MUST

Wisdom & Virtue

MIRPUR UNIVERSITY OF SCIENCE AND TECHNOLOGY (MUST), MIRPUR
DEPARTMENT OF SOFTWARE ENGINEERING

Formal Methods in Software Engineering

Lecture [12]: Minimization of DFA

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(Lecturer)

Topics discussed in Today's Lectures

- Minimization of DFA
- Examples of Minimization of DFA

Minimization of DFA

- Minimization of DFA means reducing the number of states from given FA
- We get the FSM with redundant states after minimizing FSM.

Minimization of DFA - Steps

- Step 1: Remove all the states that are unreachable from the initial state via any set of the transition of DFA
- Step 2: Draw the transition table for all pair of states
- Step 3: Now split the transition table into two tables T1 and T2
  - T1 contains all final states, and T2 contains non-final states.
- Step 4: Find similar rows from T1 such that:
  - 1. δ (q, a) = p
  - 2. δ (r, a) = p
  - That means, find the two states which have the same value of a and b and remove one of them.

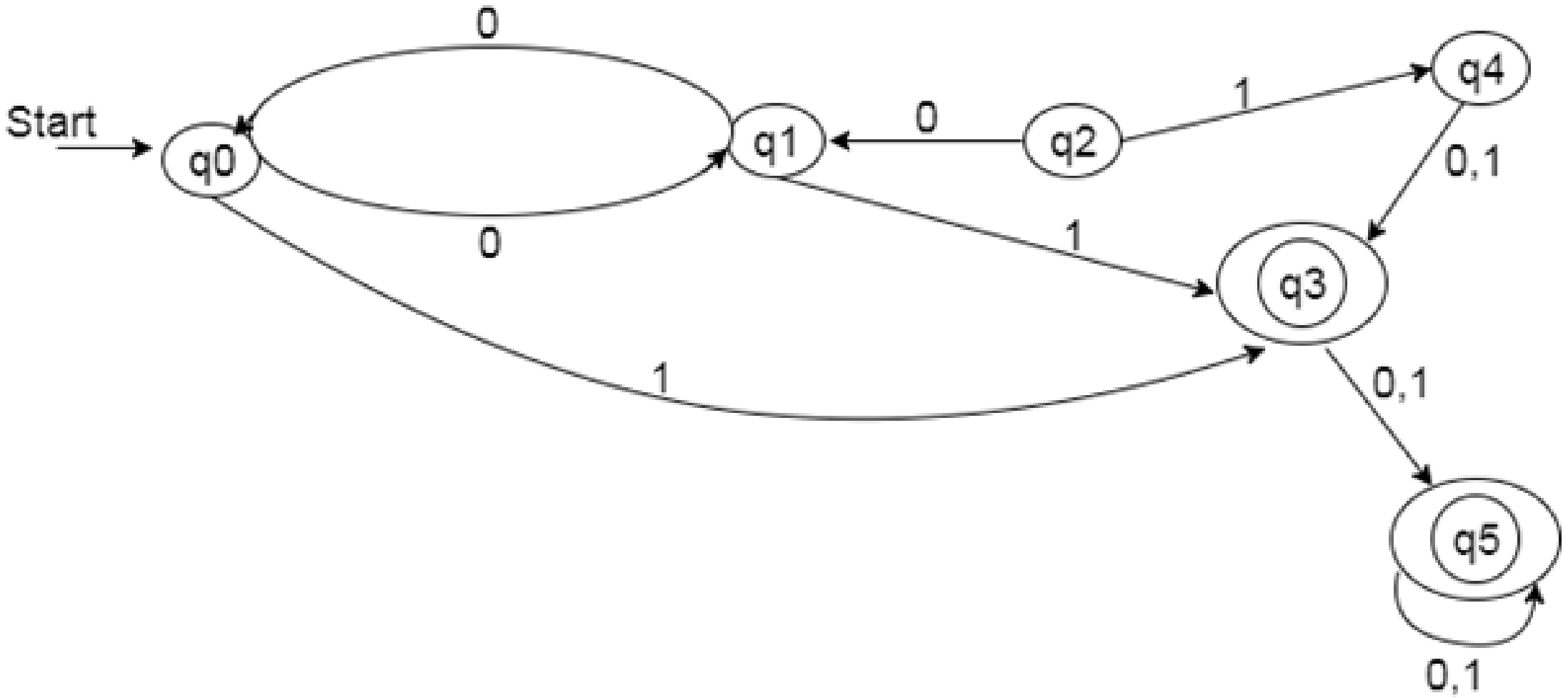
Minimization of DFA – Steps (Contd…)

