BRAC UNIVERSITY

Merul Badda, Dhaka, Bangladesh

CSE331 : Automata and Computability

Quiz 2

Spring 2024

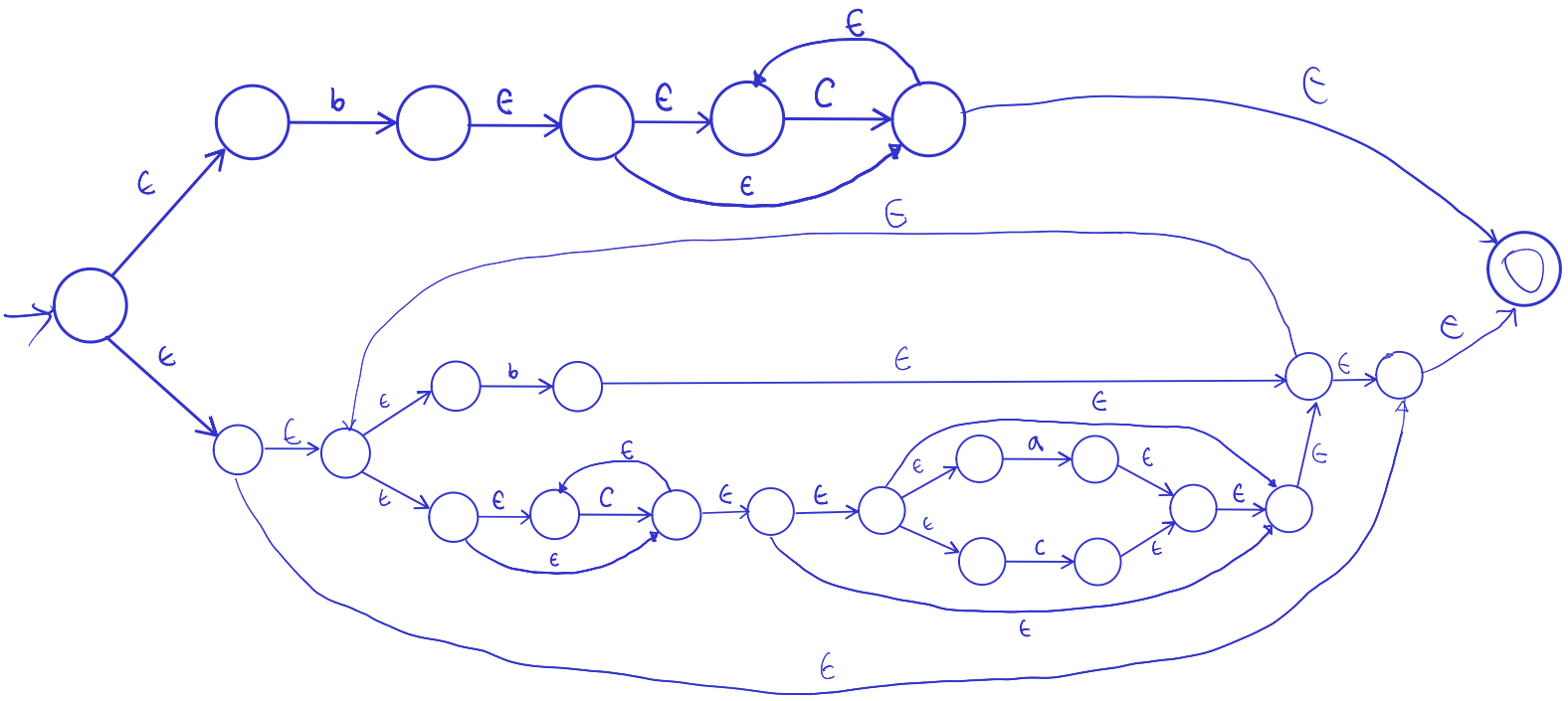
Duration: 35 minutes **CO2** **Total: 20 marks**

Name:	ID:	Section: 19

RE TO NFA [6 points]

