ $\delta(q_1, b, a) = \{(q_1, \epsilon)\}$	02
		$\delta(q_1, \epsilon, z_0) = \{(q_2, z_0)\}$ $\delta(q_0, \epsilon, z_0) = \{(q_2, z_0)\}$	01
			
		Moves for the i/p string	01
	b)	Design an SLR(1) parsing table for the following grammar. $E \rightarrow E + T \mid T$ $T \rightarrow T * F \mid F$ $F \rightarrow (E) \mid id$	
		Steps –	04
		1. $E \rightarrow E + T$ 2. $E \rightarrow T$ 3. $T \rightarrow T * F$ 4. $T \rightarrow F$ 5. $F \rightarrow (E)$ 6. $F \rightarrow id$	
			01

State	ACTION						Go to		
	ID	+	*	(	)	$	E	T	F
0	S5			S4			1	2	3
1		S6				acc			
2		R2	S&		R2	R2			
3		R4	R4		R$	R4			
4	S5			S$			8	2	3
5		R6	R6		R6	R6			
6	S5			S4				9	3
7	S5			S4					10
8		S6							
9		R1	S7			R1			
10		R3	R3			R3			
11		R5	R5			R5			

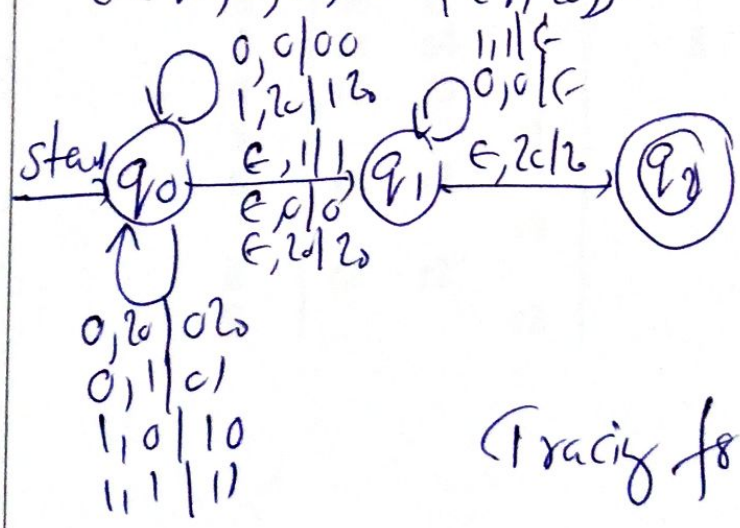
03

2 a) Design an NPDA to accept the Language L = {ww^R | w Є {0, 1}*}. Draw the transition diagram for the constructed NPDA. Also, show the moves made by this NPDA for the input string '0110'.

$\delta(q_0, 0, z_0) = \{(q_0, 0z_0)\}$
$\delta(q_0, 1, z_0) = \{(q_0, 1z_0)\}$
$\delta(q_0, 0, 0) = \{(q_0, 00)\}$
$\delta(q_0, 1, 0) = \{(q_0, 10)\}$
$\delta(q_0, 0, 1) = \{(q_0, 01)\}$
$\delta(q_0, 1, 1) = \{(q_0, 11)\}$
$\delta(q_0, \epsilon, 0) = \{(q_1, 0)\}$
$\delta(q_0, \epsilon, 1) = \{(q_1, 1)\}$
$\delta(q_0, \epsilon, z_0) = \{(q_1, z_0)\}$

$\delta(q_1, 0, 0) = \{(q_1, \epsilon)\}$
$\delta(q_1, 1, 1) = \{(q_1, \epsilon)\}$
$\delta(q_1, \epsilon, z_0) = \{(q_2, z_0)\}$

03



01

Tracing for the i/p '0110' 01

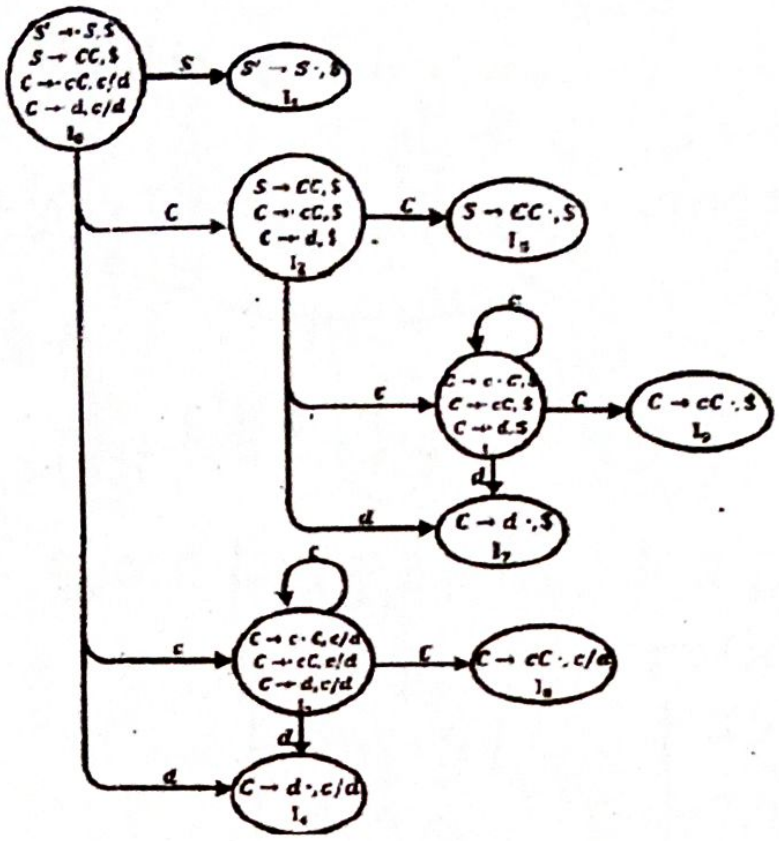
b) Design a Canonical LR(1) parsing table for the following grammar.

$S' \rightarrow S$

$S \rightarrow C\,C$

$C \rightarrow c\,C \mid d$

Steps — 04



— 02

State	Action			Goto	
	c	d	$	S	C
0	s3	s4		1	2
1			acc		
2	s6	s7			5
3	s3	s4			8
4	r3	r3			
5			r1		
6	s6	s7			9
7			r3		
8	r2	r2			
9			r2		

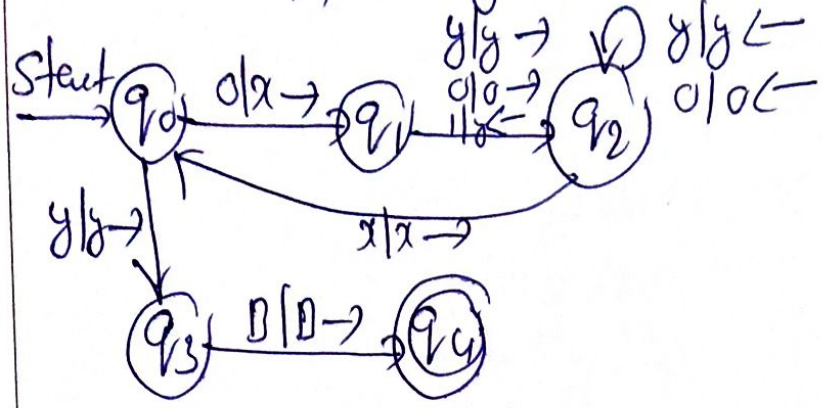
— 02

3 a) Explain the working of Turing Machine with a neat block diagram. Also, design a Turing Machine to accept the language $L = \{0^n1^n \mid n \geq 1\}$. Draw the transition diagram. Show the moves made by the Turing Machine for the input string '0011'.

Working of Turing machine ——— 01

Diagram ——— 01

Designing of Turing machine ——— 03



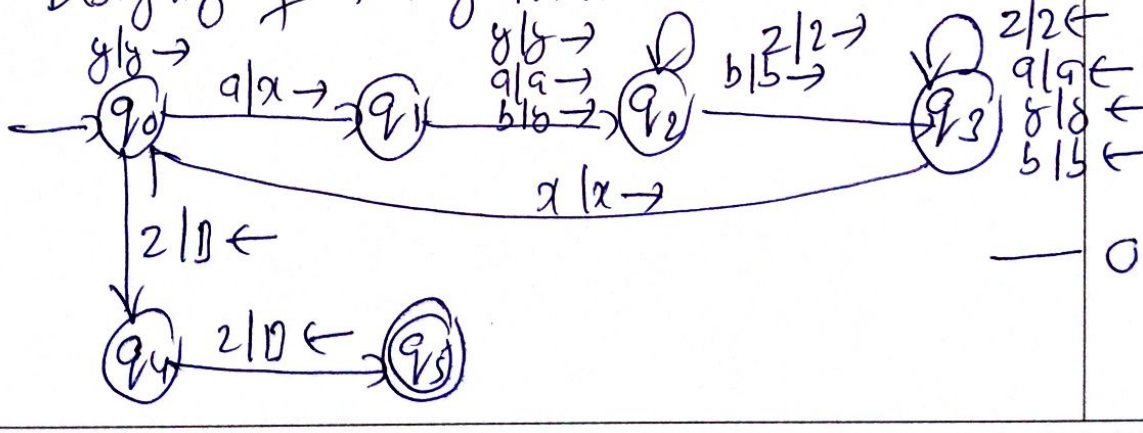
——— 01

$q_0 0011 \vdash x q_1 011$
$\vdash x 0 q_1 11$
$\vdash x q_2 0y1$
$\vdash q_2 x 0y1$
$\vdash x q_0 0y1$
$\vdash x x q_1 y1$
$\vdash x x y q_1 1$
$\vdash x x q_0 yy$
$\vdash x q_2 xyy$
$\vdash x x q_0 yy$
$\vdash x x y q_3 y$
$\vdash x x y y q_3 B$
$\vdash x x y y B q_4 B$

——— 01

4 a) Design a Turing Machine to accept the language $L = \{a^nb^nc^n \mid n \geq 1\}$. Draw the transition diagram. Also, show the moves made by the Turing Machine for the input string 'aabbcc'.

Designing of Turing machine ——— 04



——— 01

$w = aabbcc$

$q_0 aabbcc \vdash xq_1 abbcc$

$\vdash xaq_1 bbcc$

$\vdash xayq_2 bcc$

$\vdash xaybq_2 cc$

$\vdash xayq_3 bzc$

$\vdash xaq_3 ybzc$

$\vdash xq_3 aybzc$

$\vdash q_3 xaybzc$

$\vdash xq_0 aybzc$

$\vdash xxq_1 ybzc$

$\vdash xxyq_1 bzc$

$\vdash xxyyq_2 zc$

$\vdash xxyyzq_3 c$

$\vdash xxyyq_3 zz$

$\vdash xxyq_3 yzz$

$\vdash xxq_3 yyzz$

$\vdash xq_3 xyyzz$

$\vdash xxq_0 yyzz$

$\vdash xxyq_0 yzz$

$\vdash xxyyq_0 zz$

$\vdash xxyyzq_0 z$

$\vdash xxyyzzq_f$

$\vdash xxyyzzq_f$

$\vdash xxyyzzq_f$

02

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DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

Rubrics for the Continuous Internal Evaluation (CIE) and Assignments

Academic Year: **2023-24**

Course Title: **Automata Theory and Compiler Design**

Course Code: **21CS51** Semester: **V**

The Continuous Internal Evaluation (CIE) mark of a student is calculated as follows.

- Three IA Tests each of 20 Marks (duration 90 minutes) will be conducted as per the schedule.
  a) First test at the end of 5th week of the semester
  b) Second test at the end of the 10th week of the semester
  c) Third test at the end of the 15th week of the semester
- Two assignments each of 10 Marks will be awarded on successful submission of the assignment.
  a) First assignment at the end of 4th week of the semester
  b) Second assignment at the end of 9th week of the semester
- Mini Project / Seminar / quiz - any one of three suitably planned to attain the COs and POs for 20 Marks (duration 01 hour) at the end of the 13th week of the semester.
- The sum of three tests, two assignments, and quiz/seminar/mini project will be out of 100 marks and will be scaled down to 50 marks.

Rubrics for the Internal Assessment tests: **As per the scheme of evaluation**

Rubrics for the Assignments:

On time submission	1-2 days delay	3-5 days delay	Not submitted	Leaving question
Full marks as per scheme	**1 mark less as per scheme**	**2 marks less as per scheme**	**0 mark**	**Marks will be deducted as per the scheme**

IQAC Chairman/ HOD

Alva's Institute of Engineering & Technology, Moodbidri

Department of Information Science & Engineering

Assignment - I ODD Semester 2023-24

Course Title : Automata Theory and Compiler Design		Course Code: 21CS51
Date of Assignment: 22/12/2023	Date of Submission: 29/12/2023	Semester: V
Faculty: Prof. Sudheer Shetty		Max. Marks: 10

Q. No.	Questions	Marks	COs	BTL
1	Consider the DFA below: δ | 0 | 1 $\rightarrow q_1$ | q_2 | q_1 q_2 | q_2 | q_3 $*\ q_3$ | q_3 | q_2 a) Give all the regular expressions $R_{ij}^{(0)}$. b) Give all the regular expressions $R_{ij}^{(1)}$. Try to simplify the expressions as much as possible. c) Give all the regular expressions $R_{ij}^{(2)}$. Try to simplify the expressions as much as possible. d) Construct a transition diagram for the DFA and give a regular expression for the language by eliminating the states.	03	CO2	L3
2	Repeat the same for the following DFA. δ | 0 | 1 $\rightarrow q_1$ | q_2 | q_1 q_2 | q_2 | q_4 $*\ q_3$ | q_4 | q_2 $*\ q_4$ | q_4 | q_1	04	CO2	L3
3	Convert the following DFA to a regular expression, using the state elimination technique. δ | 0 | 1 $\rightarrow *\ p$ | s | p q | p | s r | r | q s | q | r	03	CO2	L3

Levels of Bloom's Taxonomy

No.	L1	L2	L3	L4	L5	L6
Level	Remember	Understand	Apply	Analyze	Evaluate	Create

Course Outcomes

CO1	Explain the fundamental concepts of automata theory & compilers and design & minimize Finite Automata.	L3
CO2	Design regular expressions, classify the languages as regular or non-regular and design lexical analyzers.	L3
CO3	Design grammars for different language classes and design top-down parsers for the grammars.	L3
CO4	Design push down automata for different language classes and design bottom-up parsers for the grammars.	L3
CO5	Develop computational models using Turing machines for various classes of languages and design back end of the compiler including code generator.	L3