- Step 5: Repeat step 3 until we find no similar rows available in the transition table T1.

- Step 6: Repeat step 3 and step 4 for table T2 also.

- Step 7: Now combine the reduced T1 and T2 tables
  - The combined transition table is the transition table of minimized DFA.

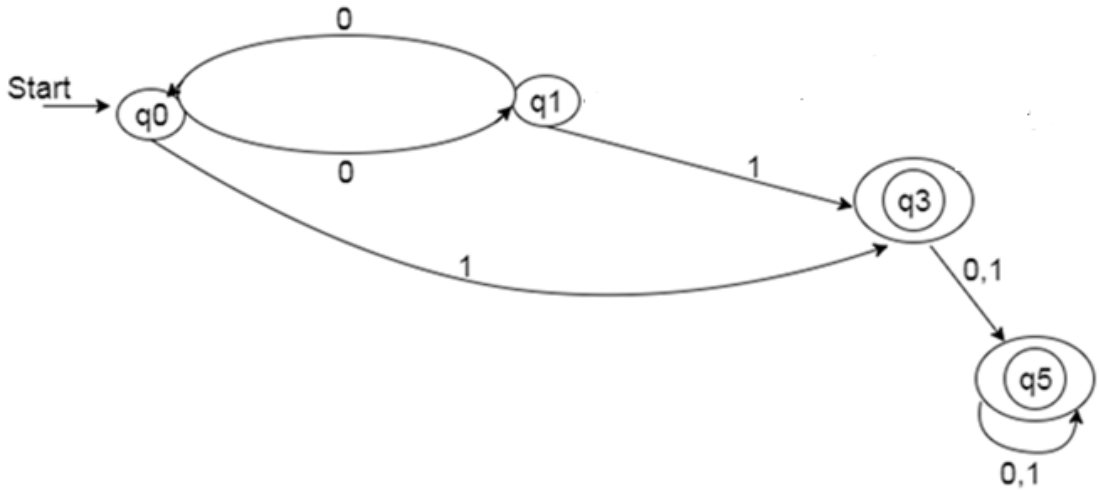
Minimization of DFA – Example



Minimization of DFA – Example

Step 1: In the given DFA, q2 and q4 are the unreachable states so remove them.

Step 2: Draw the transition table for the rest of the states.



State	0	1
→q0	q1	q3
q1	q0	q3
*q3	q5	q5
*q5	q5	q5

Minimization of DFA – Exam

State	0	1
→q0	q1	q3
q1	q0	q3
*q3	q5	q5
*q5	q5	q5

Step 3: Now divide rows of transition table into two sets as:

1. One set contains those rows, which start from non-final states:

State	0	1
q0	q1	q3
q1	q0	q3

2. Another set contains those rows, which starts from final states.

State	0	1
q3	q5	q5
q5	q5	q5

Minimization of DFA – Example

Step 4: Set 1 has no similar rows so set 1 will be the same.

Step 5: In set 2, row 1 and row 2 are similar since q3 and q5 transit to the same state on 0 and 1. So skip q5 and then replace q5 by q3 in the rest.