Convert the following regular expression over $\Sigma = \{a, b, c\}$ into an equivalent NFA.

$$bc^* \cup (b \cup c^*(a \cup c)^*)^*$$



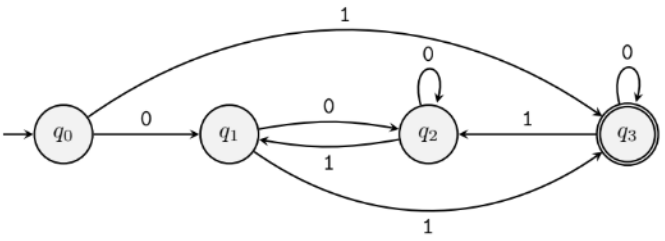
Conditions

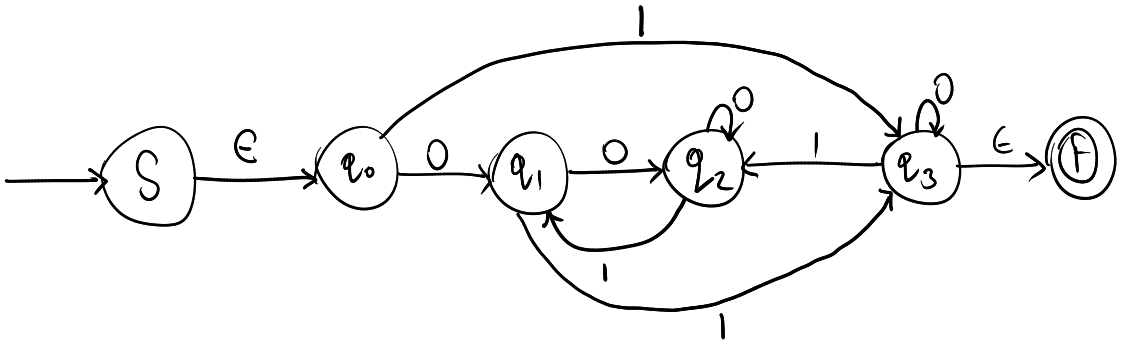
The NFA derived from Thompson's Construction must follow some conditions:

1. There can be only one start state.
2. The start state cannot be accessible from any states i.e. it cannot have transitions to it from other states.
3. There can be only one final state. The final state cannot have any transition from it to other states.
4. The number of transitions leaving any state is at most two.

DFA to RE [6 points]

Convert the following DFA into an equivalent regular expression using the state elimination method. First eliminate q_1, then q_2 and finally q_3. You must show work.