Alva's Institute of Engineering & Technology, Moodbidri

Department of Information Science & Engineering

Assignment - II ODD Semester 2023-24

Course Title : Automata Theory and Compiler Design		Course Code: 21CS51
Date of Assignment: 29/01/2024	Date of Submission: 05/02/2024	Semester: V
Faculty: Dr. Sudheer Shetty		Max. Marks: 10

Q. No.	Questions	Marks	COs	BTL
1	For each of the following grammars, devise predictive parsers and show the parsing tables. Left-factor and / or eliminate left-recursion from the grammars first. Also show the parsing steps for the specified strings. a) S → 0 S 1 | 01 with string 00011 b) S → + S S | * S S | a with string +*aaa c) S → S (S) S | ϵ with string (()()) d) S → S + S | S S | (S) | S * | a with string (a+a)*a e) S → a S b S | b S a S | ϵ with string aabbab	02 x 5 = 10	CO3	L3

Levels of Bloom's Taxonomy

No.	L1	L2	L3	L4	L5	L6
Level	Remember	Understand	Apply	Analyze	Evaluate	Create

Course Outcomes

CO1	Explain the fundamental concepts of automata theory & compilers and design & minimize finite automata.	L3
CO2	Design regular expressions, classify the languages as regular or non-regular and design lexical analyzers.	L3
CO3	Design grammars for different language classes and design top-down parsers for the grammars.	L3
CO4	Design push down automata for different language classes and design bottom-up parsers for the grammars.	L3
CO5	Develop computational models using Turing machines for various classes of languages and design back end of the compiler including code generator.	L3

Date enrolled	2024-01-22
Email	sapthamijain54@gmail.com
Name	SAPTHAMI

Course Progress

Unit wise Progress

Assessment scores

Week 01 : Assignment 01:	**100.0**
Week 02 : Assignment 02:	**100.0**
Week 03 : Assignment 03:	**100.0**
Week 04 : Assignment 04:	**88.0**
Week 05 : Assignment 05:	**100.0**
Week 06 : Assignment 06:	**100.0**

If already registered, click to check your payment status

Week 1 : Assignment 1

The due date for submitting this assignment has passed.

Due on 2024-02-07, 23:59 IST.

Assignment submitted on 2024-01-27, 14:51 IST

1) *1 point*

Which of the following is an example of finite state systems?

(a) Text editor

(b) Elevator

(c) Control unit of a computer

(d) All of these

- (a)
- (b)
- (c)
- (d)

Yes, the answer is correct.
Score: 1

Accepted Answers:
(d)

2) *1 point*

The number of elements in the set for the Language $L = \{x \in \Sigma^* :$ length of x is at most $2\}$ and $\Sigma=\{0,1\}$ is .....

(a) 7

(b) 6

(c) 8

(d) 5

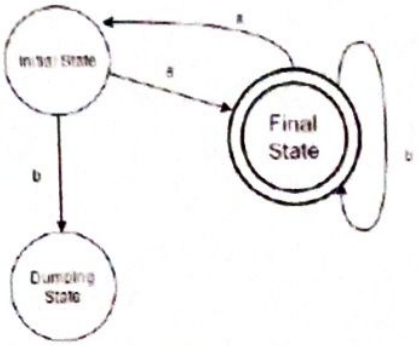
- (a)
- (b)
- (c)
- (d)

Yes, the answer is correct.
Score: 1

Accepted Answers:
(a)

3) ***1 point***

Which of the following will not be accepted by the following DFA?



(a) ababaabaa

(b) abbbaa

(c) abbbaabb

(d) abbaabbaa

- (a)
- (b)
- (c)
- (d)

Yes, the answer is correct.
Score: 1

Accepted Answers:
(a)

4) ***1 point***

Two finite state machines are said to be equivalent if they:

(a) Have same number of edges.

(b) Have same number of states.

(c) Recognize same set of strings.

(d) Have same number of edges and states.

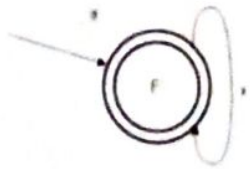
- (a)
- (b)
- (c)
- (d)

Yes, the answer is correct.
Score: 1

Accepted Answers:
(c)

5) **1 point**

What does the following figure most correctly represent?



(a) Final state with loop x.

(b) Transitional state with loop x.

(c) Initial as well as final state with loop x.

(d) Insufficient data.

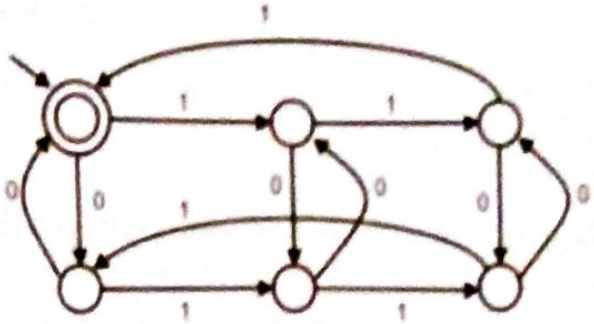
- (a)
- (b)
- (c)
- (d)

Yes, the answer is correct.
Score: 1

Accepted Answers:
(c)

6) **1 point**

The following DFA accepts all those strings in which numbers of 1's and 0's are



(a) Divisible by 3 and 2 respectively.

(b) Odd and Even respectively.

(c) Even and Odd respectively.

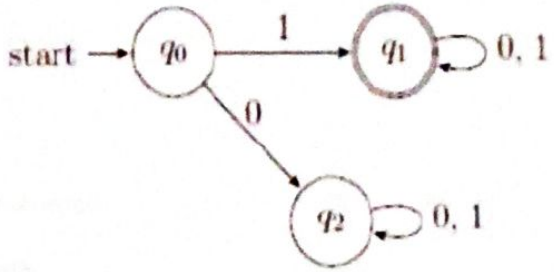
(d) Divisible by 2 and 3 respectively.

- (a)
- (b)
- (c)
- (d)

Yes, the answer is correct.
Score: 1
Accepted Answers:
(a)

7) **1 point**

The node q_2 is best defined as .....



(a) Final state.

(b) Dead state.

(c) Both final and Dead state.

(d) Neither Final nor Dead state.

- (a)

(b)

(c)

(d)

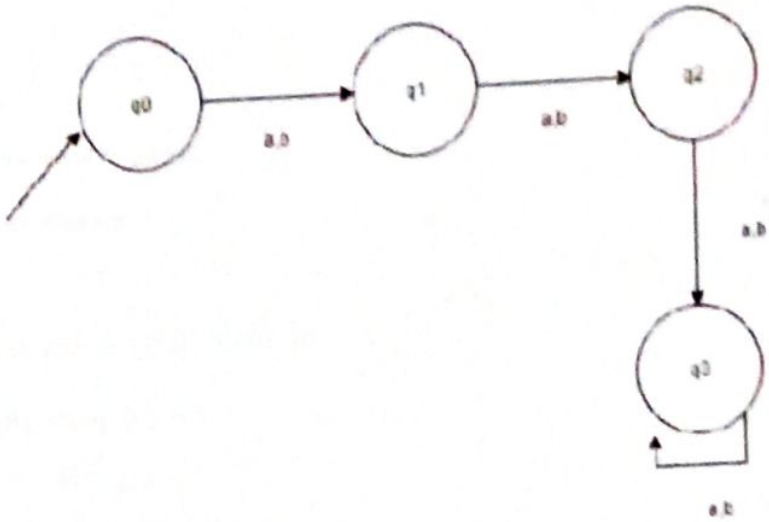
Yes, the answer is correct.
Score: 1

Accepted Answers:
(b)

1 point

8)

Which of the following states would be notated as the final state/acceptance state for $L = \{x \in \Sigma^* : \text{length of } x \text{ is } 2\}$, $\Sigma = \{a, b\}$?



(a) $q1$ only

(b) $q2$ only

(c) $q1, q2$

(d) $q3$ only

(a)

(b)

(c)

(d)

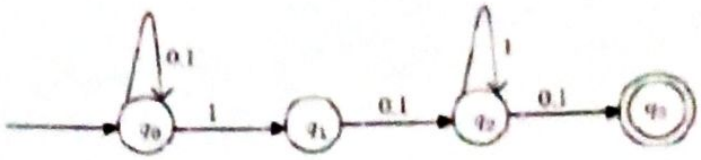
Yes, the answer is correct.
Score: 1

Accepted Answers:
(b)

1 point

9)

Is the given figure a DFA?



(a) Yes

(b) No.

- (a)
- (b)

Yes, the answer is correct.
Score: 1
Accepted Answers:
(b)

1 point

10) $\hat{\delta}(q, ya)$ is equivalent to

(a) $\delta((q, y), a)$.

(b) $\delta(\hat{\delta}(q, y), a)$.

(c) $\delta(q, ya)$.

(d) Independent of δ.

- (a)
- (b)
- (c)
- (d)

Yes, the answer is correct.
Score: 1
Accepted Answers:
(b)

Date enrolled	2024-01-22
Email	ranjithkharvi77@gmail.com
Name	Ranjith

100.0%

Course Progress

Unit wise Progress

Assessment scores

Week 01 : Assignment 01:	**100.0**
Week 02 : Assignment 02:	**100.0**
Week 03 : Assignment 03:	**100.0**
Week 04 : Assignment 04:	**100.0**
Week 05 : Assignment 05:	**100.0**
Week 06 : Assignment 06:	**90.0**

If already registered, click to check your payment status

Course outline

About NPTEL ()

How does an NPTEL online course work? ()

Week 0 ()

Week 1 ()

Week 2 ()

Week 3 ()

Lecture 11 : ε-NFA (unit?unit=33&lesson=34)

Lecture 12 : Extended transition

Week 3 : Assignment 3

The due date for submitting this assignment has passed.

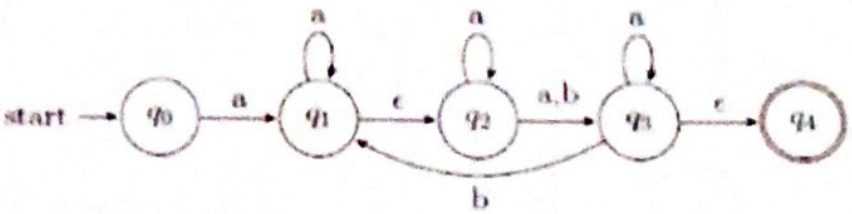
Due on 2024-02-14, 23:59 IST.

Assignment submitted on 2024-02-12, 20:21 IST

Choose the most appropriate option.

1) *1 point*

Which of the following string is not accepted by given ϵ-NFA?



(a) aba

(b) $abaabb$

(c) $aaba$

(d) $babab$

- (a)
- (b)
- (c)
- (d)

Yes, the answer is correct.
Score: 1

Accepted Answers:
(d)

2)

1 point

The domain and codomain for the transition function for ϵ-NFA is given by ....., where Q is a finite set of states and Σ is a finite input alphabet.

(a) $Q \times \Sigma \rightarrow Q$

(b) $Q \times \Sigma \rightarrow 2^Q$

(c) $Q \times \{\Sigma \cup \{\epsilon\}\} \rightarrow Q$

(d) $Q \times \{\Sigma \cup \{\epsilon\}\} \rightarrow 2^Q$

(a)

(b)

(c)

(d)

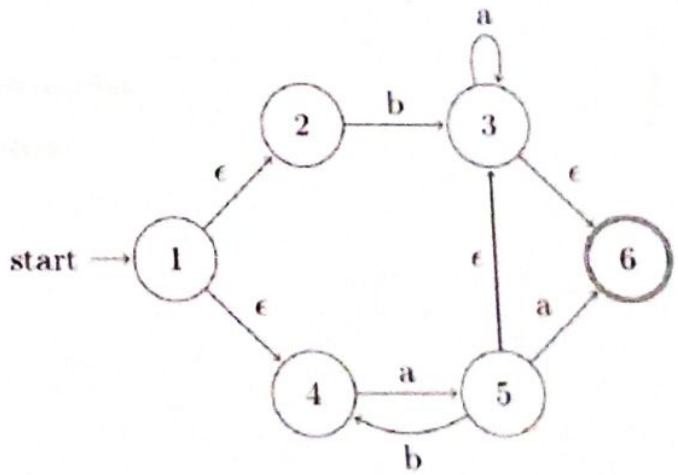
Yes, the answer is correct.
Score: 1

Accepted Answers:
(d)

3)

1 point

Which of the following string will not be accepted by the given ϵ-NFA?



(a) *abababa*

(b) *aaaaaaa*

(c) *ababab*

(d) *baaa*

(a)

(b)

(c)

(d)

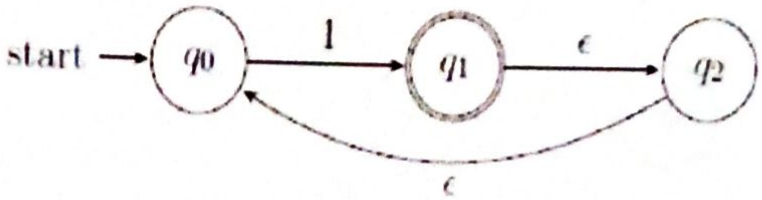
Yes, the answer is correct.
Score: 1

Accepted Answers:
(c)

4)

1 point

What is ϵ-closure of q_1 in the given ϵ-NFA?



(a) $\{q_0\}$.

(b) $\{q_0, q_1, q_2\}$.

(c) $\{q_0, q_2\}$.

(d) $\{q_0, q_1\}$.