State	0	1
q3	q3	q3

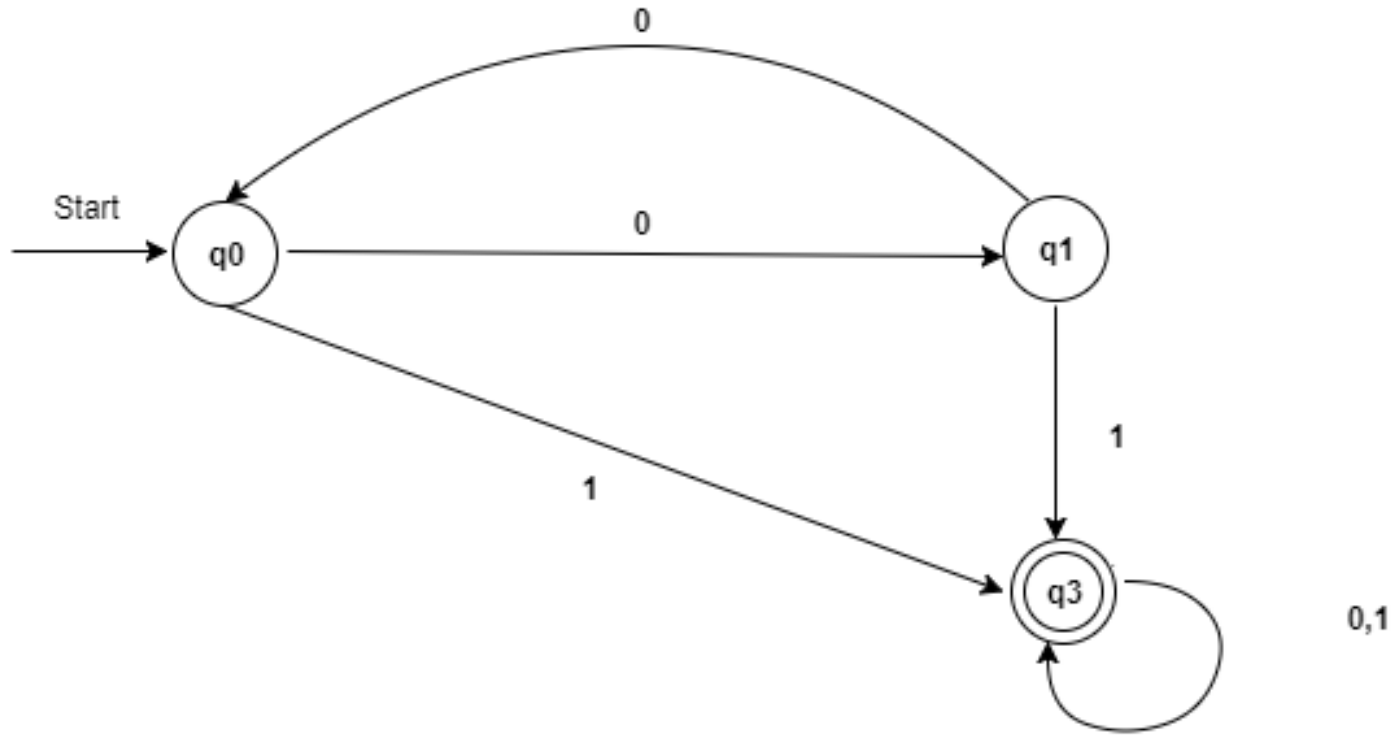
Step 6: Now combine set 1 and set 2 as:

