Minimization of DFA

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⟹ minimization of DFA is required to obtain the minimum version of any DFA which consists of the minimum number of states possible.

<u>DFA</u>   with 5 States / with 4 States

$$\underbrace{O\ O}_{\downarrow}\,O\ O\ O$$

Combine (How?)

⟹ Two states can be combine when they are <u>Equivalent</u>.

⟹ Two states 'A' and 'B' are said to be <u>equivalent iff</u>

$\delta(A, x) \rightarrow F$
and
$\delta(B, x) \rightarrow F$

OR

$\delta(A, x) \nrightarrow F$
and
$\delta(B, x) \nrightarrow F$

where 'x' is any input string
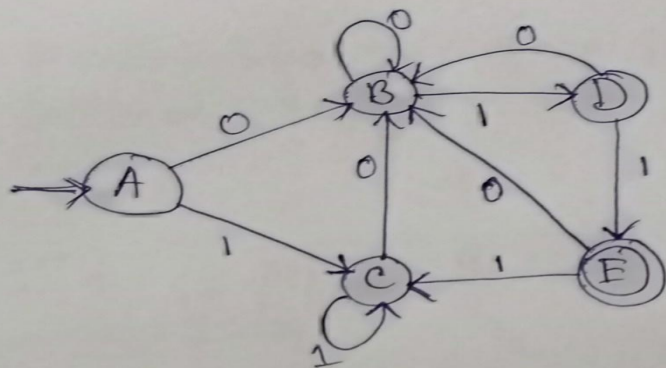
⟹ <u>Types of equivalent</u> ~~(e.g. DFA equi)~~

If $|x| = 0$, then A and B are said to be 0 equivalent

If $|x| = 1$, then A and B are said to be 1 equivalent

If $|x| = 2$, then A and B are said to be 2 equivalent

⋮

If $|x| = n$, then A and B are said to be n equivalent
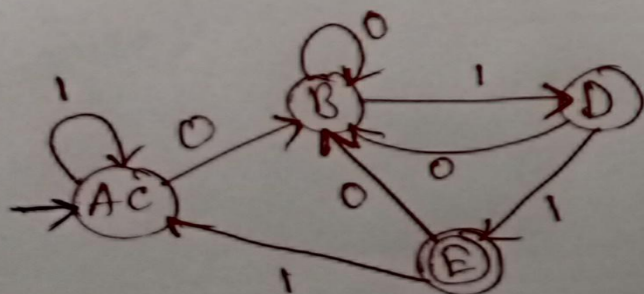
Minimization of DFA - Examples (Part-1)

	0	1
→A	B	C
B	B	D
C	B	C
D	B	E
(E)	B	C

0-Equivalence: {ABCD} {E}

1-Equivalence: {A, B, C} {D} {E} ← [AB ✓ / AC ✓ / CD ✗]

2-Equivalence: {A,C} {B} {D} {E}

3-Equivalence: {A,C} {B} {D} {E}

→ Minimal version of above DFA

Partitioning method

Minimization of DFA - Examples (Part-2)

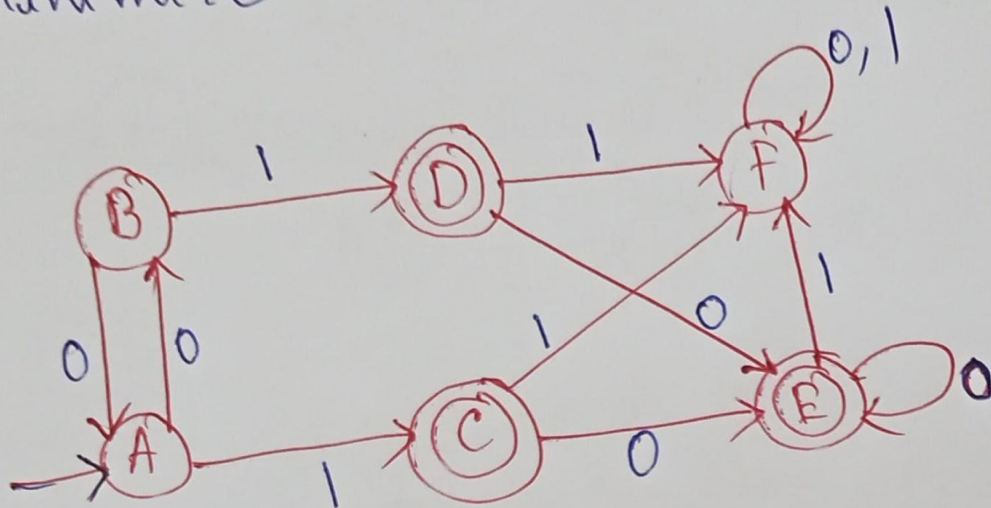⇒ Construct a minimum DFA equivalent to the DFA
described by

