Module (Course Syllabus) Catalogue

2020-2021

College/ Institute	Erbil Technical Engineering	
Department	Information Systems Engineering	
Module Name	Computational Theory	
Module Code	Computational Theory	
Degree	Technical Diploma ☐ Bachler ✔ High Diploma ☐ Master ☐ PhD ☐	
Semester	Full year course	
Qualification	PhD	
Scientific Title	Lecturer	
ECTS (Credits)	6	
Module type	Prerequisite ☐ Core ✔ Assist. ☐	
Weekly hours	4	
Weekly hours (Theory)	(2)hr Class	(93.5)Total hrs Workload
Weekly hours (Practical)	(2)hr Class	(68.5)Total hrs Workload
Number of Weeks	15	
Lecturer (Theory)	Dr. Sara Raouf Muhamad Amin	
E-Mail & Mobile NO.	Sara.muhamad@epu.edu.iq 07504881488	
Lecturer (Practical)	Mr. Niyaz Muhamad Salih	
E-Mail & Mobile NO.	+964 7504054557	
Websites		

Course Book

Course Description	This subject is a part of theory of computation. It comprises the fundamental mathematical properties of computer hardware, software, and certain applications thereof. In studying this subject we seek to determine what can and cannot be computed, how quickly, with how much memory, and on which type of computational model. The subject has obvious connections with engineering practice, and as in many sciences, it also has purely philosophical aspects.
Course objectives	1. Introduce students to the mathematical foundations of computation including automata theory; the theory of formal languages and grammars; the notions of algorithm, decidability, complexity, and computability. 2. Enhance/develop students' ability to understand and conduct mathematical proofs for computation and algorithms.
Student's obligation	The attendance of students in both lectures and labs will have extra credit. He / she is required to continuously follow the lectures, submits homework and assignments. Expect quizzes any time. This is part of the assessment defined in section **Assessment scheme**.
Required Learning Materials	Java or C++ or any Programming Language and a computer device

		Task	Weight (Marks)	Due Week	Relevant Learning Outcome
Evaluation		Paper Review			
	Assignments	Homework	5	15	
		Class attendance	2	15	
		Report	10	2	Academic writing

	Seminar	10	1	presentation	
	Essay				
	Project				
Quiz		8	2		
Lab.		15	1		
Midterm Exam		10	1	Student evaluation1	
Final Exam		40	2	Student evaluation2	
Total		100	25		

Specific learning outcome:	1- Students will learn several formal mathematical models of computation along with their relationships with formal languages. 2- In particular, they will learn regular languages and context free languages which are crucial to understand how compilers and programming languages are built 3- Students will understand that there are limitations on what computers can do, and learn examples of unsolvable problems. 4- Students will learn that certain problems do not admit efficient algorithms, and identify such problems.
Course References:	1. Introduction to the Theory of Computation by Michel Sipser, 2nd Ed., Cengage Learning, 2005. 2. Introduction to Automata Theory, Languages, and computations by John E. Hopcroft, Rajeev Motwani, Jeffery D. Ullman, 2nd Ed., 2001

Course topics (Theory)	Week	Learning Outcome
Introduction to Computational Theory	1	General information about FF
Deterministic finite automata (DFA) & Nondeterministic finite automata (NFA).	2	Design DFA and NFA
Equivalence of DFA and NFA,	3	Convert NFA to DFA

Myhill Nerode Theorem – Table Filling Method	4	Minimizing DFA
Finding a String in a text	5	How compiler work
Regular expressions	6	What is regular language
Midterm exam	7	Evaluation the students
Mealy Machine and Moore Machine	8	Design Moore Machine
Context Free Grammar (CFG)	9	Design CFG
Simplification of CFG	10	How to simplify CFG
Push Down Automata	11	Design an automata
Turing Machines and reduction	12	Turing Machines
Turing Machine Programming Techniques	13	Programming Turing Machine
Review and final exam.	14	Students final evaluation

Questions Example Design

Q1/ design a DFA that accept any strings that ends with 00 or 11
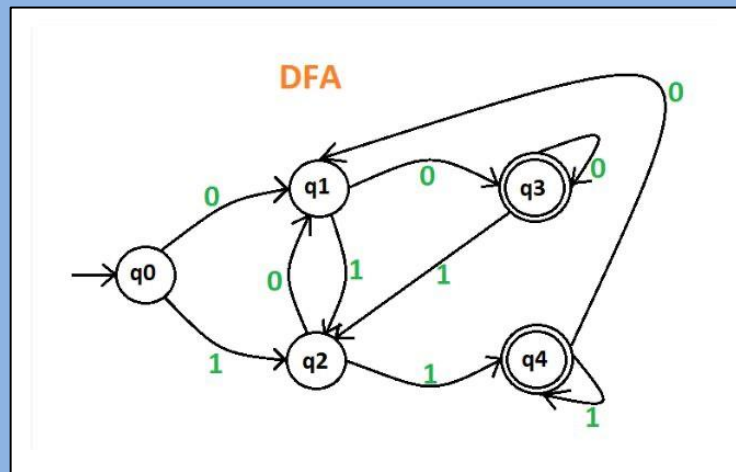**Solution:**
Q: {q0, q1, q2, q3, q4}

