


King Saud University College of Computer and Information Sciences Computer Science Department				 College of Computer & Information Sciences Computer Science Department	
Course Code:		CSC 339		/ 20	
Course Title:		Theory of Computation			
Semester:		2 nd (1442)			
Exercises Cover Sheet:		Homework			
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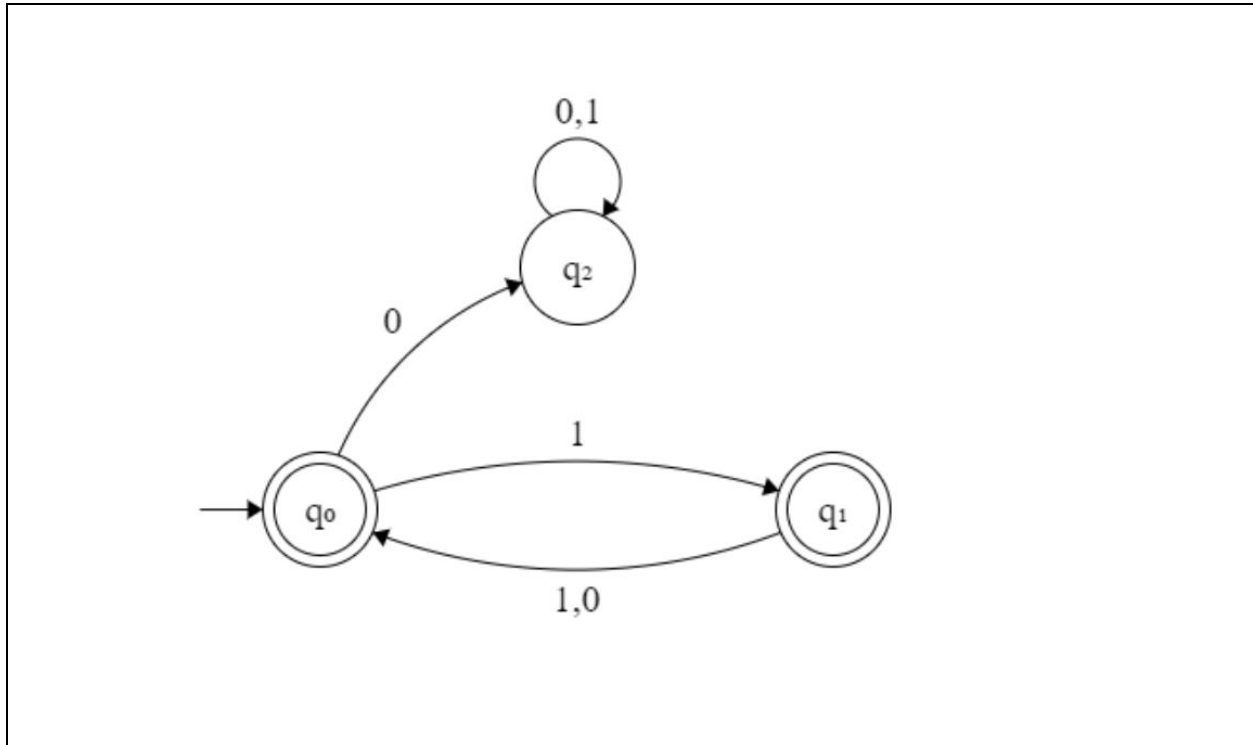
Course Learning Outcomes		Relevant Question No	Full Mark	Student Mark
CLO 1	Identify regular and non-regular languages (K1)			
CLO 2	Identify decidable and non-decidable, NP-complete, and reducible problems (K1)			
CLO 3	Produce computing based solutions using regular expressions, and context free grammar (K2)			
CLO 4	Design different machine models (DFA, NFA, PDA, TM) (S1)	Part 1	12	
CLO 5	Evaluate the language accepted by a machine, a regular expression, and a context free grammar (S1)	Part 2	8	
CLO 6	Evaluate the time and space complexity of a Turing machine (S1)			