(a)

(b)

(c)

(d)

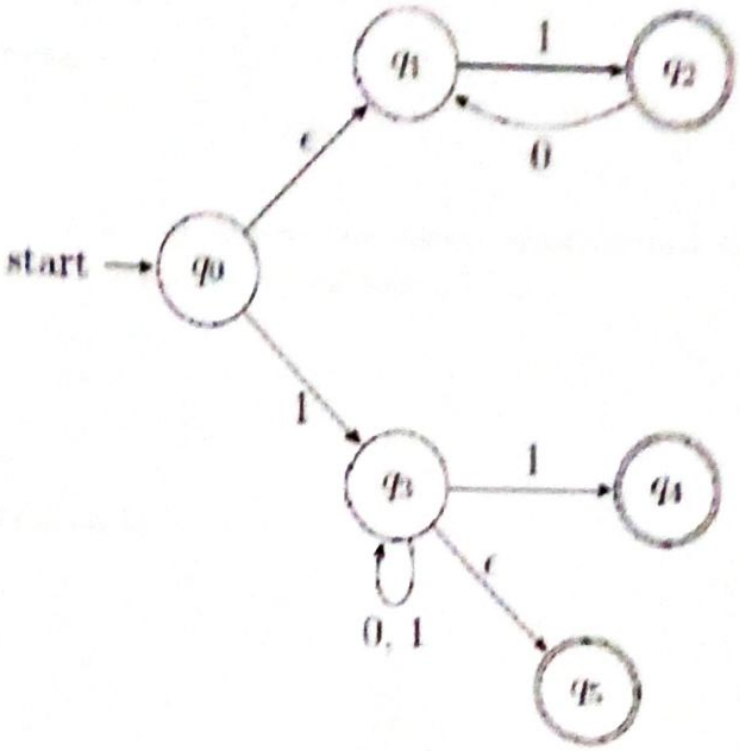
Yes, the answer is correct.
Score: 1

Accepted Answers:
(b)

5)

1 point

This ϵ-NFA accepts which language?



(a) $1(01)^*$

(b) $1(01)^* + 1(0+1)^*1$

(c) $1(01)^* + 1(0+1)^*$

(d) None of these

- (a)
- (b)
- (c)
- (d)

Yes, the answer is correct.
Score: 1

Accepted Answers:
(c)

6) **1 point**

While construction of NFA $M(Q, \Sigma, \delta, q_0, F)$ from an ϵ-NFA $M'(Q, \Sigma \cup \{\epsilon\}, \delta', q_0, F')$. The final state F' is defined as:
$F' = F \cup \{q_0\}$ if ϵ-closure of $(q_0) \cap F \neq \emptyset$
$F' = F$, otherwise
The above statement is True/False.

(a) True

(b) False

(a)

(b)

Yes, the answer is correct.
Score: 1

Accepted Answers:
(a)

7)

0 points

Which of the following Automation allows transformation to a new state without receiving any output signal?

(a) DFA

(b) NFA.

(c) ϵ-NFA

(d) All of the above.

(a)

(b)

(c)

(d)

Yes, the answer is correct.
Score: 0

Accepted Answers:
(c)

8)

1 point

Which of the following is **True**?
I. A language L is accepted by DFA iff it is accepted by some ϵ-NFA.
II. A language L is accepted by ϵ-NFA iff it is accepted by some NFA.

(a) Only I is True.

(b) Only II is True.

(c) Both I and II are True.

(d) Neither I nor II is True.

(a)

(b)

(c)

(d)

Yes, the answer is correct.
Score: 1

Accepted Answers:
(c)

9) ϵ- closure of a node can be empty.
The above statement is True/False.

1 point

(a) True.

(b) False.

(a)

(b)

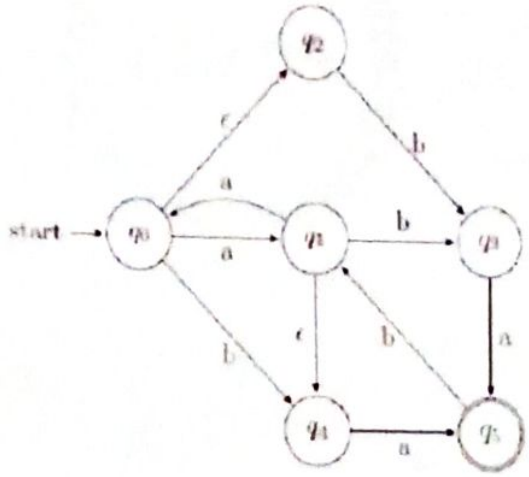
Yes, the answer is correct.
Score: 1

Accepted Answers:
(b)

10)

1 point

Number of state(s) reachable on the transition $\delta(q_1, a)$ is...



(a) 2.

(b) 3.

(c) 1.

(d) 4.

(a)

(b)

(c)

(d)

Yes, the answer is correct.
Score: 1

Accepted Answers:
(b)

ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY

SHOBHAVANA CAMPUS, MIJAR, MOODBIDRI – 574 225

DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

Continuous Internal Evaluation - I (CIE-I) Marks

Automata Theory and Compiler Design (21CS51)

SN	USN	NAME	CO1 1a 2	CO1 1b 7	CO1 1c 3	CO1 2a 2	CO1 2b 7	CO1 2c 3	CO1 3a 5	CO2 3b 3	CO1 4a 3	CO1 4b 2	CO2 4c 3	Total
1	4AL21IS001	ADITHYA TEJASWI D	1	6	2						3	1	2	15
2	4AL21IS002	AFIZA A				2	4	3	4	3				16
3	4AL21IS003	AISHWARYA SALIMATH		2					2		2	1	2	7
4	4AL21IS004	AKASH DEVADIGA	1	6	2						2	1	0	12
5	4AL21IS005	AMAR B M				1	6	2	2	1				12
6	4AL21IS006	ANAGHA UDUPA Y N	2	4	3				5	2				16
7	4AL21IS007	ANANYA	1	5	1				5	0				12
8	4AL21IS008	ANIRUDH KAMATH K												AB
9	4AL21IS009	ANKITHA B		6	2						3	1	2	14
10	4AL21IS010	BHAGYASHREE R PUJARI	1	6					2	1	2	1	2	12
11	4AL21IS011	BHARATH J				2	5	2	5	2				16
[illegible]	4AL21IS012	BHUMIKA SUNIL KULKARNI	2	7	3	1	6	3	2		3	1	3	19
13	4AL21IS013	CHAITRA S KODDADDI	0	2	1				2	1				6
14	4AL21IS014	CHANDAN M N	1	4	0				1	0	3			8
15	4AL21IS015	CHINDAN B V	2	4	2				5	1				14
16	4AL21IS017	GOWRISH N	1	5	3		2		5	2				16
17	4AL21IS018	HARSHITHA B	1	2	2			3			3	1	2	11
18	4AL21IS019	JAHNAVI				2	3	2			2	1	2	12
19	4AL21IS020	KARTHIK MADAKARI T P	1	6	2				3	2	2	1	2	14
20	4AL21IS021	KELVIN DMELLO	2	7	3		6	1	2		3	2	3	20
21	4AL21IS022	KOUSHIK ACHAR	2	4	2				2	2				12
22	4AL21IS023	KRUPASHREE R					2	1	3	1	2		1	7
23	4AL21IS024	LAYA R	0	3	1				3	1	2			8
24	4AL21IS025	MANIKANTA	0	6	3						3	1	2	15
25	4AL21IS026	MANISH K		2	1		2	2	3	1				8
26	4AL21IS027	MANJUNATH R		4	2	1	5	2		1	2	1	2	13
27	4AL21IS029	MANOJ M U				1	7	2	3	2				15
28	4AL21IS030	MOHAMMED ADIL	0	3	2				1	0				6
[illegible]9	4AL21IS031	MOHAMMED RIHAN				1	3	2	3	2				11
30	4AL21IS032	MUHAMMED YAMIN SHARFUDDIN												AB
31	4AL21IS033	NANDAN S		6	2				2	1				11
32	4AL21IS034	NISHANT KUMAR	1	3	2				2	1				9
33	4AL21IS035	PRAGATHI G GOWDA	2	7	3				5	2				19
34	4AL21IS036	PRAJNA	2	6	3	1	2		3	2				16
35	4AL21IS037	PRAJWAL GOWDA H G	1	5	0				3	2				11
36	4AL21IS038	PRASHANTH KUMAR B C	0	3	1						2	0	1	7
37	4AL21IS039	PREETHAM BYADAGI	1	2	2						1	1	1	8
38	4AL21IS040	R SREEJITH	1	4	1		1		2	1				9
39	4AL21IS041	RANJITH	1	6	3				2	3				15
40	4AL21IS042	SANJAY G K	1	4	2	2	5	3	2	2	0			14
41	4AL21IS043	SANNIDHI K S				2	6	3	2	2	2			15
42	4AL21IS044	SAPTHAMI	2	3	2	2	4	2			3	1	3	15
43	4AL21IS045	SARTHAK K JAIN				1	2	1	2					6
44	4AL21IS046	SATEESH DYAVAPPA SATYANNAVAR				0	6	1	2	2				11
45	4AL21IS047	SATHWIK K D	2	4	3				5	2	2	1	2	16
46	4AL21IS048	SHARAVI R RAI				2	5	2	2	2				13

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DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

Continuous Internal Evaluation - I (CIE-I) Marks

Automata Theory and Compiler Design (21CS51)

SN	USN	NAME	CO1	CO1	CO1	CO1	CO1	CO1	CO1	CO2	CO1	CO1	CO2	Total
			1a	1b	1c	2a	2b	2c	3a	3b	4a	4b	4c	
			2	7	3	2	7	3	5	3	3	2	3	
47	4AL21IS049	SHASHIDHAR MAHADEV PATGAR	1	6	3		4		5	2				17
48	4AL21IS050	SHRAVAN R POOJARY				1	4	2			2	1	2	12
49	4AL21IS051	SHRAVITHA	0	3	1						2			6
50	4AL21IS052	SHREYA RAI	1	4	2						2	1	2	12
51	4AL21IS053	SHRUJAN KUMAR H V	1	2					2	2	0	1		7
52	4AL21IS054	SOORAJ	0	3	3				1	2				9
53	4AL21IS055	SRIDEEKSHA G	1	4	2	0	4	1		1	2	1	1	11
54	4AL21IS056	SRIKANTH RAJU SRINIVAS				1	3	1			2	1	1	9
55	4AL21IS057	SRUJAN K M	0	5	3		3		5	0			0	13
56	4AL21IS058	SRUSTI P S	1	4	2				5	2				14
57	4AL21IS059	SUVAN P KEDILAYA	1	5	3				5	2				16
58	4AL21IS060	SUVARNA ARVINKANTH HARISH	1	3	2				1	1				8
59	4AL21IS061	SYED SALEHA				1	3	2	2	2				10
60	4AL21IS062	VASAVI RAI C	1	4	1	1	1				1	1	1	9
61	4AL21IS063	VITHIKA SHETTY	2	6	3						2	1	2	16
62	4AL21IS064	CHANDANA N M				1	3	1	3	3				11
63	4AL22IS400	ANKITH		3	3				2	2				10
64	4AL22IS401	CHARAN S V	1	3	1				2	1				8
65	4AL22IS402	CHETAN BYAHATTI	1	3	1	1			2	2				9
66	4AL22IS403	LOHITH H				2	5	2	4	2				15
67	4AL22IS404	NAMRATHA J SHETTY		5	2				2	2	2			11
68	4AL22IS405	RAHUL P SHETTY		2	2				0	1				5

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(Dr. Sudheer Shetty)

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DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

Continuous Internal Evaluation - II (CIE-II) Marks

Automata Theory and Compiler Design (21CS51)

SN	USN	NAME	CO2	CO2	CO2	CO2	CO2	CO2	CO3	CO3	CO3	CO3	CO3	CO3	Total
			1a	1b	1c	2a	2b	2c	3a	3b	3c	4a	4b	4c	
			4	3	2	4	3	2	3	3	5	3	3	5	
1	4AL21IS001	ADITHYA TEJASWI D				2	3	1	2	3	2				13
2	4AL21IS002	AFIZA A				4	2	2	0	0	5				13
3	4AL21IS003	AISHWARYA SALIMATH				2	3		2	3	2	1	3	2	12
4	4AL21IS004	AKASH DEVADIGA	0	2	2	2	3	1				1	3	5	15
5	4AL21IS005	AMAR B M	4	2	0							2	2	1	11
6	4AL21IS006	ANAGHA UDUPA Y N				3	2		1	2	1	1	2	1	9
7	4AL21IS007	ANANYA				4	0	1	1	1	0	1	2	0	8
8	4AL21IS008	ANIRUDH KAMATH K	2	0	1					1	1				5
9	4AL21IS009	ANKITHA B				4	2	1	0	1	1	1	3		11
10	4AL21IS010	BHAGYASHREE R PUJARI				4	2	1	2	2	5				16
11	4AL21IS011	BHARATH J	1		2		2	2	2	0	1	2	3	1	10
12	4AL21IS012	BHUMIKA SUNIL KULKARNI	4	3	2				2	3	1	3	3	5	20
[illegible]	4AL21IS013	CHAITRA S KODDADDI				0	1					1	2	0	4
14	4AL21IS014	CHANDAN M N		0	2	2		1				1	3	1	8
15	4AL21IS015	CHINDAN B V		2	1							1	3	5	12
16	4AL21IS017	GOWRISH N	4	1	0							2	3	4	14
17	4AL21IS018	HARSHITHA B				3	2	1				2	3	5	16
18	4AL21IS019	JAHNAVI				4	3					1	3	4	15
19	4AL21IS020	KARTHIK MADAKARI T P		3	2				1	2	3	2	2	5	14
20	4AL21IS021	KELVIN DMELLO	4	3	2				3	3	4				19
21	4AL21IS022	KOUSHIK ACHAR	4	2	2							2	3	5	18
22	4AL21IS023	KRUPASHREE R				1	2			0		0	3	1	7
23	4AL21IS024	LAYA R				0	3	1	2	3	3				12
24	4AL21IS025	MANIKANTA				2	2	2	3			2	3	2	13
25	4AL21IS026	MANISH K				2			3	3					8
26	4AL21IS027	MANJUNATH R				2	2		2	3	0	2	3	0	9
27	4AL21IS029	MANOJ M U				4	3	1				2	3	5	18
28	4AL21IS030	MOHAMMED ADIL				3	1	1				0	0	1	6
29	4AL21IS031	MOHAMMED RIHAN				3	2	1	2	3	0		0		11
[illegible]	4AL21IS032	MUHAMMED YAMIN SHARFUDDIN	3	3	1				1	3	5				16
31	4AL21IS033	NANDAN S	3	0					2	1		2	3		8
32	4AL21IS034	NISHANT KUMAR	4	2	2				2	3	2				15
33	4AL21IS035	PRAGATHI G GOWDA	4	3	2				3	3	5				20
34	4AL21IS036	PRAJNA	4	3	2							3	3	5	20
35	4AL21IS037	PRAJWAL GOWDA H G				1	3		2	2	2				10
36	4AL21IS038	PRASHANTH KUMAR B C													AB
37	4AL21IS039	PREETHAM BYADAGI	1	1	2				0	2	1				7
38	4AL21IS040	R SREEJITH				1	2			2	0	0	3	2	8
39	4AL21IS041	RANJITH				4	3	0				2	3	3	15
40	4AL21IS042	SANJAY G K	4		2		2		1	3	1	1	3	0	11
41	4AL21IS043	SANNIDHI K S				4	3	1	2	2	1	1	2		13
42	4AL21IS044	SAPTHAMI	4	3	2					0		1	3	5	18
43	4AL21IS045	SARTHAK K JAIN					1	1					2	0	4
44	4AL21IS046	SATEESH DYAVAPPA SATYANNAVAR					3					1	3	3	10
45	4AL21IS047	SATHWIK K D	4	3	2				2	3	2	2	3		16
46	4AL21IS048	SHARAVI R RAI	4	0					2	3	2				11
47	4AL21IS049	SHASHIDHAR MAHADEV PATGAR				4	3	2	2	0	1	3	3	5	20
48	4AL21IS050	SHRAVAN R POOJARY					3			3			2	1	6
49	4AL21IS051	SHRAVITHA				1	1	1				0	0		3