State	0	1
→q0	q1	q3
q1	q0	q3
*q3	q3	q3

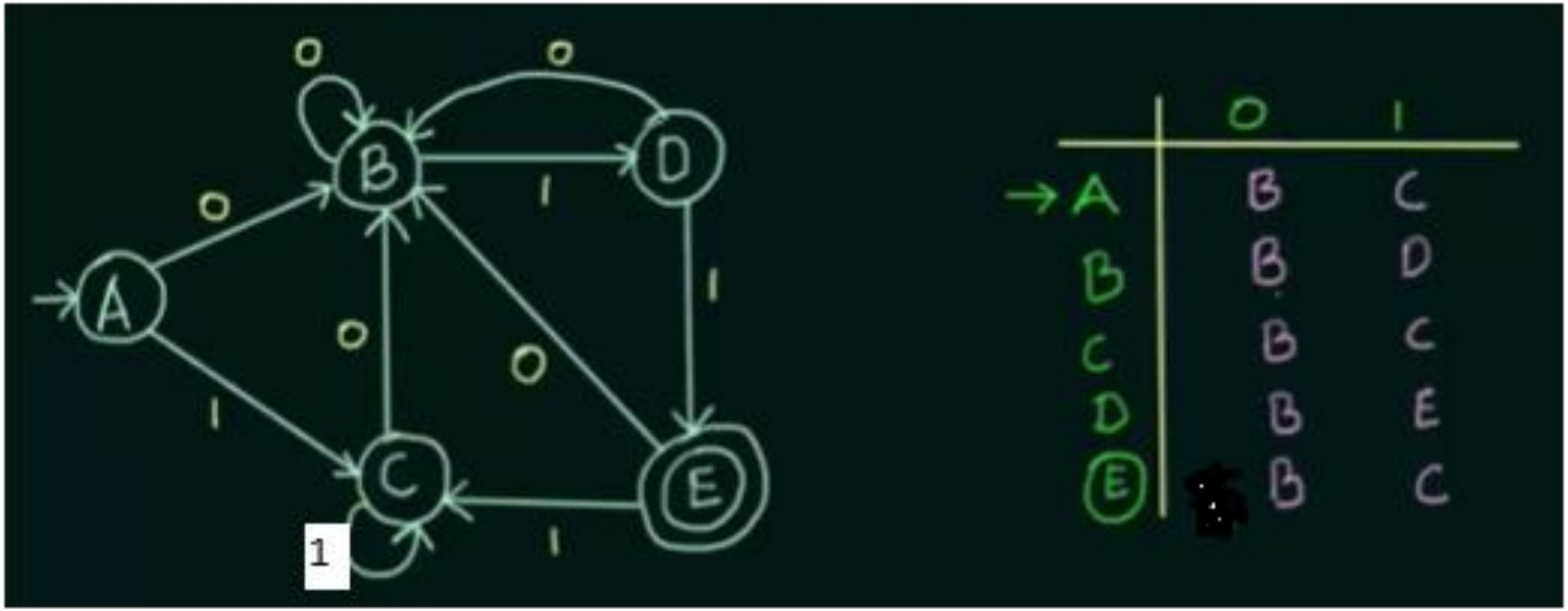
Now it is the transition table of minimized DFA.