Feedback and Remarks:		
I certify that the work contained within this assignment is all my own work and referenced where required. <div style="display: flex; justify-content: space-between;"> Student Signature: Date: </div>		Feedback Received: <div style="display: flex; justify-content: space-between;"> Student Signature: Date: </div>

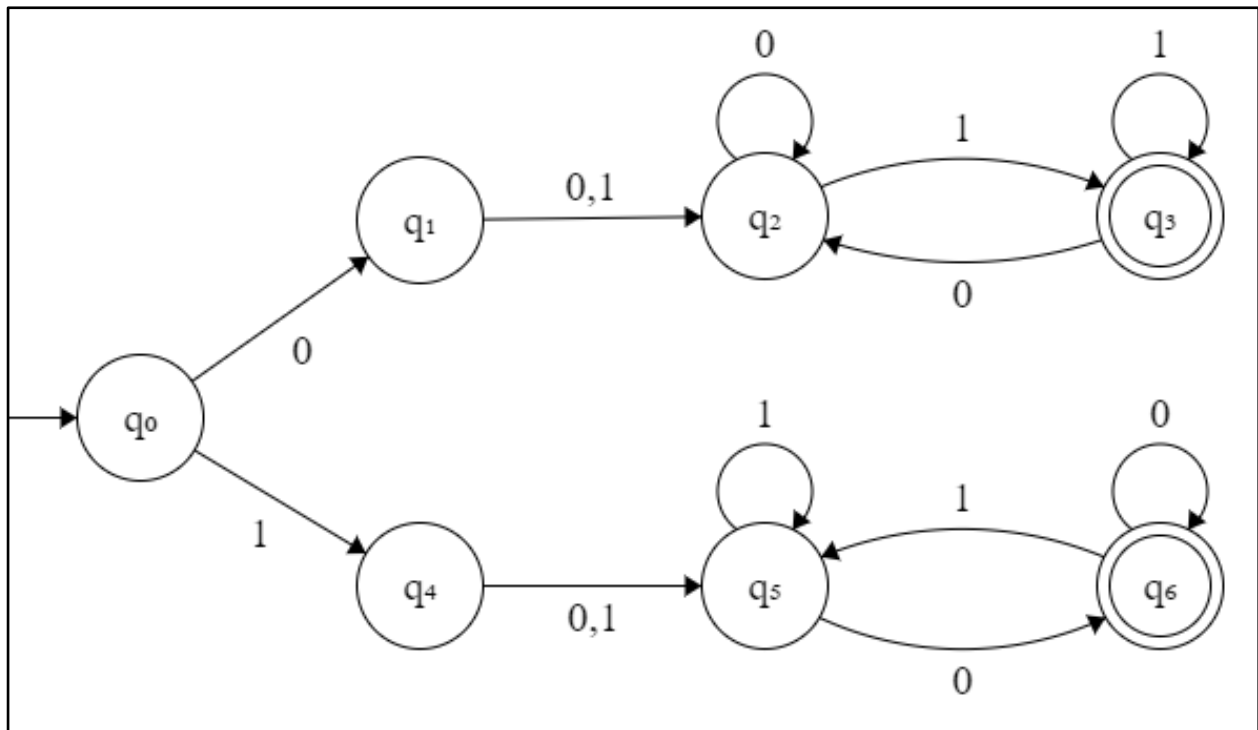
Part 1 [12 pts]

Exercise 1 [4 pts]