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DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

Continuous Internal Evaluation - II (CIE-II) Marks

Automata Theory and Compiler Design (21CS51)

SN	USN	NAME	CO2	CO2	CO2	CO2	CO2	CO2	CO3	CO3	CO3	CO3	CO3	CO3	Total
			1a	1b	1c	2a	2b	2c	3a	3b	3c	4a	4b	4c	
			4	3	2	4	3	2	3	3	5	3	3	5	
50	4AL21IS052	SHREYA RAI				3	2	2	3	3	4				17
51	4AL21IS053	SHRUJAN KUMAR H V				2	3		1	2	0				8
52	4AL21IS054	SOORAJ				3	2					2	3	2	12
53	4AL21IS055	SRIDEEKSHA G				4	2	1	2	3	2				14
54	4AL21IS056	SRIKANTH RAJU SRINIVAS	2	0	1		2	1	1	1	0				5
55	4AL21IS057	SRUJAN K M				2	3	0	2	3	1				11
56	4AL21IS058	SRUSTI P S	4	1					3	3	4	1	1		15
57	4AL21IS059	SUVAN P KEDILAYA	4	3	2	1	3		3	3	5				20
58	4AL21IS060	SUVARNA ARVINKANTH HARISH							2	2			0		4
59	4AL21IS061	SYED SALEHA				1	2	0	1	3	3				10
60	4AL21IS062	VASAVI RAI C	2	0	0		1	1	0	1					3
61	4AL21IS063	VITHIKA SHETTY	4	2	2				2	3		1	3	5	17
[illegible]	4AL21IS064	CHANDANA N M	0			3	1	1	1	3	1				10
63	4AL22IS400	ANKITH					2	1				2	3	2	10
64	4AL22IS401	CHARAN S V	1		0				1	1	0		1		3
65	4AL22IS402	CHETAN BYAHATTI	1	2	0							1	1	3	8
66	4AL22IS403	LOHITH H					3					2	3	5	13
67	4AL22IS404	NAMRATHA J SHETTY	4	3	2				3		4	3	3	5	20
68	4AL22IS405	RAHUL P SHETTY				2	2	1	0	2	2				9

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DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

Continuous Internal Evaluation - III (CIE-III) Marks

Automata Theory and Compiler Design (21CS51)

SN	USN	NAME	CO4 1a	CO4 1b	CO4 2a	CO4 2b	CO5 3a	CO5 4a	Total
			5	8	5	8	7	7	
1	4AL21IS001	ADITHYA TEJASWI D	4	8			5		17
2	4AL21IS002	AFIZA A	5	7	3			7	19
3	4AL21IS003	AISHWARYA SALIMATH	5	8			5	3	18
4	4AL21IS004	AKASH DEVADIGA	5	7			6		18
5	4AL21IS005	AMAR B M	5	7			2		14
6	4AL21IS006	ANAGHA UDUPA Y N	4	7	4	7			11
7	4AL21IS007	ANANYA	5	8			3		16
8	4AL21IS008	ANIRUDH KAMATH K	2	2			3		7
[illegible]	4AL21IS009	ANKITHA B	4	8			6		18
10	4AL21IS010	BHAGYASHREE R PUJARI			5	6	6		17
11	4AL21IS011	BHARATH J	2	8				5	15
12	4AL21IS012	BHUMIKA SUNIL KULKARNI	4	8			6	6	18
13	4AL21IS013	CHAITRA S KODDADDI	3	0					3
14	4AL21IS014	CHANDAN M N	3	7					10
15	4AL21IS015	CHINDAN B V	4	6				4	14
16	4AL21IS017	GOWRISH N	3	7				3	13
17	4AL21IS018	HARSHITHA B	3	6		2	5		14
18	4AL21IS019	JAHNAVI	5	6				6	17
19	4AL21IS020	KARTHIK MADAKARI T P	5	5			6		16
20	4AL21IS021	KELVIN DMELLO	5	8				6	19
21	4AL21IS022	KOUSHIK ACHAR	4	6			4		14
[illegible]2	4AL21IS023	KRUPASHREE R	4	6			1	2	12
23	4AL21IS024	LAYA R	4	7			3		14
24	4AL21IS025	MANIKANTA	4	7			5		16
25	4AL21IS026	MANISH K	4	6			3		13
26	4AL21IS027	MANJUNATH R	5	6			5		16
27	4AL21IS029	MANOJ M U	4	8				6	18
28	4AL21IS030	MOHAMMED ADIL	1	6			6		13
29	4AL21IS031	MOHAMMED RIHAN	3	5			5		13
30	4AL21IS032	MUHAMMED YAMIN SHARFUDDIN	3	5				6	14
31	4AL21IS033	NANDAN S	4	5			4		13
32	4AL21IS034	NISHANT KUMAR	4	6				6	16
33	4AL21IS035	PRAGATHI G GOWDA	4	7			4		15
34	4AL21IS036	PRAJNA			5	6	4	4	15
35	4AL21IS037	PRAJWAL GOWDA H G	5	8			6		19
36	4AL21IS038	PRASHANTH KUMAR B C	1	5				1	7

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DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

Continuous Internal Evaluation - III (CIE-III) Marks

Automata Theory and Compiler Design (21CS51)

SN	USN	NAME	CO4 1a 5	CO4 1b 8	CO4 2a 5	CO4 2b 8	CO5 3a 7	CO5 4a 7	Total
37	4AL21IS039	PREETHAM BYADAGI	0	3			5		**8**
38	4AL21IS040	R SREEJITH	3	3				5	**11**
39	4AL21IS041	RANJITH	5	8			3		**16**
40	4AL21IS042	SANJAY G K	5	7				4	**16**
41	4AL21IS043	SANNIDHI K S	5	8			5		**18**
42	4AL21IS044	SAPTHAMI	5	8				7	**20**
43	4AL21IS045	SARTHAK K JAIN	5	2					**7**
44	4AL21IS046	SATEESH DYAVAPPA SATYANNAVAI	4	7				3	**14**
45	4AL21IS047	SATHWIK K D	5	7			7		**19**
46	4AL21IS048	SHARAVI R RAI	3	7			5		**15**
47	4AL21IS049	SHASHIDHAR MAHADEV PATGAR	5	8				7	**20**
48	4AL21IS050	SHRAVAN R POOJARY	5	8				2	**15**
49	4AL21IS051	SHRAVITHA	3	8			1		**12**
50	4AL21IS052	SHREYA RAI	4	7			7		**18**
51	4AL21IS053	SHRUJAN KUMAR H V	1	3					**4**
52	4AL21IS054	SOORAJ	4	5			3		**12**
53	4AL21IS055	SRIDEEKSHA G	4	7			5		**16**
54	4AL21IS056	SRIKANTH RAJU SRINIVAS	3	3				2	**8**
55	4AL21IS057	SRUJAN K M	5	8				6	**19**
56	4AL21IS058	SRUSTI P S	5	8				7	**20**
57	4AL21IS059	SUVAN P KEDILAYA	5	8			7		**20**
58	4AL21IS060	SUVARNA ARVINKANTH HARISH	1	6				1	**8**
59	4AL21IS061	SYED SALEHA	2	2			3		**7**
60	4AL21IS062	VASAVI RAI C	2	3				3	**8**
61	4AL21IS063	VITHIKA SHETTY	5	8			7		**20**
62	4AL21IS064	CHANDANA N M	4	8				4	**16**
63	4AL22IS400	ANKITH	4	3			3		**10**
64	4AL22IS401	CHARAN S V	3	6			4		**13**
65	4AL22IS402	CHETAN BYAHATTI	4	7			6		**17**
66	4AL22IS403	LOHITH H	5	8			6		**19**
67	4AL22IS404	NAMRATHA J SHETTY	5	8				7	**20**
68	4AL22IS405	RAHUL P SHETTY	3	1			2	4	**8**

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DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

Assignment Marks

Automata Theory and Compiler Design (21CS51)

SN	USN	NAME	CO2	CO3	CO1	CO2	CO3	CO4	CO5	Total
			A1	A2	N1	N2	N3	N4	N5	
			10	10	4	4	4	4	4	
1	4AL21IS001	ADITHYA TEJASWI D	8	10	4	4	4	4	4	38
2	4AL21IS002	AFIZA A	9	10	4	4	4	4	4	39
3	4AL21IS003	AISHWARYA SALIMATH	10	10	4	4	4	4	4	40
4	4AL21IS004	AKASH DEVADIGA	10	10	4	4	4	4	4	40
5	4AL21IS005	AMAR B M	10	10	4	4	4	4	4	40
6	4AL21IS006	ANAGHA UDUPA Y N	10	9	4	4	4	4	4	39
7	4AL21IS007	ANANYA	10	10	4	4	4	4	4	40
8	4AL21IS008	ANIRUDH KAMATH K	7	8	4	3	4	3	4	33
9	4AL21IS009	ANKITHA B	10	10	4	4	4	4	4	40
10	4AL21IS010	BHAGYASHREE R PUJARI	10	10	4	4	4	4	4	40
11	4AL21IS011	BHARATH J	10	10	4	4	4	4	4	40
12	4AL21IS012	BHUMIKA SUNIL KULKARNI	10	10	4	4	4	4	4	40
13	4AL21IS013	CHAITRA S KODDADDI	8	8	4	4	4	4	4	36
14	4AL21IS014	CHANDAN M N	8	7	4	4	4	4	4	35
15	4AL21IS015	CHINDAN B V	10	9	4	4	4	4	4	39
16	4AL21IS017	GOWRISH N	10	10	4	4	4	4	4	40
17	4AL21IS018	HARSHITHA B	10	10	4	4	4	4	4	40
18	4AL21IS019	JAHNAVI	9	10	4	4	4	4	4	39
19	4AL21IS020	KARTHIK MADAKARI T P	10	7	4	4	4	4	4	37
20	4AL21IS021	KELVIN DMELLO	10	10	4	4	4	4	4	40
21	4AL21IS022	KOUSHIK ACHAR	10	10	4	4	4	4	4	40
22	4AL21IS023	KRUPASHREE R	10	9	4	4	4	4	4	39
23	4AL21IS024	LAYA R	9	10	4	4	4	4	4	39
24	4AL21IS025	MANIKANTA	10	9	4	4	4	4	4	39
25	4AL21IS026	MANISH K	8	10	4	4	4	4	4	38
26	4AL21IS027	MANJUNATH R	10	9	4	4	4	4	4	39
27	4AL21IS029	MANOJ M U	10	8	4	4	4	4	4	38
28	4AL21IS030	MOHAMMED ADIL	10	8	4	4	4	4	4	38
29	4AL21IS031	MOHAMMED RIHAN	10	10	4	4	4	4	4	40
30	4AL21IS032	MUHAMMED YAMIN SHARFUDDIN	10	7	4	4	4	4	4	37
31	4AL21IS033	NANDAN S	8	7	4	4	4	4	4	35
32	4AL21IS034	NISHANT KUMAR	10	10	4	4	4	4	4	40
33	4AL21IS035	PRAGATHI G GOWDA	10	10	4	4	4	4	4	40
34	4AL21IS036	PRAJNA	10	10	4	4	4	4	4	40
35	4AL21IS037	PRAJWAL GOWDA H G	10	10	4	4	4	4	4	40
36	4AL21IS038	PRASHANTH KUMAR B C	9	10	4	4	4	4	4	39
37	4AL21IS039	PREETHAM BYADAGI	10	8	4	4	4	4	4	38
38	4AL21IS040	R SREEJITH	8	7	4	4	4	4	4	35
39	4AL21IS041	RANJITH	10	7	4	4	4	4	4	37
40	4AL21IS042	SANJAY G K	10	9	4	3	4	4	4	38
41	4AL21IS043	SANNIDHI K S	10	9	4	4	4	4	4	39
42	4AL21IS044	SAPTHAMI	10	10	4	4	4	4	4	40
43	4AL21IS045	SARTHAK K JAIN	10	10	4	4	4	4	4	40

ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY

SHOBHAVANA CAMPUS, MIJAR, MOODBIDRI – 574 225

DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

Assignment Marks

Automata Theory and Compiler Design (21CS51)

