Practical 4

(PART – A)

Aim: To determine the equivalence of NFA and DFA

Outcome: After successfully competing of this practical, students will be able to learn:

- What is DFA, NFA
- How both works by simulating some sample data
- DFA Minimization
- Understand that power of DFA and NFA are equal
- Designing of NFA and its conversion to DFA using JFLAP tool

A.1 Reading

Read Page 10 to 36 of lab manual circulated before using the tool.

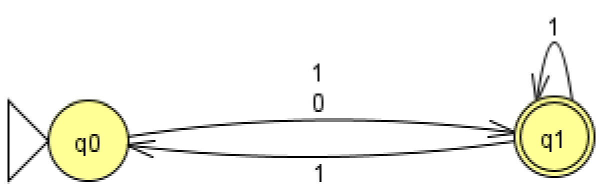
A.2 Tasks

1. Construct the NFA: M = [{q0, q1}, [0,1], ʒ, q0, {q1}], where ʒ is as shown in table below, to its equivalent DFA.

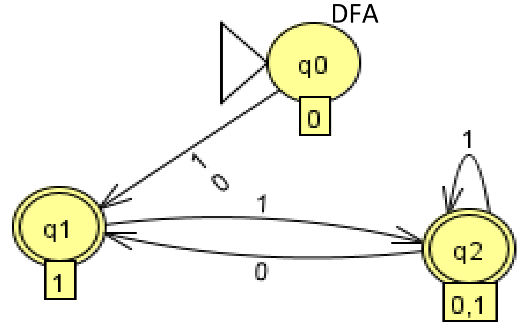
∑ Q	0	1
q0	[q0, q1]	[q1]
q1	Ø	[q0, q1]

Test the designed NFA and converted DFA for values line 0011, 1100, 1111 and 1100 and report your observation on the working.

NFA



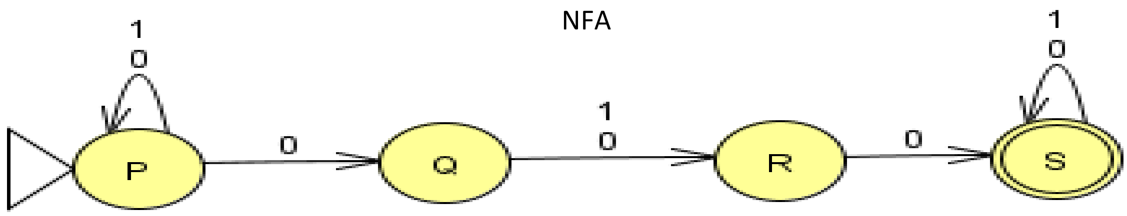
DFA

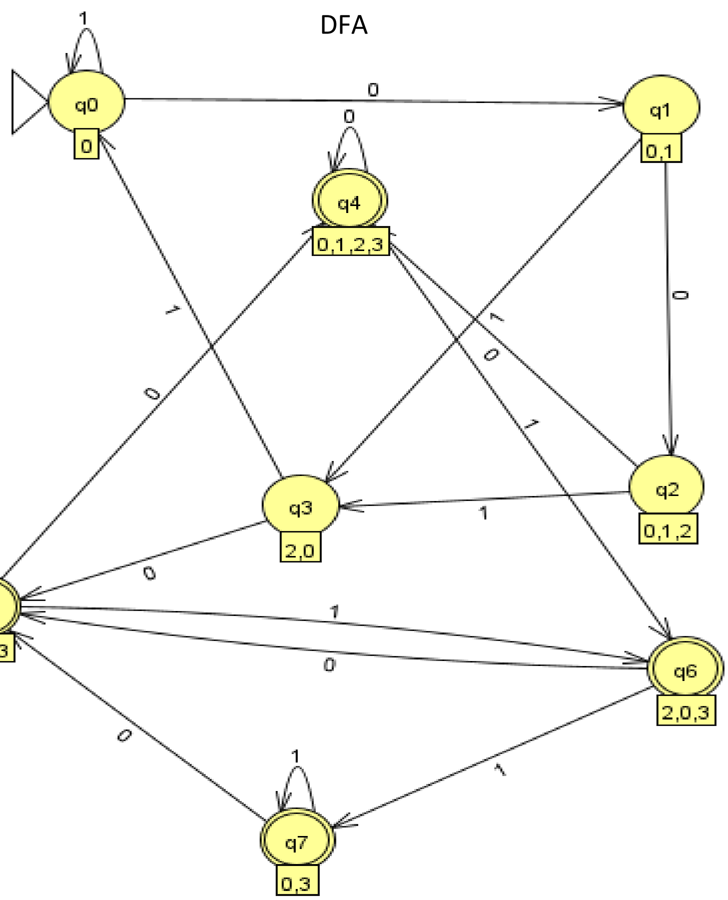


2. Construct the NFA: M = [{p,q,r,s}, [0,1], ƺ, p, {s}], in its equivalent DFA, where the state transition function ƺ is as shown in table below. Carry out DFA minimization using the tool.