Minimization of DFA – Example

State	0	1
→q0	q1	q3
q1	q0	q3
*q3	q3	q3

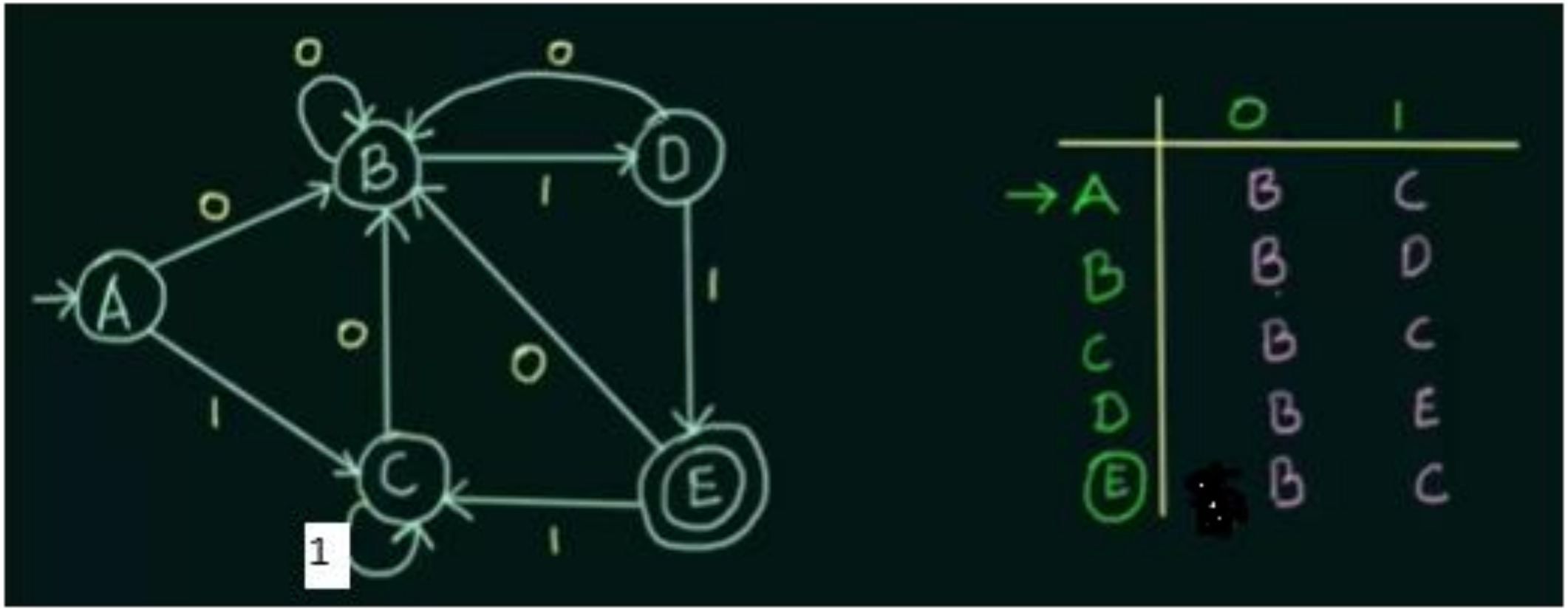


Minimization of DFA – Example 2



	0	1
→ A	B	C
B	B	D