SN	USN	NAME	CO2	CO3	CO1	CO2	CO3	CO4	CO5	Total
			A1	A2	N1	N2	N3	N4	N5	
			10	10	4	4	4	4	4	
44	4AL21IS046	SATEESH DYAVAPPA SATYANNAVAR	10	10	4	4	4	4	4	40
45	4AL21IS047	SATHWIK K D	8	10	4	4	4	4	4	38
46	4AL21IS048	SHARAVI R RAI	10	10	4	4	4	4	4	40
47	4AL21IS049	SHASHIDHAR MAHADEV PATGAR	10	10	4	4	4	4	4	40
48	4AL21IS050	SHRAVAN R POOJARY	8	8	4	4	4	4	4	36
49	4AL21IS051	SHRAVITHA	8	9	4	4	4	3	4	36
50	4AL21IS052	SHREYA RAI	10	10	4	4	4	4	4	40
51	4AL21IS053	SHRUJAN KUMAR H V	8	9	3	3	3	3	3	32
52	4AL21IS054	SOORAJ	10	10	4	4	4	4	4	40
53	4AL21IS055	SRIDEEKSHA G	10	10	4	4	4	4	4	40
54	4AL21IS056	SRIKANTH RAJU SRINIVAS	9	10	4	4	4	4	4	39
55	4AL21IS057	SRUJAN K M	10	10	4	4	4	4	4	40
56	4AL21IS058	SRUSTI P S	10	10	4	4	4	4	4	40
57	4AL21IS059	SUVAN P KEDILAYA	10	10	4	4	4	4	4	40
58	4AL21IS060	SUVARNA ARVINKANTH HARISH	10	9	4	4	4	4	4	39
59	4AL21IS061	SYED SALEHA	10	10	4	4	4	4	4	40
60	4AL21IS062	VASAVI RAI C	8	7	4	3	4	3	4	33
61	4AL21IS063	VITHIKA SHETTY	10	10	4	4	4	4	4	40
62	4AL21IS064	CHANDANA N M	10	10	4	4	4	4	4	40
63	4AL22IS400	ANKITH	10	9	4	4	4	4	4	39
64	4AL22IS401	CHARAN S V	8	7	4	4	4	4	4	35
65	4AL22IS402	CHETAN BYAHATTI	9	10	4	4	4	4	4	39
66	4AL22IS403	LOHITH H	8	10	4	4	4	4	4	38
67	4AL22IS404	NAMRATHA J SHETTY	10	10	4	4	4	4	4	40
68	4AL22IS405	RAHUL P SHETTY	10	9	4	4	4	4	4	39

HoD, Dept. of ISE
(Dr. Sudheer Shetty)

ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY

SHOBHAVANA CAMPUS, MIJAR, MOODBIDRI – 574 225

DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

Continuous Internal Evaluation Final Marks

Automata Theory and Compiler Design (21CS51)

SN	USN	NAME	CIE1	CIE2	CIE3	Asg	Total	Avg
1	4AL21IS001	ADITHYA TEJASWI D	15	13	17	38	83	42
2	4AL21IS002	AFIZA A	16	13	19	39	87	44
3	4AL21IS003	AISHWARYA SALIMATH	7	12	18	40	77	39
4	4AL21IS004	AKASH DEVADIGA	12	15	18	40	85	43
5	4AL21IS005	AMAR B M	12	11	14	40	77	39
6	4AL21IS006	ANAGHA UDUPA Y N	16	9	11	39	75	38
7	4AL21IS007	ANANYA	12	8	17	40	77	39
8	4AL21IS008	ANIRUDH KAMATH K	AB	5	7	33	45	23
9	4AL21IS009	ANKITHA B	14	11	18	40	83	42
10	4AL21IS010	BHAGYASHREE R PUJARI	12	16	17	40	85	43
11	4AL21IS011	BHARATH J	16	10	15	40	81	41
12	4AL21IS012	BHUMIKA SUNIL KULKARNI	19	20	20	40	99	50
13	4AL21IS013	CHAITRA S KODDADDI	6	4	3	36	49	25
14	4AL21IS014	CHANDAN M N	8	8	10	35	61	31
15	4AL21IS015	CHINDAN B V	14	12	14	39	79	40
16	4AL21IS017	GOWRISH N	16	14	13	40	83	42
17	4AL21IS018	HARSHITHA B	11	16	14	40	81	41
18	4AL21IS019	JAHNAVI	12	15	17	39	83	42
19	4AL21IS020	KARTHIK MADAKARI T P	14	14	20	37	85	43
20	4AL21IS021	KELVIN DMELLO	20	19	20	40	99	50
21	4AL21IS022	KOUSHIK ACHAR	12	18	15	40	85	43
22	4AL21IS023	KRUPASHREE R	7	7	12	39	65	33
23	4AL21IS024	LAYA R	8	12	14	39	73	37
24	4AL21IS025	MANIKANTA	15	13	16	39	83	42
25	4AL21IS026	MANISH K	8	8	13	38	67	34
26	4AL21IS027	MANJUNATH R	13	9	16	39	77	39
27	4AL21IS029	MANOJ M U	15	18	18	38	89	45
28	4AL21IS030	MOHAMMED ADIL	6	6	13	38	63	32
29	4AL21IS031	MOHAMMED RIHAN	11	11	13	40	75	38
30	4AL21IS032	MUHAMMED YAMIN SHARFUDDIN	AB	16	14	37	67	34
31	4AL21IS033	NANDAN S	11	8	13	35	67	34
32	4AL21IS034	NISHANT KUMAR	9	15	17	40	81	41
33	4AL21IS035	PRAGATHI G GOWDA	19	20	20	40	99	50
34	4AL21IS036	PRAJNA	16	20	19	40	95	48
35	4AL21IS037	PRAJWAL GOWDA H G	11	10	20	40	81	41
36	4AL21IS038	PRASHANTH KUMAR B C	7	AB	7	39	53	27
37	4AL21IS039	PREETHAM BYADAGI	8	7	8	38	61	31
38	4AL21IS040	R SREEJITH	9	8	11	35	63	32
39	4AL21IS041	RANJITH	15	15	16	37	83	42
40	4AL21IS042	SANJAY G K	14	11	16	38	79	40
41	4AL21IS043	SANNIDHI K S	15	13	18	39	85	43
42	4AL21IS044	SAPTHAMI	15	18	20	40	93	47
43	4AL21IS045	SARTHAK K JAIN	6	4	7	40	57	29
44	4AL21IS046	SATEESH DYAVAPPA SATYANNAVAI	11	10	14	40	75	38

ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY

SHOBHAVANA CAMPUS, MIJAR, MOODBIDRI – 574 225

DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

Continuous Internal Evaluation Final Marks

Automata Theory and Compiler Design (21CS51)

SN	USN	NAME	CIE1	CIE2	CIE3	Asg	Total	Avg
45	4AL21IS047	SATHWIK K D	16	16	19	38	89	45
46	4AL21IS048	SHARAVI R RAI	13	11	15	40	79	40
47	4AL21IS049	SHASHIDHAR MAHADEV PATGAR	17	20	20	40	97	49
48	4AL21IS050	SHRAVAN R POOJARY	12	6	15	36	69	35
49	4AL21IS051	SHRAVITHA	6	3	12	36	57	29
50	4AL21IS052	SHREYA RAI	12	17	18	40	87	44
51	4AL21IS053	SHRUJAN KUMAR H V	7	8	4	32	51	26
52	4AL21IS054	SOORAJ	9	12	12	40	73	37
53	4AL21IS055	SRIDEEKSHA G	11	14	16	40	81	41
54	4AL21IS056	SRIKANTH RAJU SRINIVAS	9	5	8	39	61	31
55	4AL21IS057	SRUJAN K M	13	11	19	40	83	42
56	4AL21IS058	SRUSTI P S	14	15	20	40	89	45
57	4AL21IS059	SUVAN P KEDILAYA	17	20	20	40	97	49
58	4AL21IS060	SUVARNA ARVINKANTH HARISH	8	4	8	39	59	30
59	4AL21IS061	SYED SALEHA	10	10	7	40	67	34
60	4AL21IS062	VASAVI RAI C	9	3	8	33	53	27
61	4AL21IS063	VITHIKA SHETTY	16	17	20	40	93	47
62	4AL21IS064	CHANDANA N M	11	10	16	40	77	39
63	4AL22IS400	ANKITH	10	10	10	39	69	35
64	4AL22IS401	CHARAN S V	8	3	13	35	59	30
65	4AL22IS402	CHETAN BYAHATTI	9	8	17	39	73	37
66	4AL22IS403	LOHITH H	15	13	19	38	85	43
67	4AL22IS404	NAMRATHA J SHETTY	11	20	20	40	91	46
68	4AL22IS405	RAHUL P SHETTY	5	9	8	39	61	31

HoD, Dept. of ISE
(Dr. Sudheer Shetty)

CBCS SCHEME

USN | | | | | | | | | | |

18CS54

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021
Automata Theory and Computability

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define the following with example:
i) String ii) Language iii) Alphabet iv) Symbol (04 Marks)

b. Design a DFSM to accept each of the following language:
i) $L = \{w \in \{a, b\}^*$; w has all strings that ends with sub string abb $\}$
ii) $L = \{w;$ where $|w| \bmod 3 = 0$ where $\Sigma = \{a\}\}$
iii) $L = \{w \in \{a, b\}^*$ every a region in w is of even length.$\}$ (09 Marks)

c. Construct an equivalent DFA from the following given NFA using subset construction method. (Refer Fig.Q.1(c)) (07 Marks)

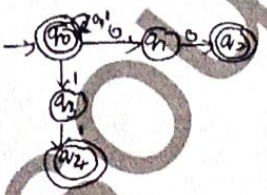


Fig.Q.1(c)

OR

2 a. Construct a minimum state automation equivalent to the FA given table

States	0	1
$\rightarrow q_0$	q_1	q_5
q_1	q_6	q_2
q_2	q_0	q_2
q_3	q_2	q_6
q_4	q_7	q_5
q_5	q_2	q_6
q_6	q_6	q_4
q_7	q_6	q_2

(10 Marks)

b. Consider the following NFA with ∈-moves construct on equivalent DFA. (10 Marks)

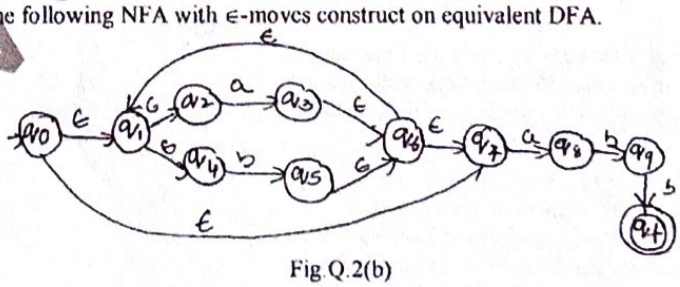


Fig.Q.2(b)

Module-2

3 a. Define Regular expression. Write RE for the following languages:
i) $L = \{a^n b^m \mid m + n \text{ is even}\}$
ii) $L = \{a^n b^m \mid m \geq 1 \; n \geq 1 \; nm \geq 3\}$
iii) $L = \{a^{2n} b^{2m} \mid n \geq 0, m \geq 0\}$ (10 Marks)

b. Construct an $\in$ - NFA for the regular expression $0 + 01^*$ (05 Marks)

c. Construct on FA for the regular expression $10 + (0 + 11)0^*1$ (05 Marks)

OR

4 a. State and prove pumping lemma theorem for regular languages (08 Marks)

b. Prove that $L = \{a^p \mid p \text{ is a prime}\}$ is not a regular. (08 Marks)

c. List out closure properties of regular sets. (04 Marks)

Module-3

5 a. Define CFG. Write a CFG to specify
i) all string over {a, b} that are even and odd palindromes.
ii) $L = \{a^n b^{2n} \text{ over } \Sigma = \{a, b\} \; n \geq 1\}$ (10 Marks)

b. Write the procedure for removal of $\in$-productions. Simplify the following grammar.
$S \rightarrow aA \mid aBB$
$A \rightarrow aAA \mid \in$
$B \rightarrow bB \mid bbC$
$C \rightarrow B$ (10 Marks)

OR

6 a. Define PDA. Design a PDA for the language that accepts the string with $n_a(w) < n_b(w)$ where $w \in (a + b)^*$ and show the instantaneous description of the PDA on input abbab. (10 Marks)

b. What is CNF and GNF? Convert the following grammar into GNF.
$S \rightarrow AA \mid a$
$A \rightarrow SS \mid b$ (10 Marks)

Module-4

7 a. With a neat diagram, explain variant of turning machine. (10 Marks)

b. Construct a Turning machine that accept the language 0^n, 1^n where $n > 1$ and draw transition graph for Turning Machine. (10 Marks)

OR

8 a. Define Turning Machine with its tuples. (04 Marks)

b. Explain the working principle of Turning Machine with diagram. Design a Turing Machine to accept strings formed on {0, 1} and ending with 000. Write transition diagram and ID for w = 101000. (16 Marks)

Module-5

9 a. Explain restricted turing machines. (08 Marks)

b. Explain the following with example:
i) Decidability ii) Decidable languages iii) Undecidable languages. (12 Marks)

OR

10 Write a short note on:
a. Post correspondence problem
b. Halting problems in Turning Machine
c. Linear Bound Automation (LBA)
d. Classes of P and NP (20 Marks)

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

18CS54

Fifth Semester B.E. Degree Examination, Feb./Mar. 2022
Automata Theory and Computability

Time: 3 hrs. Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Define the following terms with examples :
i) Alphabet ii) String iii) Language iv) Concatenation at Languages
v) Power of an Alphabet. **(10 Marks)**

b. Define DFSM. Design DFSM
i) To accept strings having Even number of a's and even number b's
ii) To accept binary numbers divisible by 5. **(10 Marks)**

OR

2 a. Convert the following NDFSM of DFSM. [Refer Fig Q2(a)].

Fig Q2(a) **(08 Marks)**

b. Minimize the following DFSM by indentifying Distinguishable and Non-distinguishable states.

