Middle East Technical University   Department of Computer Engineering

CENG 280

Formal Languages and Abstract Machines

Spring 2022-2023
Homework 2

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Answer for Q1

a. r = ((b + a(b+c)*a) + aa)(a + b)*
First box = (b + c)
Second box = b
Third box = aa
Forth box = (a + b)*

b.
A=: 0
B=: 1
C=: (0+1)
D=: 2
E=: 1
F=: (0+2)

Answer for Q2

a. We can use the algortihm which does state minimization, and reaches to regular expression, with small changes.

b.

- There will be a new state for start state like actual algorithm and it will have a empty transition to initial state, but there is no final state. We can create a new state and this state will have empty transition to start state. Because machine can create Kleen star from regular expression and it will be accepted if it can reach to final state we created.

- If we want to find a certain regular expression, we should rearrange the FA for this expression. For instance if we want to find the strings which starts with A, start state will have a transiton to real start state for A.

- While applying the rules from state minimization, same operations should be applied to output as well. For instance if we take Kleen star of a, we should take Kleen star of A as well.

c. According to algortihm, first I created a state which has empty transition to q_0. Since we want to find strings end with "C", we need a final state according to algorithm. For this, the transition that contains C must go to the final state instead of q_0, and final state has a empty transition to start state. q_3 is created as a final state. Now, we can apply the rules from original algorithm, and we need to apply same operations to output as well. Regular expression for strings which end with "C":

$$r = ((A + BA)^*BBB^*C)^*$$

First, q_1 is eliminated. There is a self loop on q_0 and transition to q_2 for BB*. Second, q_0 is eliminated. There is a transition to q_2 from start state for $(A + BA)^*BBB^*$. Finally, we can eliminate q_2, and we obtain r with concatenate "C" to the previous expression, and add the Kleen star. And the input for this:

$$((a + ba)^*bbb^*a)^*$$

Answer for Q3
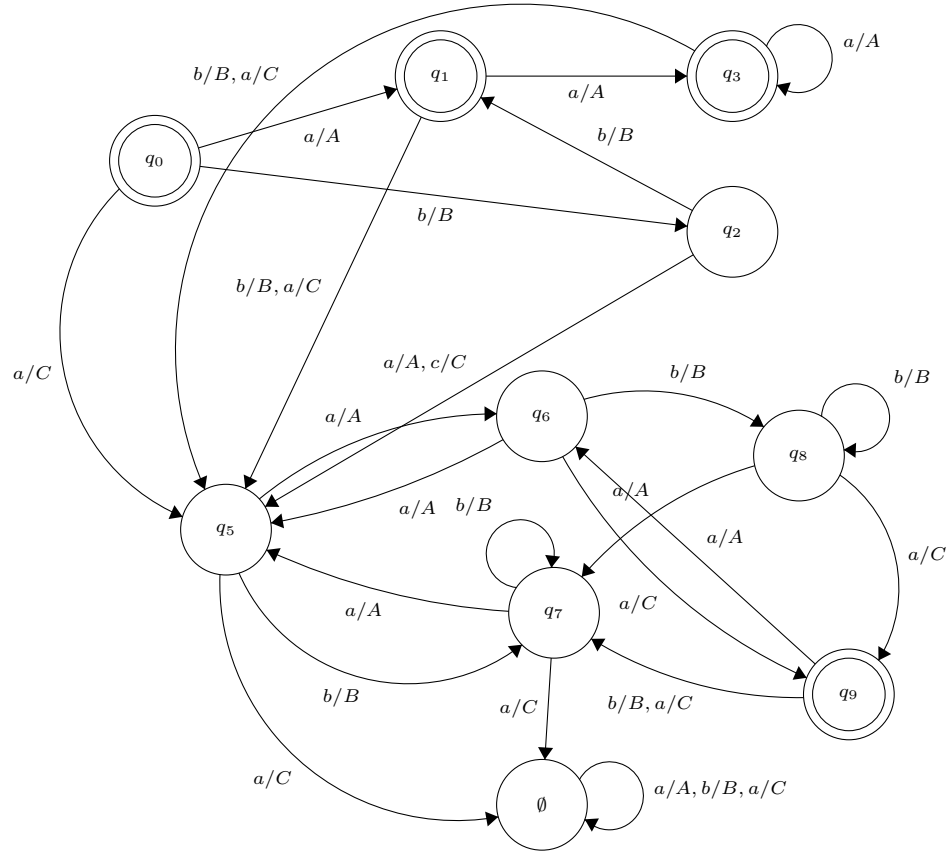
First, I convert NFA2 and NFA3 to DFA, and add new state to union them with empty transitions from new state, but it needs to be DFA, so I made transitions to q_5 ,which is start state of DFA3. Actually, this transitions reaches trap state in DFA2, i.e. if string is not accepted by DFA2, it's directly going to DFA3's start state. With this logic, I eliminated the gate. If it's not accepted by DFA3, going to trap state. To handle Mealy, there is 3 different input type which is suitable for Mealy. With this inputs I guaranteed input string is coming from Mealy.