C	B	C
D	B	E
E	B	C

Minimization of DFA – Example 2



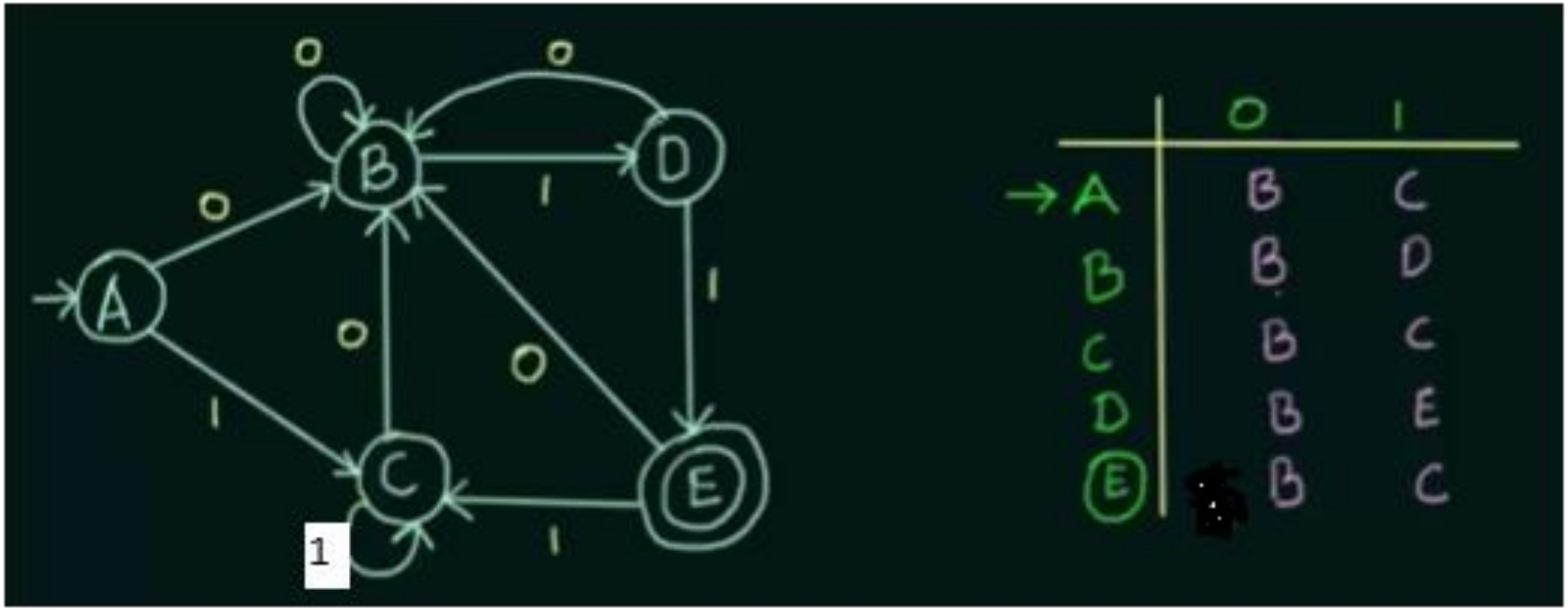
Step 1: In the given DFA, there is no unreachable states to remove