	0	1
→q₀	q₁	q₅
q₁	q₆	q₂
(q₂)	q₀	q₂
q₃	q₂	q₆
q₄	q₇	q₅
q₅	q₂	q₆
q₆	q₆	q₄
q₇	q₆	q₂

Assignment

Minimization of DFA - Examples (Part 3)

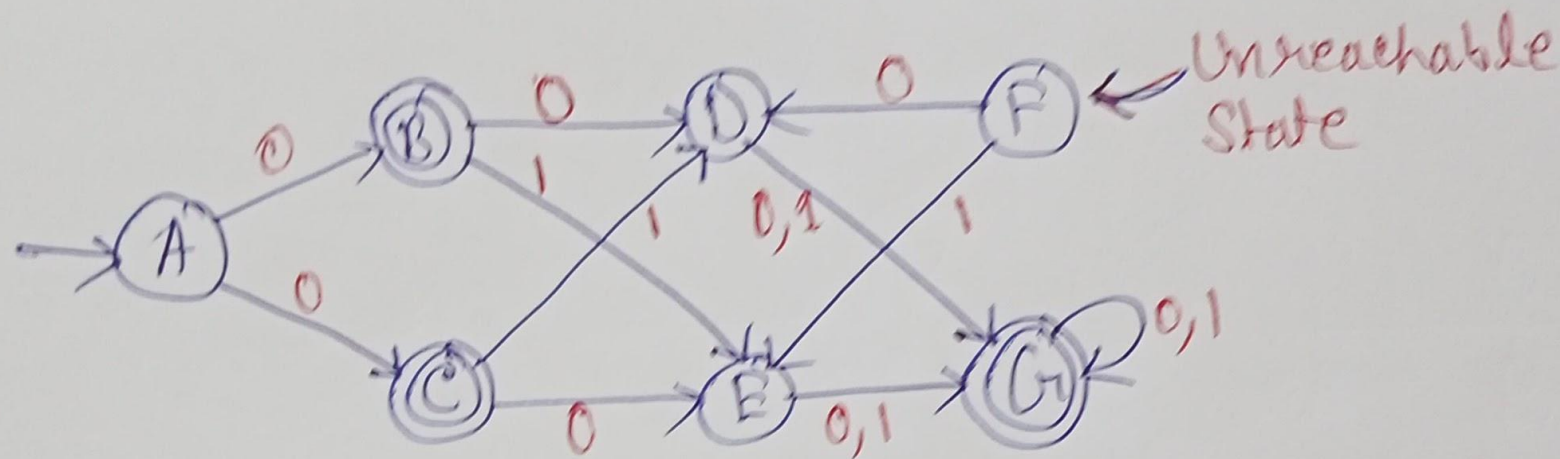⇒ When there are more than one **final states involved**

Minimize the following DFA:

	0	1
→A	B	C
B	A	D
Ⓒ	E	F
Ⓓ	E	F
Ⓔ	E	F
F	F	F

Minimization of DFA - Examples

⟹ When there are **Unreachable** states involved

← Unreachable State

⟹ A State is said to be Unreachable if there is no way it can be reached from the Initial State.

⟹ Remove the Unreachable state from DFA.

Assignment