∑: {0,1}
q$_0$ = q0
F = {q3, q4}

δ =

	0	1
q0	q1	q2
q1	q3	q2
q2	q1	q4
q3	q3	q3
q4	q1	q4

Q2/ Find the equivalent DFA for the NFA given by M=[{A,B,C}, (a,b), δ, A, {C}] where δ is given by
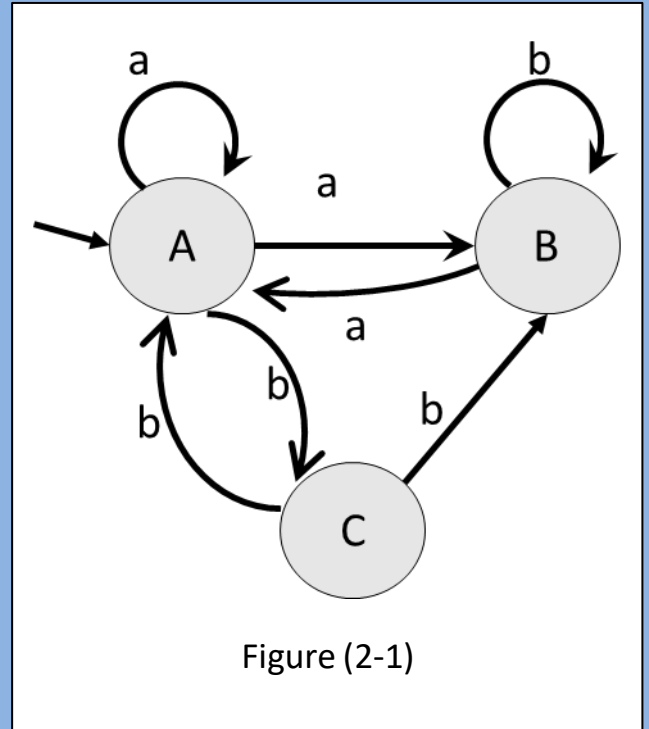**Table (2-1)**

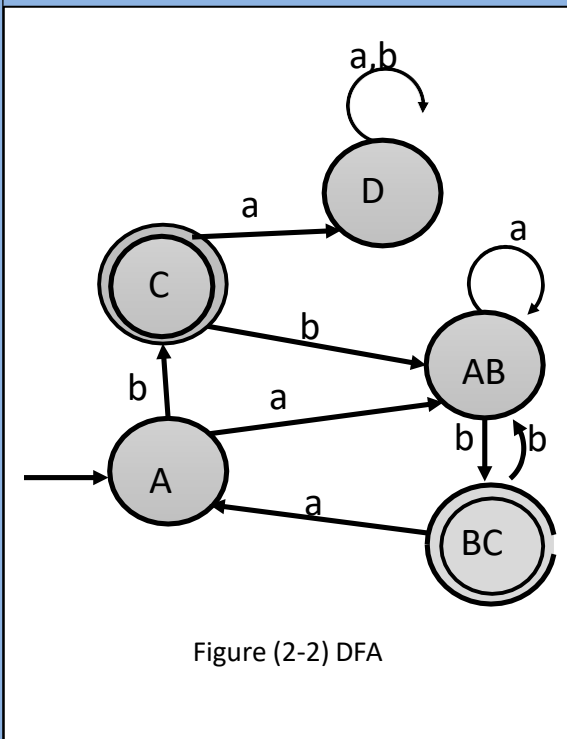|	a	b
A	A,B	C
B	A	B
C	-	A,B

Solution:

From the given table (2-1) we designed NFA as in figure (2-1). Then we will create table (2-2) as shown below.

Table (2-2)

	a	b
A	AB	C
AB	AB	BC
BC	A	AB
C	D	AB
D	D	D

Figure (2-1)

From the table (2-2) we create DFA as shown in figure (2-2)

Figure (2-2) DFA

Extra notes:

External Evaluator

I found that this course book is easy to learn and beneficial in building reflective learners who took the time to think through their work and monitor their own progress. Very clear sub-titles, good detail in explaining the subjects and good application examples have been presented.

Assist. Lect. Najat Yohana Danha