

The DFA minimization is the process of reducing states in a deterministic finite automaton (DFA) and maintaining its language recognition abilities.

That means, DFA minimization is aimed at finding a DFA with the least number of states that can recognize the same language as the original DFA.

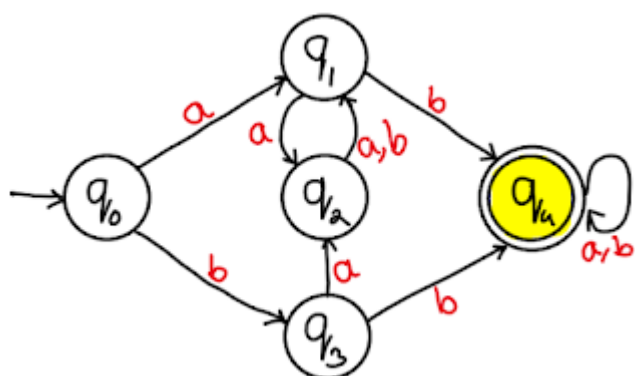
Some of the benefits of minimizing DFA:

- Reduced memory usage: DFAs with fewer states require less memory to store. This can be important for applications where memory usage is a constraint.
- Improved computational efficiency: DFAs with fewer states can process strings more quickly. This can be important for applications where processing speed is a concern.
- Enhanced understanding: DFAs with fewer states are generally easier to understand and analyze. This can be helpful for debugging and maintaining DFAs.
- Simplified hardware implementation: DFAs with fewer states are more amenable to hardware implementation. This can be important for applications where performance is critical.

Example of DFA minimization:

Construct a minimum state automata equivalent to given automata?

(RGPV 2008)



Solution:

Transition table for above automata.

State	Input = a	Input = b
->q0 Initial state	q1	q3
q1	q2	q4
q2	q1	q1
q3	q2	q4
q4 Final state	q4	q4

Step 01: Remove steps which are unreachable from initial states.

Step 02: Split final states and non final states.

- $A_0 = \{q_4\}$
- $A_1 = \{q_0, q_1, q_2, q_3\}$
- $\pi_0 = \{q_4\}, \{q_0, q_1, q_2, q_3\}$
- A_0 cannot be partition further.

In A_1 ,

- q_0 is 1 equivalent to q_2 for input a , but not equivalent to q_1 and q_3 .
- q_1 is 1 equivalent to q_3 for input a and b , but not to q_0 and q_2 .

So, A_1 can be partitioned as,

- $B_0 = \{q_0, q_2\}$
- $B_1 = \{q_1, q_3\}$
- $\pi_1 = \{q_4\}, \{q_0, q_2\}, \{q_1, q_3\}$

Now, B_0 and B_1 can not be partitioned further.

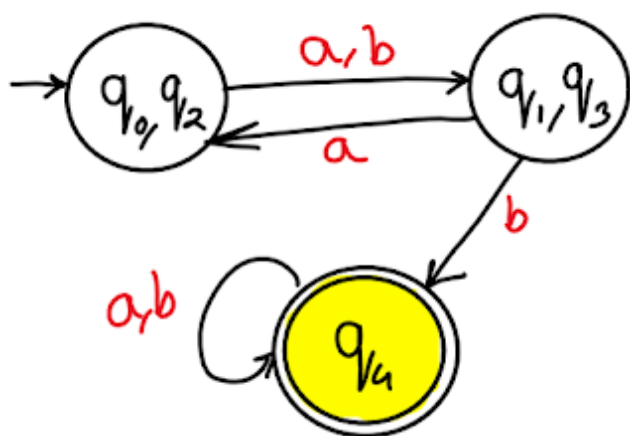
- $\pi_2 = \{q_4\}, \{q_0, q_2\}, \{q_1, q_3\}$
- $\pi_2 = \pi_1$

In minimized DFA, we have three states,

- $\{q_4\},$
- $\{q_0, q_2\},$
- $\{q_1, q_3\}$

Minimized DFA:

State	Input = a	Input = b
->{q0,q2} Initial state	{q1,q3}	{q1,q3}
{q1,q3}	{q0,q2}	{q4}
{q4} Final state	{q4}	{q4}



Reference:

- Introduction to the Theory of Computation” by Michael Sipser.

Related Posts:

1. Definition of Deterministic Finite Automata
2. Notations for DFA
3. How do a DFA Process Strings?
4. DFA solved examples

5. Definition Non Deterministic Finite Automata
6. Moore machine
7. Mealy Machine
8. Regular Expression Examples
9. Regular expression
10. Arden's Law
11. NFA with ϵ -Moves
12. NFA with ϵ to DFA Indirect Method
13. Define Mealy and Moore Machine
14. What is Trap state ?
15. Equivalent of DFA and NFA
16. Properties of transition functions
17. Mealy to Moore Machine
18. Moore to Mealy machine
19. Difference between Mealy and Moore machine
20. Pushdown Automata
21. Remove ϵ transitions from NFA
22. TOC 1
23. Difference between Mealy and Moore machine
24. RGPV TOC What do you understand by DFA how to represent it
25. What is Regular Expression
26. What is Regular Set in TOC
27. RGPV short note on automata
28. RGPV TOC properties of transition functions
29. RGPV TOC What is Trap state
30. DFA which accept 00 and 11 at the end of a string
31. CFL are not closed under intersection

32. NFA to DFA | RGPV TOC
33. Moore to Mealy | RGPV TOC PYQ
34. DFA accept even 0 and even 1 | RGPV TOC PYQ
35. Short note on automata | RGPV TOC PYQ
36. DFA ending with 00 start with 0 no epsilon | RGPV TOC PYQ
37. DFA ending with 101 | RGPV TOC PYQ
38. Construct DFA for a power n , $n \geq 0$ || RGPV TOC
39. Construct FA divisible by 3 | RGPV TOC PYQ
40. Construct DFA equivalent to NFA | RGPV TOC PYQ
41. RGPV Define Mealy and Moore Machine
42. RGPV TOC Short note on equivalent of DFA and NFA
43. RGPV notes Write short note on NDFA
44. Construct NFA without ϵ
45. CNF from $S \rightarrow aAD; A \rightarrow aB/bAB; B \rightarrow b, D \rightarrow d$.
46. NDFA accepting two consecutive a's or two consecutive b's.
47. Regular expression to CFG
48. Regular expression to Regular grammar
49. Grammar is ambiguous. $S \rightarrow aSbS|bSaS|\epsilon$
50. leftmost and rightmost derivations
51. Construct Moore machine for Mealy machine
52. RGPV TOC PYQs
53. Introduction to Automata Theory