

Date: 16 June, 2021
Time: 2:30 pm - 4:00 pm

Mid Semester Examination
Course Number: CSE 4703
Course Title: Theory of Computing
DURATION: 1 Hour 30 Minutes

There are **3 (three)** questions. Answer **all** of them. The symbols and acronyms have their usual meanings. The examination is **Online** and **Closed Book**. Programmable calculators are not allowed. Marks of each question and corresponding CO and PO are written in the brackets.

- 6+7
(CO3)
(PO1)

	0	1
$\rightarrow A$	B	E
B	C	F
$* C$	D	H
D	E	H
E	F	I
$* F$	G	B
G	H	B
H	I	C
$* I$	A	E

- I. Draw the table of distinguishabilities for this automaton.
- II. Construct the minimum-state equivalent DFA.

- b. To turn on a computer, you need to press the power button of the computer. Whether you long press or short press the button, it works the same. When the computer is on, if you long-press the power button, it shuts down and to restart the computer you need to short press the button. When the computer is restarting, it keeps working to restart whatever you do with the power button. Draw a DFA to design the aforementioned scenario. 8
(CO2)
(PO3)
- c. Define the following terms with examples: 2×2
(CO1)
(PO1,
PO2)
- I. Alphabet
- II. Language

2. a. Find the language and the values of the 5 tuples of the NFA in Figure 1.

5
(CO1)
(PO1,
PO2)

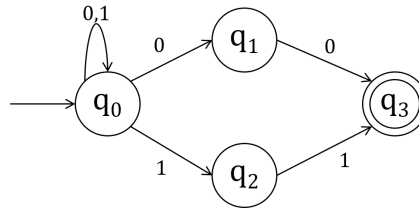


Figure 1: Transition diagram of an NFA for question 2.a.

- b. Design an NFA for the language $L = \{a^n \mid n \text{ is even or divisible by } 3\}$. Try to use ϵ -transitions to simplify your design.
- c. Convert the NFA of Table 2 to its equivalent DFA.

8
(CO2)
(PO3)

12
(CO5)
(PO1,
PO2)

	0	1
$\rightarrow p$	$\{q, s\}$	$\{q\}$
$*q$	$\{r\}$	$\{q, r\}$
r	$\{s\}$	$\{p\}$
$*s$	\emptyset	$\{p\}$

Table 2: Transition table of an NFA for question 2.c.

3. a. Describe the regular expression $c^*a(a+c)^*b(a+b+c)^* + c^*b(b+c)^*a(a+b+c)^*$

5
(CO1)
(PO1,
PO2)

- b. Convert the DFA of Table 3 to a regular expression using the state-elimination technique.

12
(CO5)
(PO1,
PO2)

	0	1
$\rightarrow * p$	s	p
q	p	s
r	r	q
s	q	r

Table 3: Transition table of a DFA for question 3.b.

- c. Consider the language, $L = \{1^P \mid P \text{ is a prime number}\}$. Show that L is not a regular language.

8
(CO1)
(PO1,
PO2)