δ	0	1
→ A	B	F
B	G	C
C	A	C
D	C	G
E	H	F
F	C	G
G	G	F
H	G	C

(12 Marks)

Module-2

3 a. Define Regular Expression. Write RE for the following Languages. **(10 Marks)**
i) Strings of 0's and 1's ending with three consecutive zeroes.
ii) Strings of a's and b's having substring aa.

b. Write DFSM to accept intersection of Languages $L_1 = (a + b)^*a$ and $L_2 = (a + b)^*b$ **(10 Marks)**

OR

4 a. Using Kleen's theorem, prove that for any Regular Expression R, their exits a finite automata $M = (Q, \Sigma, \delta, q_0, F)$ which accepts L(R). **(10 Marks)**

b. State and prove pumping Lemma for Regular Languages. Show that the Language $L = \{ww^r : w \in (0, 1)^*\}$ is not regular. **(10 Marks)**

Module-3

5 a. Define Context Free Grammar. Design CFG for the following Languages.
i) $L_1 = \{w : |w| \text{ Mod } 3 = 0\}$ over $\Sigma = \{a\}$
ii) $L_2 = \{a^n b^m c^k : m = n + k\}$ over $\Sigma = \{a, b, c\}$ (10 Marks)

b. Define Ambiguity. Consider the grammar
$E \rightarrow E + E \mid E * E \mid (E) \mid id$
Find Leftmost and Rightmost derivations and parse tree for the string id + id * id. show that the grammar is ambiguous. (10 Marks)

OR

6 a. What is Chomsky Normal Form of CFG? Convert the following grammar to CNF.
$S \rightarrow ABC \mid BaB$
$A \rightarrow aA \mid BaC \mid aaa$
$B \rightarrow bBb \mid a \mid D$
$C \rightarrow CA \mid AC$
$D \rightarrow \varepsilon$
Eliminate ε - productions, Unit productions and useless symbols if any before conversion. (10 Marks)

b. What is NPDA? Design NPDA for Language $L = \{a^n b^n \mid n \geq 1\}$. Draw transition diagram. Write sequence of moves made by NPDA to accept the string aaabbb. (10 Marks)

Module-4

7 a. Design TM for WCW^R over $\Sigma = \{0, 1\}$. Write transition diagram, and ID for w = 101C101 (14 Marks)

b. Explain : i) Multitape ii) Non-deterministic TM (06 Marks)

OR

8 a. Define Turning Machine. Explain the working of Turning Machine. (06 Marks)

b. Design Turning machine to accept the Language $L = \{0^n 1^n 2^n \mid n >= 0\}$. Draw the transition diagram. Write sequence of moves made by TM for string 001122. (14 Marks)

Module-5

9 a. Explain Halting problem in Turning machine. (07 Marks)
b. Write applications of Turning Machine. (06 Marks)
c. Explain Recursively Enumerable Languages. (07 Marks)

OR

10 a. Explain Quantum Computers. (07 Marks)
b. Explain P and NP classes. (07 Marks)
c. Explain Church Turning Thesis. (06 Marks)

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

18CS54

Fifth Semester B.E. Degree Examination, July/August 2022
Automata theory and Computability

Time: 3 hrs. Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Define the following terms with an example i) Alphabet ii) Power of an alphabet iii) String iv) String concatenation v) language. **(05 Marks)**

b. Explain the hierarchy of language classes in automata theory with diagram. **(05 Marks)**

c. Design DFSM for each of the following language.

i) $L = \{\omega \in \{0,1\}^* : \omega \text{ does not end in } 01\}$

ii) $L = \{\omega \in \{a,b\}^* : \text{every a in } \omega \text{ is immediately preceded and followed by b}\}$. **(10 Marks)**

OR

2 a. Use MiNDFSM algorithm to minimize M given in Fig Q2(a).

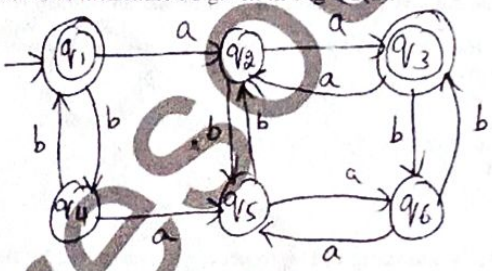


Fig Q2(a) **(08 Marks)**

b. Convert the following NDFSM given in Fig Q2(b) to its equivalent DFSM.

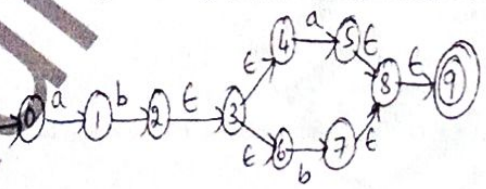


Fig Q2(b) **(08 Marks)**

c. Design a **mealy** machine that takes binary number as input and produces 2's complement of the number as output. **(04 Marks)**

Module-2

3 a. Define Regular expression. Write regular expression for the following language.

i) $L = \{0^m 1^{mn} \mid m \geq 1, n \geq 1, mn \geq 3\}$

ii) $L = \{\omega \in \{a,b\}^* : \text{string with atmost one pair of consecutive a's}\}$ **(08 Marks)**

b. Obtain NDFSM for the regular expression $(a^* \cup ab)(a \cup b)^*$. **(05 Marks)**

c. Build a regular expression for the given FSM in Fig Q3(c).

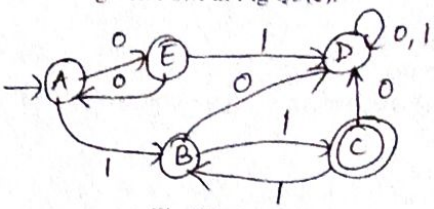


Fig Q3(c) **(07 Marks)**

OR

4 a. State and prove pumping Lemma theorem for regular language. **(08 Marks)**

b. Prove that regular languages are closed under complement. **(05 Marks)**

c. Write regular expression, regular grammer and FSM for the languages $L = \{\omega \in \{a, b\}^* : w \text{ ends with pattern aaaa}\}$. **(07 Marks)**

Module-3

5 a. Define Context Free Grammer (CFG). Write CFG for the following languages $L = \{0^m 1^m 2^n : m \geq 1, n \geq 0\}$. **(05 Marks)**

b. What is ambiguity in a grammar? Eliminate ambiguity from balanced parenthesis grammar? **(08 Marks)**

c. Simplify the grammar by removing productive and unreachable symbols

$S \rightarrow AB|AC$

$A \rightarrow aA\ b|\in$

$B \rightarrow bA$

$C \rightarrow bCa$

$D \rightarrow AB$

(07 Marks)

OR

6 a. Define PDA and design PDA to accept the language by final state method. $L(M) = \{\omega C \omega^R \mid \omega \in (a \cup b)^*$ and ω^R is reverse of $\omega\}$ **(07 Marks)**

b. Convert the following grammar to CNF

$S \rightarrow ASB|\in$

$A \rightarrow a\ AS|a$

$B \rightarrow SbS|A|bb$

(08 Marks)

c. Consider the grammar

$E \rightarrow E + E|E * E|(E)|id$

Construct LMD, RMD and parse tree for the string (id + id * id). **(05 Marks)**

Module-4

7 a. Define Turing Machine (TM). Design a TM for language $L = \{0^n 1^n \mid n \geq 1\}$. Show that the string 0011 is accepted by ID. **(10 Marks)**

b. Explain multiple TM with a neat diagram. **(05 Marks)**

c. Explain any two techniques for TM construction. **(05 Marks)**

OR

8 a. Design a TM for the language $L = \{1^n 2^n 3^n \mid n \geq 1\}$ show that the string 11 2233 is accepted by ID. **(12 Marks)**

b. Demonstrate the model of Linear Bounded Automata (LBA) with a neat diagram. **(08 Marks)**

Module-5

9 a. Show that A_{DFA} is decidable. **(05 Marks)**

b. Define Post Correspondence Problem (PCP). Does the PCP with two list $x = (b, bab^3, ba)$ $y = (b^3, ba, b)$ have a solution. **(08 Marks)**

c. Explain quantum computation. **(07 Marks)**

OR

10 a. Prove the A_{TM} is undecidable. **(05 Marks)**

b. Does the PCP with two list $x = (0, 01000, 01)$ $y = (000, 01, 1)$ have a solution. **(05 Marks)**

c. State and explain Church Turning Thesis in detail. **(10 Marks)**

* * * * *

Theorem 1:

For every Regular Expression there is an equivalent Finite State Machine (FSM).

OR

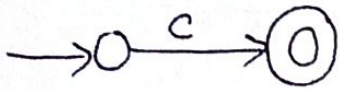
Any language that can be defined with a Regular Expression can be accepted by some Finite State Machine (FSM) and so is Regular.

Proof:

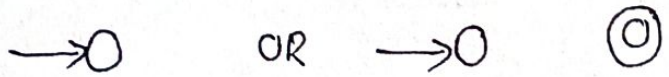
The proof is by construction. We will show that, given a Regular Expression α, we can construct a Finite State machine (FSM) M such that $L(\alpha) = L(M)$.

We first show that there exists an FSM that corresponds to each primitive Regular Expression:

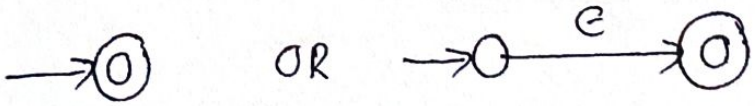
1. If α is any $c \in \Sigma$, we construct for it the simple FSM shown below.



2. If α is $\emptyset$, we construct for it the simple FSM shown below.



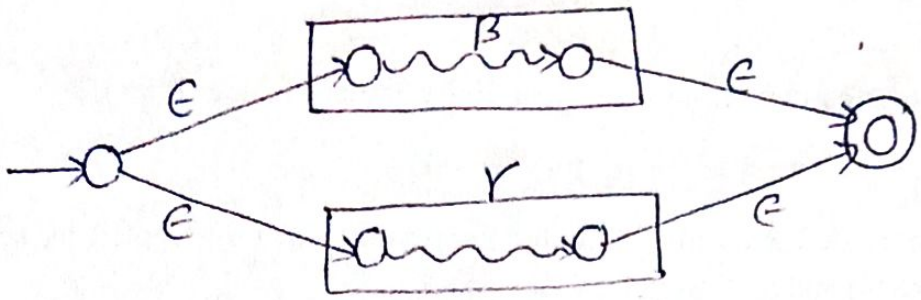
3. If α is ϵ, we construct for it the simple FSM shown below.



Next, we must show how to build FSMs to accept languages that are defined by the Regular Expressions that exploit the operations of Concatenation, Union and Kleene star.

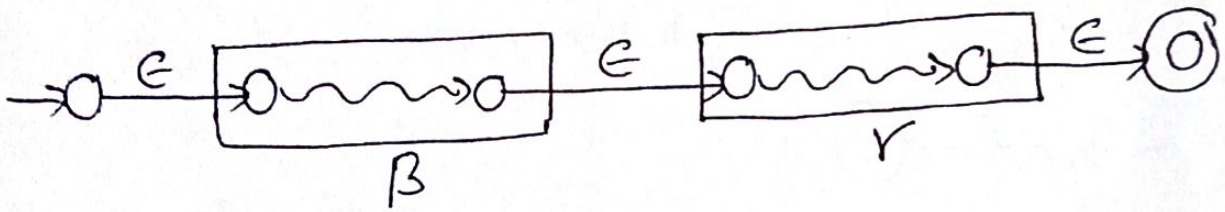
Let β and γ be Regular Expressions that define languages over the alphabet Σ. If $L(\beta)$ and $L(\gamma)$ are regular, then let they are accepted by some FSM's $M_1 = (Q_1, \Sigma, \delta_1, q_1, F_1)$ and $M_2 = (Q_2, \Sigma, \delta_2, q_2, F_2)$ respectively.

4. If α is the Regular Expression $\beta \cup \gamma$, then we construct an FSM $M_3 = (Q_3, \Sigma, \delta_3, q_3, F_3)$ such that $L(M_3) = L(\alpha) = L(\beta) \cup L(\gamma)$ as shown below.



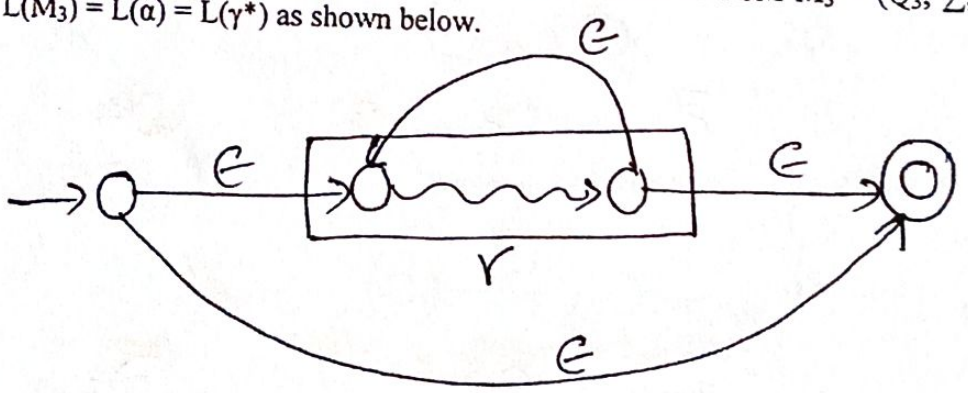
Since there are 2 paths to the final state, one through M1 and another through M2, the language of the above FSM is $L(\beta) \cup L(\gamma) = L(\beta \cup \gamma)$.

5. If α is the Regular Expression $\beta\gamma$, then we construct an FSM $M_3 = (Q_3, \Sigma, \delta_3, q_3, F_3)$ such that $L(M_3) = L(\alpha) = L(\beta)L(\gamma)$ as shown below.



We observe that the language of the above FSM is $L(\beta)L(\gamma) = L(\beta\gamma)$.

6. If α is the Regular Expression γ^*, then we construct an FSM $M_3 = (Q_3, \Sigma, \delta_3, q_3, F_3)$ such that $L(M_3) = L(\alpha) = L(\gamma^*)$ as shown below.



We have $L(\gamma^*) = (L(\gamma))^* = \{\epsilon\} \cup L(\gamma) \cup L(\gamma)L(\gamma) \cup \ldots\ldots\ldots\ldots$

The above FSM accepts all the strings and exactly those strings which are the strings of the language $L(\gamma^*)$.

Based on the constructions that have just been described for the primitive as well as derived Regular Expressions, we conclude that for every Regular Expression there is an equivalent Finite State Machine (FSM).

Theorem 8: <u>Pumping theorem (Lemma) for Regular Languages</u>

If L is a Regular language, then:

$$\exists\, k \geq 1\ (\forall \text{strings } w \in L, \text{ where } |w| \geq k\ (\exists\, x, y, z\ (w = xyz,\ |xy| \leq k,\ y \neq \varepsilon, \text{ and } \forall\, q \geq 0\ (xy^q z \in L)))).$$

i.e. Every sufficiently long string in L can be decomposed into 3 parts in such a way that an arbitrary number of repetitions of the middle part yields another string in L and we say that the middle string is pumped.