1. Construct a **DFA** which accepts the language of all binary strings where every odd position is 1. [2 pts]

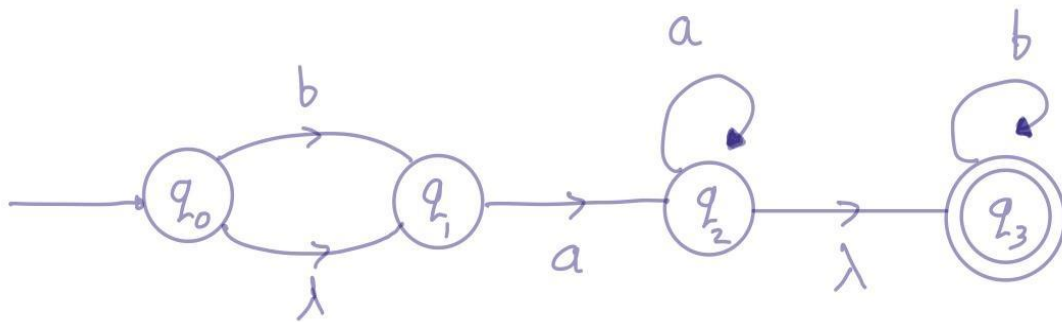


2. Construct a **DFA** which accepts the language of all binary strings that have at least three symbols and whose first and last symbols are different. [2 pts]

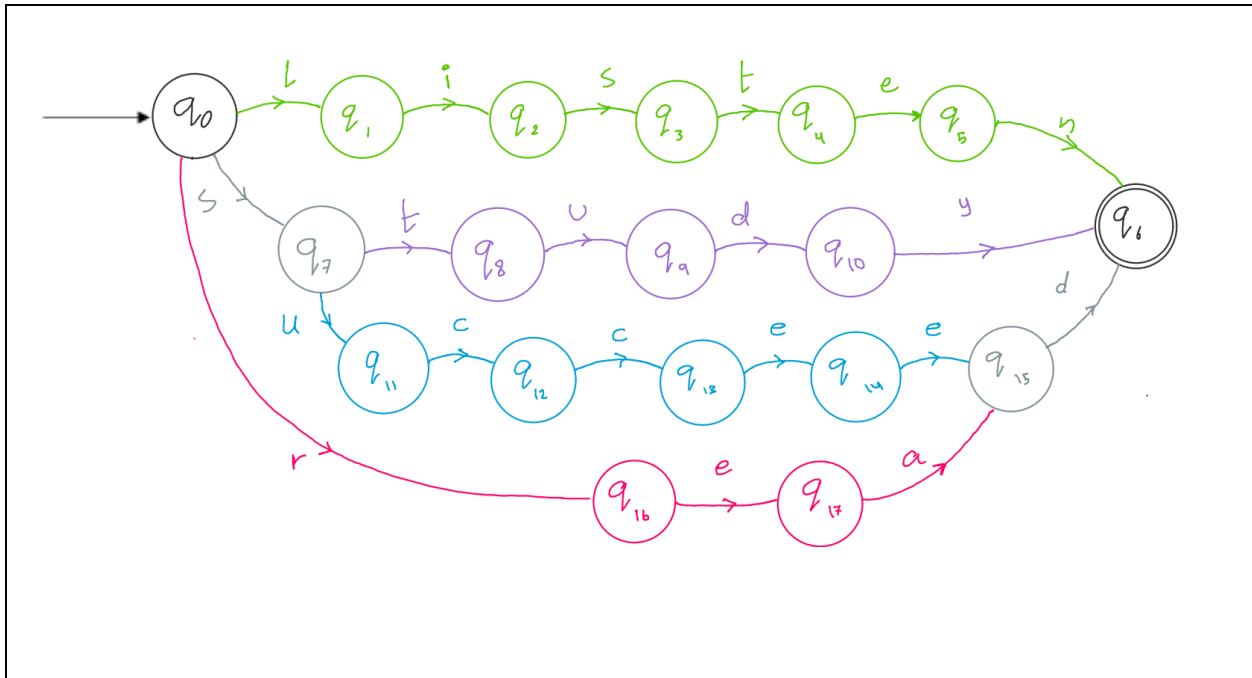


Exercise 2 [4 pts]