$\sum$ Q	0	1
p	p, q	p
q	r	r
r	s	---
s	s	s

Test the designed NFA and converted DFA for values line 0011, 1100, 1111 and 1100 and report your observation on the working.





PART B

(PART B: TO BE COMPLETED BY STUDENTS)

(Students must submit the soft copy as per following segments within two hours of the practical. The soft copy must be uploaded on the Portal or emailed to the concerned lab in charge faculties at the end of the practical in case the there is no portal access available)

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Date of Submission: 21/07/2020	Grade :

B.1 Output:

1. Write the procedure to design the NFA of given problems using JFLAP tool

2. Run simulated DFA by giving various input strings (as given Part A under Task section)

3. Covert designed DFA and minimizes it using JFLAP tool

B.2 Observations/Learning

(Students are supposed to write the logic of constructed DFA and generated regular expression)

To construct DFA from NFA, following steps should be perform:

1. Look for new states other than in Q in the STT (State Transition Table).
2. Apply STT on new states to get the output.
3. Repeat step 1 and step 2 till there are no new states and STT is performed on all states.
4. Draw a new diagram using the STT table results which include the new states.
5. This diagram is the DFA diagram.

Ques 1.

Q = {q0, q1}
Q' = {[q0], [q1], [q0q1], Φ}
δ': Q' * Σ →Q'

STT NFA

Q \ Σ	0	1
q_0	[q_0 q_1]	[q_1]
q_1	Φ	[q_0 q_1]

δ' ([q0], 0) = [q0q1]
δ' ([q0], 1) = [q1]
δ' ([q1], 0) = Φ
δ' ([q1], 1) = [q0q1]

δ' ([q0q1], 0) = [δ(q0, 0) Uδ(q1,0)] = [{q0q1} UΦ] = [q0q1]
δ'([q0q1], 1) = [δ(q0, 1) U δ(q1,1)] = [{q1} U{q0q1}] = [q0q1]

STT DFA

Q \ Σ	0	1
[q_0]	[q_0 q_1]	[q_1]
[q_1]	Φ	[q_0 q_1]
[q_0 q_1]	[q_0 q_1]	[q_0 q_1]

Ques 2.

Q = {p, q, r, s}
Q' = {p, q, r, s, pq, pr, ps, qr, qs,rs,pqr, pqs, qrs, pqrs, Φ}
δ': Q' * Σ →Q'

STT NFA

Q \ Σ	0	1
p	p, q	p
q	r	r
r	s	Φ
s	s	s

δ ([p], 0) = [pq]

δ ([p], 1) = [p]

δ ([q], 0) = [r]

δ ([q], 1) = [r]

δ ([r], 0) = [s]

δ ([r], 1) = Φ

δ ([s], 0) = [s]

δ ([s], 1) = [s]

δ ([pq], 0) = [pqr]

δ ([pq], 1) = [pr]

δ ([pqr], 0) = [pqrs]

δ ([pqr], 1) = [prs]

δ ([pqrs], 0) = [pqrs]

δ ([pqrs], 1) = [prs]

δ ([pr], 0) = [pqs]

δ ([pr], 1) = [p]

δ ([prs], 0) = [pqs]

δ ([prs], 1) = [ps]

δ ([pqs], 0) = [pqs]

δ ([pqs], 1) = [prs]

δ ([ps], 0) = [pqs]

δ ([ps], 1) = [ps]

STT DFA

Q \ ∑	0	1
[p]	[pq]	[p]
[q]	[r]	[r]
[r]	[s]	Φ
[s]	[s]	[s]
[pq]	[pqr]	[pr]
[pqr]	[pqrs]	[prs]
[pqrs]	[pqrs]	[prs]
[prs]	[pqs]	[ps]
[pqs]	[pqs]	[prs]
[ps]	[pqs]	[ps]

B.3 Conclusion:

(Students must write the conclusion as per the attainment of individual outcomes and learning/observation)

In both questions, the given FA was NFA which was converted to DFA using method 2, in which we carry out operation using input variables on newly formed states and continue the process until no new states are formed. The newly formed states are added to final states and shown in DFA. Hence, both the NFA were successfully converted to DFA.

B.4 Curiosity Question

Can you generate a general formula to find total number of states when positions of particular input is fixed from left hand side? Explain