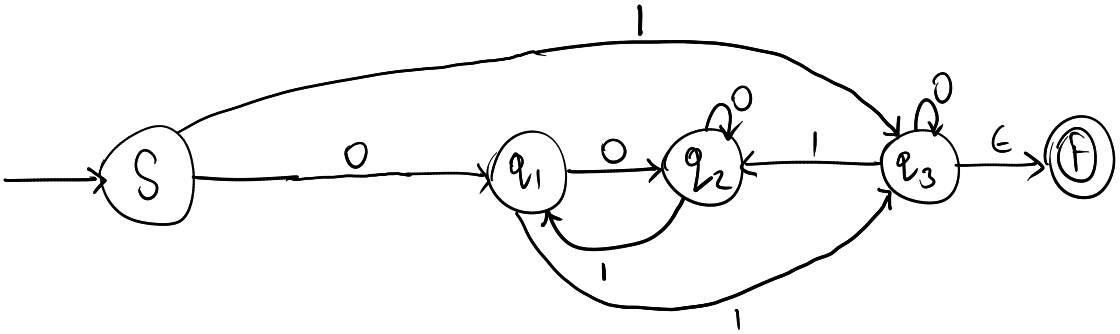


Eliminate q_0

In	Out
S	q_3
	q_1

$S \xrightarrow{1} q_3$

$S \xrightarrow{0} q_1$



Eliminate q_1

In	out
S	q_2
q_2	q_3

$S \xrightarrow{00} q_2$

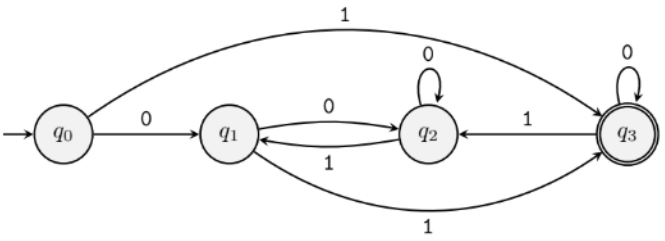
$S \xrightarrow{01} q_3$

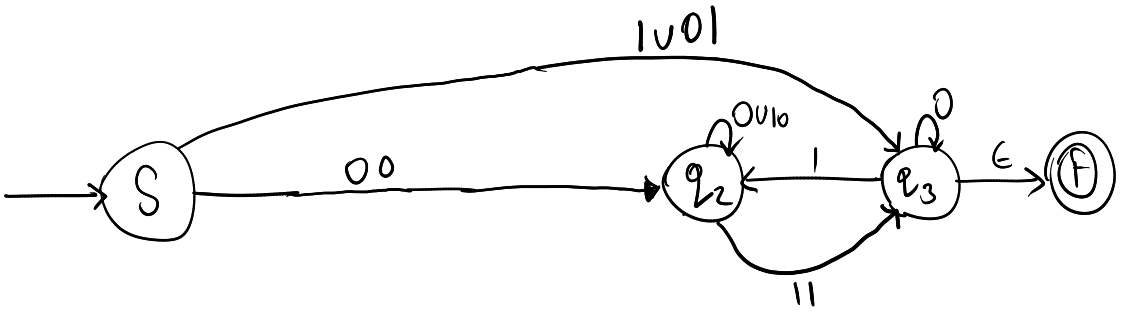
$q_2 \xrightarrow{10} q_2$

$q_2 \xrightarrow{11} q_3$

DFA to RE [6 points]

Convert the following DFA into an equivalent regular expression using the state elimination method. First eliminate q_1, then q_2 and finally q_3. You must show work.



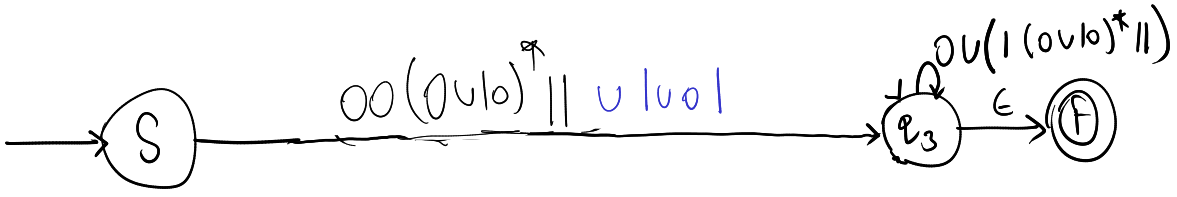


Eliminate q_2

In	out
S	q_3
q_3	

$S \xrightarrow{00(0\cup10)^*11} q_3$

$q_3 \xrightarrow{1(0\cup10)^*11} q_3$



Eliminate q_3

In	out
S	F

regex: $00(0\cup10)^*11 \cup (1\cup01)(0\cup(1\cup10)^*11)^*$

Regular expression [3 + 2 + 3 points]

Let $\Sigma = \{0, 1\}$. **Give** regular expressions generating each of the following languages over Σ.

a) $\{w : \text{every } 1 \text{ in } w \text{ is followed by an even number of } 0\text{s}\}$

b) $\{w : w \text{ does not contain } 10\}$

c) $\{w : 10 \text{ appears in } w \text{ exactly once}\}$

(Hint: If $w = x10y$, what can you say about x and y?)

(a) $0^*(1(00)^*)^*$

(b) 0^*1^*

(c) $0^*1^*10^*1^*$