1. Construct a **NFA** which accepts the language L of all strings over $\{a, b\}$ defined by $L = \{b^n a^m b^k : 0 \leq n \leq 1, m > 0, k \geq 0\}$. [2 pts]



2. Construct a **NFA** which accepts the language L of the English alphabet defined by $L = \{read, listen, study, succeed\}$. [2 pts]



Exercise 3 [4 pts]

Consider the following **NFA**, $M = (Q, \Sigma, \delta, S, F)$ where $Q = \{A, B, C, D\}$, $\Sigma = \{0, 1\}$, $S = A$, $F = \{A\}$, and

$$\delta(A, 0) = B$$

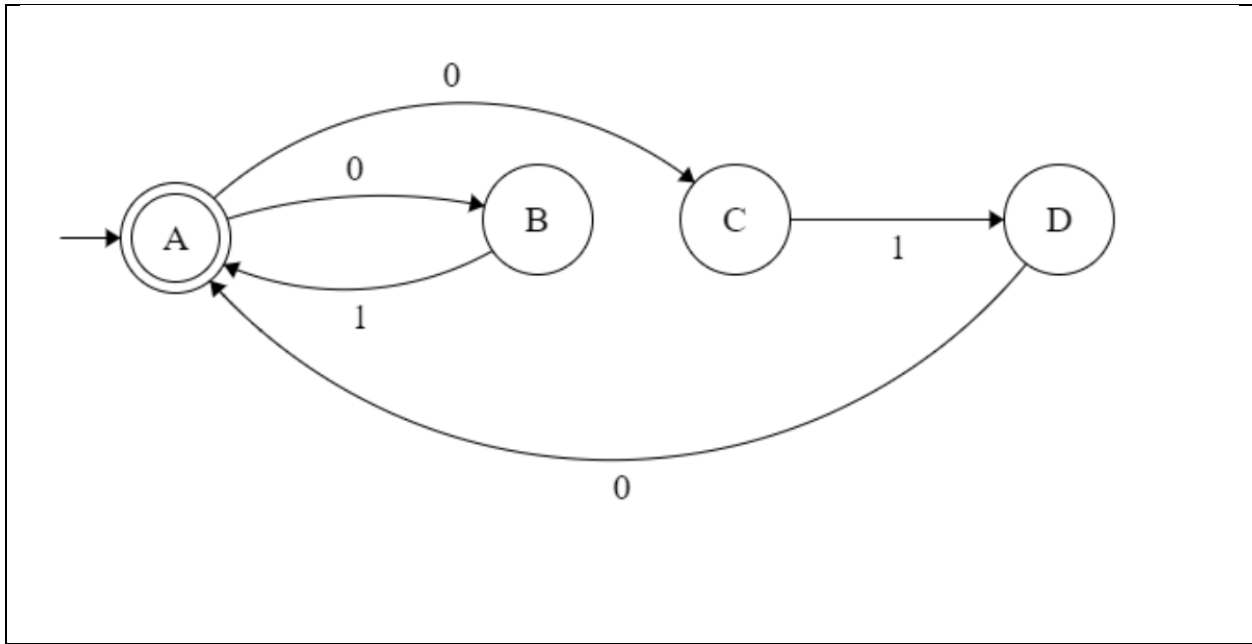
$$\delta(C, 1) = D$$

$$\delta(A, 0) = C$$

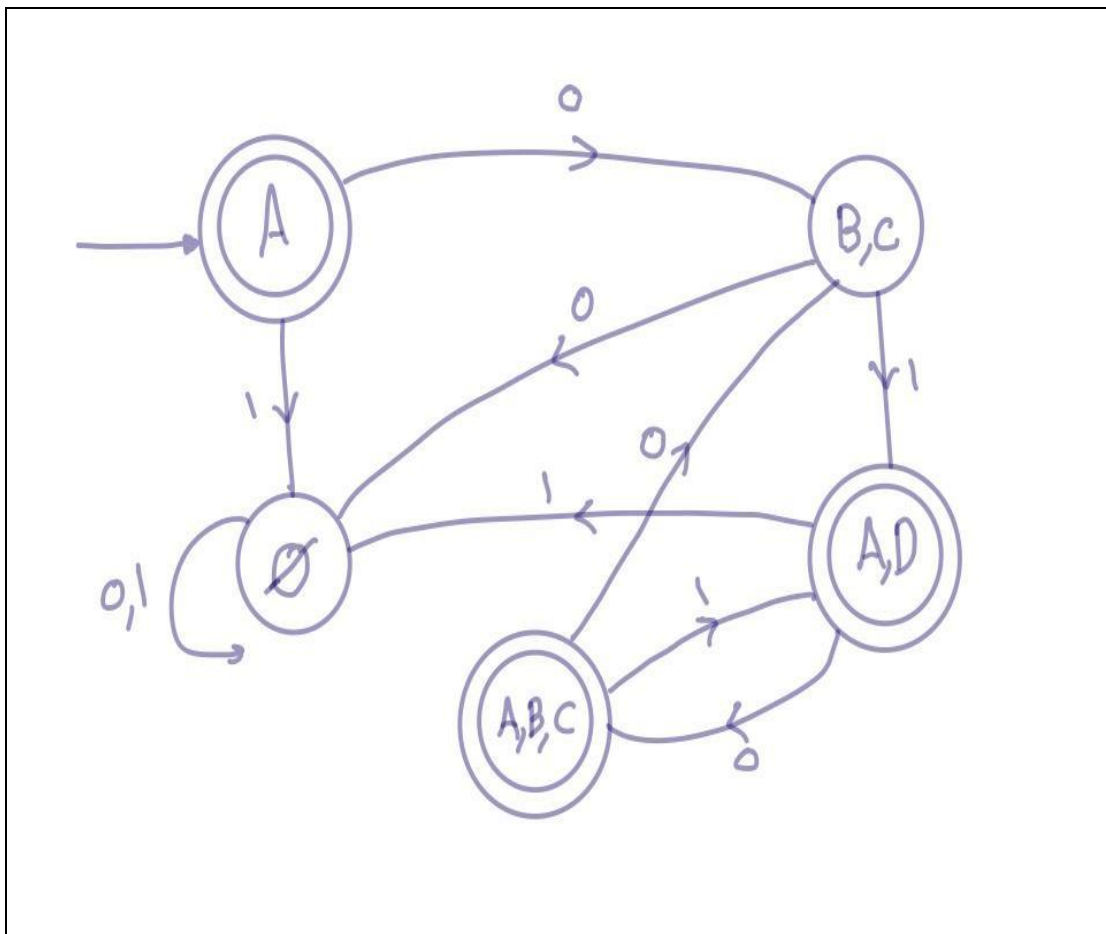