Proof:

Suppose L is Regular, then it is accepted by some DFSM $M = (Q, \Sigma, \delta, q_0, F)$ such that $L = L(M)$. Suppose M has 'k' states. Let us consider any string $w \in L$. i.e.

$$w = a_1a_2a_3\ldots\ldots a_m, \quad m \geq k$$

Let us define

$$\delta(q_0, a_1a_2a_3\ldots\ldots a_i) = p_i \text{ for } i = 0, 1, 2, 3, \ldots, m$$

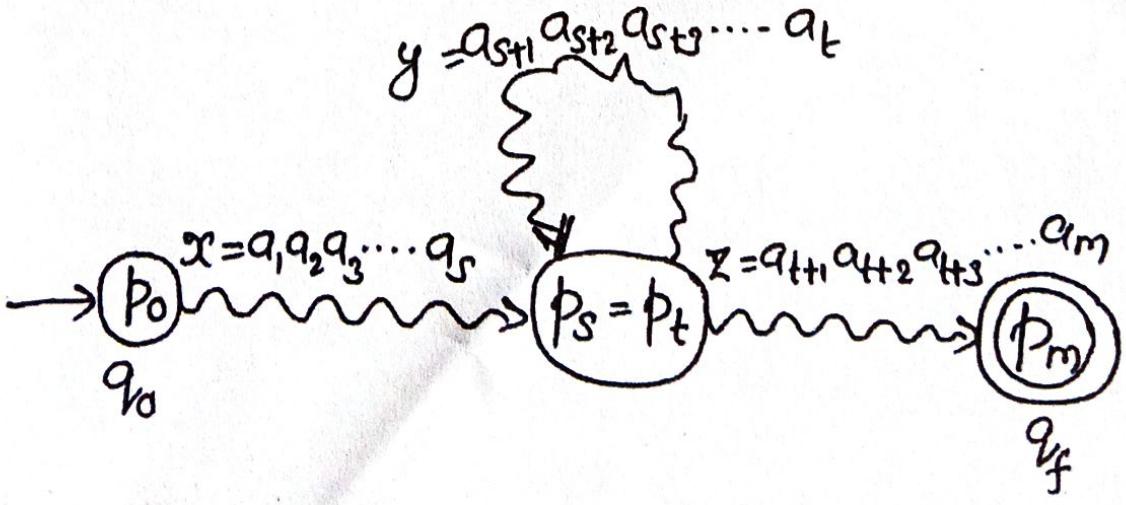
i.e. p_i is the state M is in after reading the first i symbols in w.

By the pigeonhole principle, it is not possible for the m+1 different p_i's to be distinct, since there are only 'k' distinct states. Among the various pairs of repeated states, we take the first pair. Thus, there will be 2 different integers s and t with $0 \leq s < t \leq m$ such that $p_s = p_t$.

Now, we can break w = xyz as follows.

$$x = a_1a_2a_3\ldots\ldots a_s$$
$$y = a_{s+1}a_{s+2}a_{s+3}\ldots\ldots a_t$$
$$z = a_{t+1}a_{t+2}a_{t+3}\ldots\ldots a_m$$

i.e., x takes us to p_s once, y takes us from p_s to p_t (=p_s) and z is the balance of w. This is illustrated in the following diagram.



From the above diagram, it is clear that

$\delta(q_0, xz) = q_f$ (y repeats zero times)

$\delta(q_0, xy^2z) = q_f$ (y repeats twice)

$\vdots$

$\delta(q_0, xy^qz) = q_f$ (y repeats q times)

Thus for any $q \geq 0$, $xy^qz \in L$.

Moreover $y \neq \varepsilon$ since $s < t$ and there are no ε-transitions as M is deterministic (DFSM).

Also, $|xy| \leq k$ since y is the earliest repeated part of the string w.

Hence the theorem.

ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY

SHOBHAVANA CAMPUS, MIJAR, MOODBIDRI – 574 225

DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

Jan-Feb 2024 SEE Results V Semester (2021 Scheme) AY 2023-24 (GRADE)

SN	USN	NAME	21CS51			
			CE	GL	GP	CP
1	4AL21IS001	ADITHYA TEJASWI D	3	A	8	24
2	4AL21IS002	AFIZA A	3	A	8	24
3	4AL21IS003	AISHWARYA SALIMATH	3	B+	7	21
4	4AL21IS004	AKASH DEVADIGA	3	A	8	24
5	4AL21IS005	AMAR B M	3	B+	7	21
6	4AL21IS006	ANAGHA UDUPA Y N	3	B+	7	21
7	4AL21IS007	ANANYA	3	B+	7	21
8	4AL21IS008	ANIRUDH KAMATH K	3	P	4	12
9	4AL21IS009	ANKITHA B	3	B+	7	21
10	4AL21IS010	BHAGYASHREE R PUJARI	3	A+	9	27
11	4AL21IS011	BHARATH J	3	B+	7	21
12	4AL21IS012	BHUMIKA SUNIL KULKARNI	3	A+	9	27
13	4AL21IS013	CHAITRA S KODDADDI	3	P	4	12
14	4AL21IS014	CHANDAN M N	3	C	5	15
15	4AL21IS015	CHINDAN B V	3	B+	7	21
16	4AL21IS017	GOWRISH N	3	B+	7	21
17	4AL21IS018	HARSHITHA B	3	A	8	24
18	4AL21IS019	JAHNAVI	3	A	8	24
19	4AL21IS020	KARTHIK MADAKARI T P	3	A	8	24
20	4AL21IS021	KELVIN DMELLO	3	A	8	24
21	4AL21IS022	KOUSHIK ACHAR	3	B+	7	21
22	4AL21IS023	KRUPASHREE R	3	C	5	15
23	4AL21IS024	LAYA R	3	B+	7	21

SN	USN	NAME	21CS51			
			CE	GL	GP	CP
24	4AL21IS025	MANIKANTA	3	B+	7	21
25	4AL21IS026	MANISH K	3	C	5	15
26	4AL21IS027	MANJUNATH R	3	B+	7	21
27	4AL21IS029	MANOJ M U	3	A+	9	27
28	4AL21IS030	MOHAMMED ADIL	3	C	5	15
29	4AL21IS031	MOHAMMED RIHAN	3	A	8	24
30	4AL21IS032	MUHAMMED YAMIN SHARFUDDIN	3	B	6	18
31	4AL21IS033	NANDAN S	3	B	6	18
32	4AL21IS034	NISHANT KUMAR	3	A	8	24
33	4AL21IS035	PRAGATHI G GOWDA	3	A+	9	27
34	4AL21IS036	PRAJNA	3	A+	9	27
35	4AL21IS037	PRAJWAL GOWDA H G	3	B+	7	21
36	4AL21IS038	PRASHANTH KUMAR B C	3	B	6	18
37	4AL21IS039	PREETHAM BYADAGI	3	B	6	18
38	4AL21IS040	R SREEJITH	3	B	6	18
39	4AL21IS041	RANJITH	3	B+	7	21
40	4AL21IS042	SANJAY G K	3	B	6	18
41	4AL21IS043	SANNIDHI K S	3	A	8	24
42	4AL21IS044	SAPTHAMI	3	A	8	24
43	4AL21IS045	SARTHAK K JAIN	3	C	5	15
44	4AL21IS046	SATEESH DYAVAPPA SATYANNAVAR	3	B	6	18
45	4AL21IS047	SATHWIK K D	3	A+	9	27
46	4AL21IS048	SHARAVI R RAI	3	B+	7	21
47	4AL21IS049	SHASHIDHAR MAHADEV PATGAR	3	A+	9	27
48	4AL21IS050	SHRAVAN R POOJARY	3	C	5	15
49	4AL21IS051	SHRAVITHA	3	P	4	12

SN	USN	NAME	21CS51			
			CE	GL	GP	CP
50	4AL21IS052	SHREYA RAI	3	B+	7	21
51	4AL21IS053	SHRUJAN KUMAR H V	0	F	0	0
52	4AL21IS054	SOORAJ	3	B+	7	21
53	4AL21IS055	SRIDEEKSHA G	3	A	8	24
54	4AL21IS056	SRIKANTH RAJU SRINIVAS	3	C	5	15
55	4AL21IS057	SRUJAN K M	3	A	8	24
56	4AL21IS058	SRUSTI P S	3	A	8	24
57	4AL21IS059	SUVAN P KEDILAYA	3	B+	7	21
58	4AL21IS060	SUVARNA ARVINKANTH HARISH	0	F	0	0
59	4AL21IS061	SYED SALEHA	3	B	6	18
60	4AL21IS062	VASAVI RAI C	3	P	4	12
61	4AL21IS063	VITHIKA SHETTY	3	A+	9	27
62	4AL21IS064	CHANDANA N M	3	A	8	24
63	4AL22IS400	ANKITH	3	C	5	15
64	4AL22IS401	CHARAN S V	3	B	6	18
65	4AL22IS402	CHETAN BYAHATTI	3	B	6	18
66	4AL22IS403	LOHITH H	3	B+	7	21
67	4AL22IS404	NAMRATHA J SHETTY	3	B+	7	21
68	4AL22IS405	RAHUL P SHETTY	0	F	0	0

ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY

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DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

Jan-Feb 2024 SEE Results V Semester (2021 Scheme) AY 2023-24 (MARKS)

SN	USN	NAME	21CS51			
			IN	EX	TM	P/F
1	4AL21IS001	ADITHYA TEJASWI D	42	28	70	P
2	4AL21IS002	AFIZA A	44	26	70	P
3	4AL21IS003	AISHWARYA SALIMATH	39	26	65	P
4	4AL21IS004	AKASH DEVADIGA	43	31	74	P
5	4AL21IS005	AMAR B M	39	30	69	P
6	4AL21IS006	ANAGHA UDUPA Y N	38	23	61	P
7	4AL21IS007	ANANYA	39	23	62	P
8	4AL21IS008	ANIRUDH KAMATH K	23	24	47	P
9	4AL21IS009	ANKITHA B	42	23	65	P
10	4AL21IS010	BHAGYASHREE R PUJARI	43	40	83	P
11	4AL21IS011	BHARATH J	41	21	62	P
12	4AL21IS012	BHUMIKA SUNIL KULKARNI	50	38	88	P
13	4AL21IS013	CHAITRA S KODDADDI	25	18	43	P
14	4AL21IS014	CHANDAN M N	31	22	53	P
15	4AL21IS015	CHINDAN B V	40	21	61	P
16	4AL21IS017	GOWRISH N	42	26	68	P
17	4AL21IS018	HARSHITHA B	41	31	72	P
18	4AL21IS019	JAHNAVI	42	28	70	P
19	4AL21IS020	KARTHIK MADAKARI T P	43	27	70	P
20	4AL21IS021	KELVIN DMELLO	50	21	71	P
21	4AL21IS022	KOUSHIK ACHAR	43	18	61	P
22	4AL21IS023	KRUPASHREE R	33	18	51	P
23	4AL21IS024	LAYA R	37	24	61	P

SN	USN	NAME	21CS51			
			IN	EX	TM	P/F
24	4AL21IS025	MANIKANTA	42	27	69	P
25	4AL21IS026	MANISH K	34	18	52	P
26	4AL21IS027	MANJUNATH R	39	27	66	P
27	4AL21IS029	MANOJ M U	45	38	83	P
28	4AL21IS030	MOHAMMED ADIL	32	18	50	P
29	4AL21IS031	MOHAMMED RIHAN	38	38	76	P
30	4AL21IS032	MUHAMMED YAMIN SHARFUDDIN	34	23	57	P
31	4AL21IS033	NANDAN S	34	21	55	P
32	4AL21IS034	NISHANT KUMAR	41	33	74	P
33	4AL21IS035	PRAGATHI G GOWDA	50	38	88	P
34	4AL21IS036	PRAJNA	48	36	84	P
35	4AL21IS037	PRAJWAL GOWDA H G	41	21	62	P
36	4AL21IS038	PRASHANTH KUMAR B C	27	28	55	P
37	4AL21IS039	PREETHAM BYADAGI	31	26	57	P
38	4AL21IS040	R SREEJITH	32	26	58	P
39	4AL21IS041	RANJITH	42	18	60	P
40	4AL21IS042	SANJAY G K	40	18	58	P
41	4AL21IS043	SANNIDHI K S	43	35	78	P
42	4AL21IS044	SAPTHAMI	47	31	78	P
43	4AL21IS045	SARTHAK K JAIN	29	22	51	P
44	4AL21IS046	SATEESH DYAVAPPA SATYANNAVAR	38	21	59	P
45	4AL21IS047	SATHWIK K D	45	41	86	P
46	4AL21IS048	SHARAVI R RAI	40	24	64	P
47	4AL21IS049	SHASHIDHAR MAHADEV PATGAR	49	40	89	P
48	4AL21IS050	SHRAVAN R POOJARY	35	18	53	P
49	4AL21IS051	SHRAVITHA	29	18	47	P

SN	USN	NAME	21CS51			
			IN	EX	TM	P/F
50	4AL21IS052	SHREYA RAI	44	23	67	P
51	4AL21IS053	SHRUJAN KUMAR H V	26	12	38	F
52	4AL21IS054	SOORAJ	37	24	61	P
53	4AL21IS055	SRIDEEKSHA G	41	31	72	P
54	4AL21IS056	SRIKANTH RAJU SRINIVAS	31	21	52	P
55	4AL21IS057	SRUJAN K M	42	35	77	P
56	4AL21IS058	SRUSTI P S	45	25	70	P
57	4AL21IS059	SUVAN P KEDILAYA	49	18	67	P
58	4AL21IS060	SUVARNA ARVINKANTH HARISH	30	14	44	F
59	4AL21IS061	SYED SALEHA	34	22	56	P
60	4AL21IS062	VASAVI RAI C	27	18	45	P
61	4AL21IS063	VITHIKA SHETTY	47	38	85	P
62	4AL21IS064	CHANDANA N M	39	34	73	P
63	4AL22IS400	ANKITH	35	19	54	P
64	4AL22IS401	CHARAN S V	30	27	57	P
65	4AL22IS402	CHETAN BYAHATTI	37	21	58	P
66	4AL22IS403	LOHITH H	43	26	69	P
67	4AL22IS404	NAMRATHA J SHETTY	46	23	69	P
68	4AL22IS405	RAHUL P SHETTY	31	12	43	F

Result Analysis - Subjectwise - V Semester 2023-24 (2021 Scheme)