$$\delta(D, 0) = A$$

$$\delta(B, 1) = A$$

1. Construct the corresponding **NFA**.



2. Construct the equivalent **DFA**.



Ⓛ Empty set: $S^*(A, \lambda) = \{A\}$

$S^*(B, \lambda) = \{B\}$

$S^*(C, \lambda) = \{C\}$

$S^*(D, \lambda) = \{D\}$

Ⓜ Start state: A

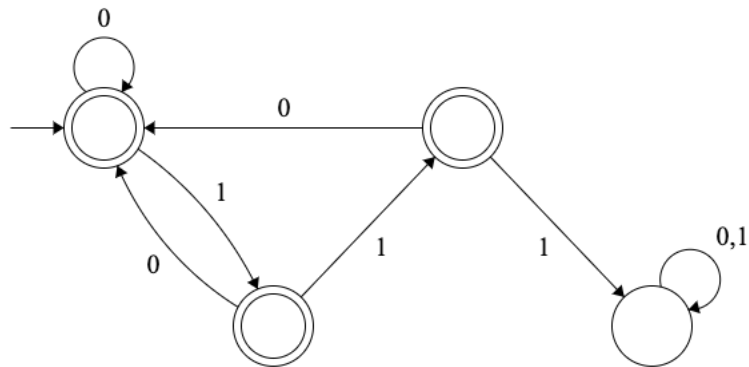
Ⓝ

State	0	1
A	C, B	\emptyset
B, C	\emptyset	AD
\emptyset	\emptyset	\emptyset
A, D	A, B, C	\emptyset
A, B, C	B, C	A, D

Part 2 [8 pts]

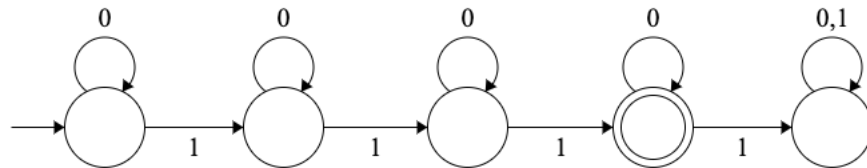
Exercise 4 [4 pts]

1. What is the language covered by this **DFA**?