SN	Subject	Sub Code	Total	O	A+	A	B+	B	C	P	F	AB	Percentage	>= A (70)%
1	AUTOMATA THEORY AND COMPILER DESIGN	21CS51	68	0	8	15	20	10	8	4	3	0	95.59	33.82
2	COMPUTER NETWORKS	21CS52	68	1	14	29	20	3	0	0	1	0	98.53	64.71
3	DATABASE MANAGEMENT SYSTEMS	21CS53	68	0	3	20	25	12	3	1	4	0	94.12	33.82
4	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	21CS54	68	0	14	19	28	4	2	1	0	0	100.00	48.53
5	DATABASE MANAGEMENT SYSTEMS LABORATORY WITH MINI	21CSL55	68	11	22	24	8	1	1	0	1	0	98.53	83.82
6	RESEARCH METHODOLOGY & INTELLECTUAL PROPERTY RIGHTS	21RMI56	68	1	20	21	22	1	1	0	2	0	97.06	61.76
7	ENVIRONMENTAL STUDIES	21CIV57	68	0	12	32	21	3	0	0	0	0	100.00	64.71
8	ANGULAR JS	21CSL581	68	46	20	2	0	0	0	0	0	0	100.00	100.00

Overall	Total	FCD	FC	SC	FL	AB	>= 9	>= 8	>= 7	>= 6	Percentage
V Sem IS	68	50	12	0	6	0	1	24	50	63	91.18

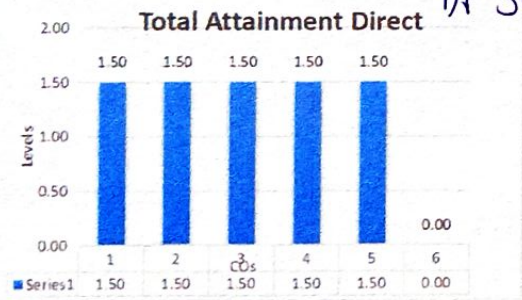
COURSE OUTCOMES (COs) ASSESSMENT MATRIX					
Alva's Institute of Engineering & Technology, Moodbidri					
Department of Information Science & Engineering					
Academic Year:	2023-2024			CO Attainment Indirect	CO Attainment
Course Name & Course Code	Automata Theory & Compiler Design/21CS51				
Faculty Name:	Dr. Sudheer Shetty				
CO Attainment - Direct					
Cos	Formative Assessment	Summative Assessment	Total Attainment		
21CS51.1	3	0	1.50	3	1.65
21CS51.2	3	0	1.50	3	1.65
21CS51.3	3	0	1.50	3	1.65
21CS51.4	3	0	1.50	3	1.65
21CS51.5	3	0	1.50	3	1.65
21CS51.6					
Average			1.50	3	1.65

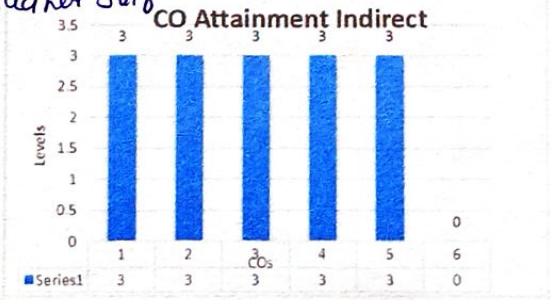
Attainment Level 1: 50% students rated more than or equal to 50% of maximum marks
Attainment Level 2: 60% students rated more than or equal to 50% of maximum marks
Attainment Level 3: 70% students rated more than or equal to 50% of maximum marks

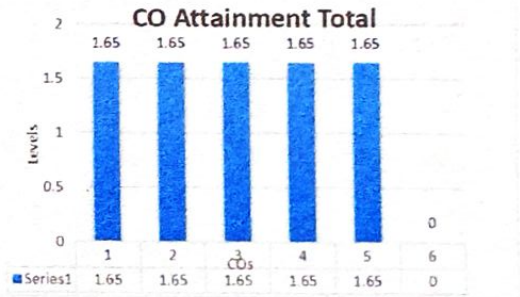
Note:
Total Attainment Direct = (Weightage*Formative Assessment)+(Weightage*Summative Assessment) Weightage for Formative Assessment = 50%; Weightage for Summative Assessment = 50%

CO Attainment = (Weightage*Total Attainment Direct)+(Weightage*CO Attainment Indirect) Weightage for Total Attainment Direct = 90%; Weightage for CO Attainment Indirect = 10%

Faculty Name & Signature:	Dr Sudheer Shetty	HOD Signature:	







PROGRAMME OUTCOME & PROGRAMME SPECIFIC OUTCOME ASSESSMENT MATRIX

Alva's Institute of Engineering & Technology, Moodbidri

Department of Information Science & Engineering

Academic Year:	2023-2024
Course Name:	Automata Theory & Compiler Design
Course Code:	21CS51
Faculty Name:	Dr. Sudheer Shetty

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CS51.1	2	1	1	1								1	1		
21CS51.2	2	2	2	2								1	1		
21CS51.3	2	2	2	1								1	2		
21CS51.4	2	2	2	2								1	1		
21CS51.5	2	2	1	1								1	1		
21CS51.6															
AVG	2	1.8	1.6	1.4								1	1.2		

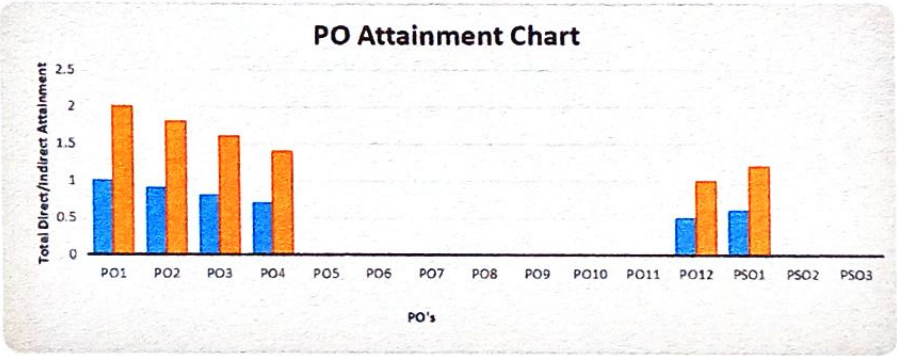
Key Words (POs)	Apply Knowledge	Solve Problems	Design/ Development of Solution	Conduct Investigations	Use Modern Tools	Engineer and Society	Enviroamnat and Sustainability	Professional Ethics	Individual and Team Work	Communicate Effectively	Project Management and Finance	Life-long Learning	PSO 1	PSO 2	PSO 3
21CS51 Direct (X)	1	0.9	0.8	0.7								0.5	0.6		
21CS51 Indirect (Y	2	1.8	1.6	1.4								1	1.2		
Attainment Level	1.1	0.99	0.88	0.77								0.55	0.66		

PO Attainment Calculation Direct

COs	CO Attainment Grade	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CS51.1	1.50	1	0.5	0.5	0.5	0	0	0	0	0	0	0	0.5	0.5	0	0
21CS51.2	1.5	1	1	1	1	0	0	0	0	0	0	0	0.5	0.5	0	0
21CS51.3	1.5	1	1	1	0.5	0	0	0	0	0	0	0	0.5	1	0	0
21CS51.4	1.5	1	1	1	1	0	0	0	0	0	0	0	0.5	0.5	0	0
21CS51.5	1.5	1	1	0.5	0.5	0	0	0	0	0	0	0	0.5	0.5	0	0
21CS51.6																
	Weighted Sum --->	5	4.5	4	3.5	0	0	0	0	0	0	0	2.5	3	0	0
	Max Weight -------->	10	9	8	7	0	0	0	0	0	0	0	5	6	0	0
PO Attainment in percentage	:---------->	50.00	50.00	50.00	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	50.00	0.00	0.00
	PO Attained Grade	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		1	0.9	0.8	0.7								0.5	0.6		

PO Attainment Calculation Indirect

COs	CO Attainment Grade	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CS51.1	3	2	1	1	1	0	0	0	0	0	0	0	1	1	0	0
21CS51.2	3	2	2	2	2	0	0	0	0	0	0	0	1	1	0	0
21CS51.3	3	2	2	2	1	0	0	0	0	0	0	0	1	2	0	0
21CS51.4	3	2	2	2	2	0	0	0	0	0	0	0	1	1	0	0
21CS51.5	3	2	2	1	1	0	0	0	0	0	0	0	1	1	0	0
21CS51.6																
	Weighted Sum --->	10	9	8	7	0	0	0	0	0	0	0	5	6	0	0
	Max Weight -------->	10	9	8	7	0	0	0	0	0	0	0	5	6	0	0
PO Attainment in percentage	:---------->	100.00	100.00	100.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00	100.00	0.00	0.00
	PO Attained Grade	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		2	1.8	1.6	1.4								1	1.2		



Faculty Name & Signature:	Sudheer Shetty

Dr. Sudheer Shetty

HOD Signature:	Sudheer

Academic Year:	2023-2024
Course Name:	Automata Theory & Compiler Design
Course Code:	21CS51
Faculty Name:	Dr. Sudheer Shetty

Observations and Action Plan (Direct)

Course	Target	Attainment	Gap	Observation	Action Proposed to bridge the Gap
21CS51	2	1.50	0.50	Due to the introduction of Compiler Design part, target could not be achieved.	Practical exposure is required in the field of Compiler Design. Proposed to put lab experiments to enhance the knowledge on compilers.

Outcomes on Actions for CAYm1 Observations/Suggestions

SI. No.	Action Taken	Change Observed
1	Target achieved. Planned to continue the same teaching methodology.	

Faculty Name & Signature:	Dr. Sudheer Shetty

HOD Signature:	

ALVA'S INSTITUTE OF ENGINEERING AND TECHNOLOGY

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DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

Advanced Learners V Semester Academic Year 2023-24

SN	USN	NAME	CGPA-III & IV Sem
1	4AL21IS035	PRAGATHI G GOWDA	9.38
2	4AL21IS012	BHUMIKA SUNIL KULKARNI	9.30
3	4AL21IS021	KELVIN DMELLO	9.23
4	4AL21IS029	MANOJ M U	9.15
5	4AL21IS049	SHASHIDHAR MAHADEV PATGAR	9.10
6	4AL21IS047	SATHWIK K D	9.05
7	4AL21IS059	SUVAN P KEDILAYA	9.05
8	4AL21IS020	KARTHIK MADAKARI T P	9.03
9	4AL21IS036	PRAJNA	8.98
10	4AL21IS058	SRUSTI P S	8.93
11	4AL21IS018	HARSHITHA B	8.90
12	4AL21IS063	VITHIKA SHETTY	8.88
13	4AL21IS022	KOUSHIK ACHAR	8.87
14	4AL21IS006	ANAGHA UDUPA Y N	8.80
15	4AL21IS032	MUHAMMED YAMIN SHARFUDDIN	8.78
16	4AL21IS044	SAPTHAMI	8.75
17	4AL21IS064	CHANDANA N M	8.73
18	4AL21IS052	SHREYA RAI	8.73
19	4AL21IS057	SRUJAN K M	8.68
20	4AL21IS037	PRAJWAL GOWDA H G	8.65
21	4AL21IS009	ANKITHA B	8.63
22	4AL21IS002	AFIZA A	8.60
23	4AL21IS025	MANIKANTA	8.50
24	4AL21IS061	SYED SALEHA	8.45
25	4AL21IS043	SANNIDHI K S	8.45
26	4AL21IS017	GOWRISH N	8.38
27	4AL21IS010	BHAGYASHREE R PUJARI	8.35
28	4AL21IS054	SOORAJ	8.35
29	4AL21IS015	CHINDAN B V	8.25
30	4AL21IS041	RANJITH	8.25
31	4AL21IS034	NISHANT KUMAR	8.23
32	4AL22IS404	NAMRATHA J SHETTY	8.20
33	4AL21IS019	JAHNAVI	8.18
34	4AL21IS004	AKASH DEVADIGA	8.15
35	4AL22IS403	LOHITH H	8.13

36	4AL21IS042	SANJAY G K	8.13
37	4AL21IS031	MOHAMMED RIHAN	8.08
38	4AL21IS007	ANANYA	8.08
39	4AL21IS001	ADITHYA TEJASWI D	8.05
40	4AL21IS051	SHRAVITHA	8.00
41	4AL21IS011	BHARATH J	7.93
42	4AL21IS050	SHRAVAN R POOJARY	7.85
43	4AL21IS055	SRIDEEKSHA G	7.83
44	4AL21IS027	MANJUNATH R	7.80
45	4AL21IS048	SHARAVI R RAI	7.80
46	4AL21IS046	SATEESH DYAVAPPA SATYANNAVAR	7.77

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DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

Slow Learners V Semester Academic Year 2023-24

SN	USN	NAME	CGPA-III & IV Sem	No.of Backlogs
1	4AL21IS024	LAYA R	7.63	0
2	4AL21IS005	AMAR B M	7.58	0
3	4AL21IS008	ANIRUDH KAMATH K	7.55	1
4	4AL21IS033	NANDAN S	7.43	0
5	4AL22IS405	RAHUL P SHETTY	7.35	0
6	4AL21IS014	CHANDAN M N	7.35	0
7	4AL21IS003	AISHWARYA SALIMATH	7.33	0
8	4AL21IS038	PRASHANTH KUMAR B C	7.33	0
9	4AL21IS062	VASAVI RAI C	7.28	0
10	4AL21IS045	SARTHAK K JAIN	7.25	0
11	4AL21IS040	R SREEJITH	7.15	1
12	4AL21IS026	MANISH K	7.08	0
13	4AL21IS056	SRIKANTH RAJU SRINIVAS	6.85	2
14	4AL21IS023	KRUPASHREE R	6.82	1
15	4AL21IS060	SUVARNA ARVINKANTH HARISH	6.80	1
16	4AL22IS400	ANKITH	6.73	0
17	4AL21IS013	CHAITRA S KODDADDI	6.45	1
18	4AL22IS402	CHETAN BYAHATTI	6.43	0
19	4AL22IS401	CHARAN S V	6.35	0
20	4AL21IS039	PREETHAM BYADAGI	6.20	1
21	4AL21IS053	SHRUJAN KUMAR H V	6.15	0
22	4AL21IS030	MOHAMMED ADIL	5.98	0

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