The language is all binary strings that do not contain more than two consecutive 1's. ie: $L = \{\lambda, 0, 01, 001, 0110, 00110011\}$

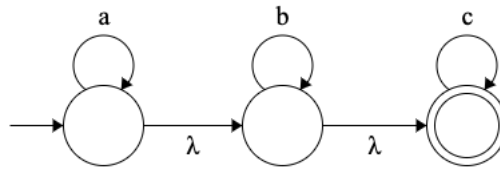
2. What is the language covered by this **DFA**?



The language is all strings that contain three ones exactly. ie: $L = \{111, 1110, 010101, 011010\}$

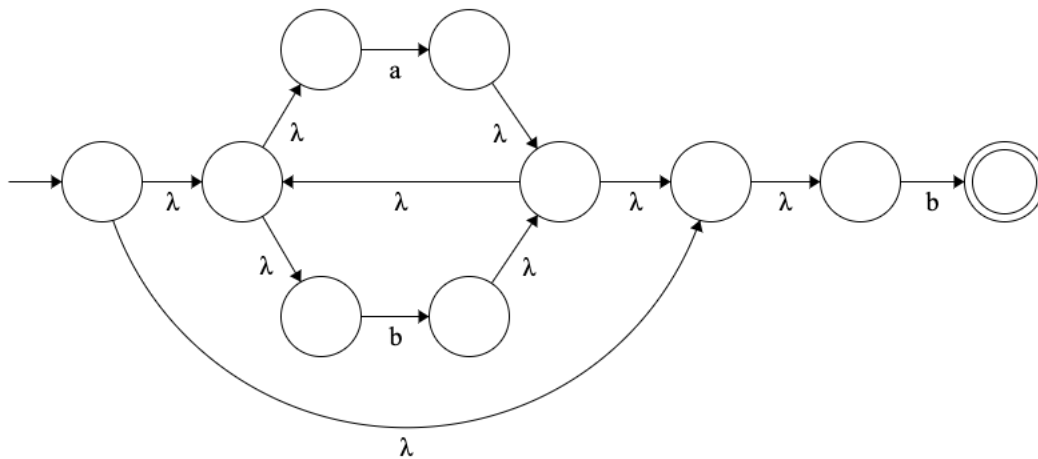
Exercise 5 [4 pts]

1. What is the language covered by this **NFA**?



$$L = \{a^*b^*c^*\} \text{ OR } L = \{a^x b^y c^z \mid x, y \text{ and } z \geq 0\}$$

2. What is the language covered by this **NFA**?



$$L = \{(a + b)^* b\} \text{ OR } L = \{\{a, b\}^* b\} \text{ OR } L = \{(a^* b^*)^* b\}$$