Step 2: Draw the transition table for all pair of states

Step 3: Now split the transition table into two tables T1 and T2

- T1 contains non-final states {A,B,C,D}, and T2 contains the final state {E}

Minimization of DFA – Example 2

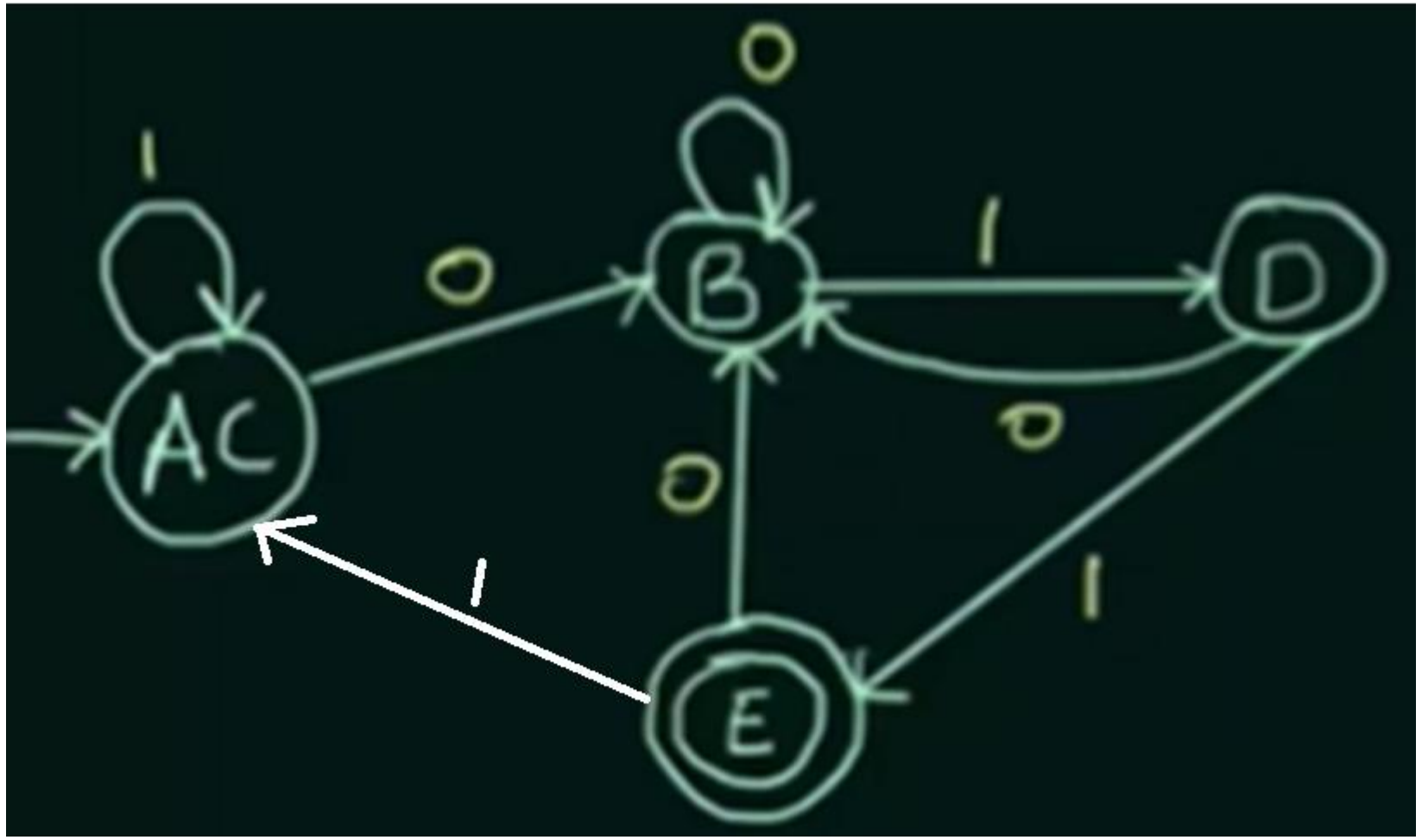


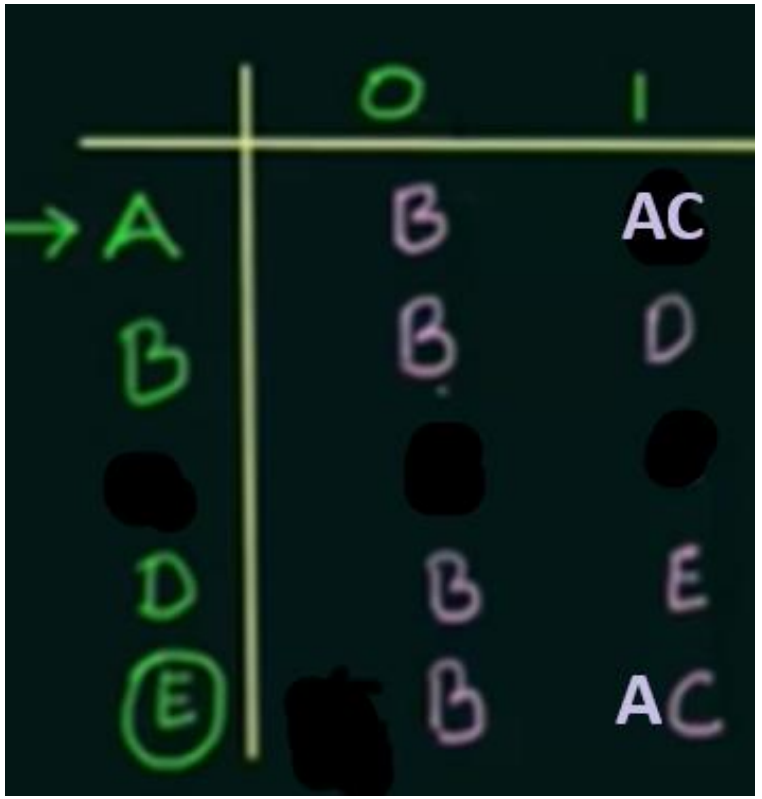
Step 4: Step 4: Find similar rows from T1 such that:

1. δ (A, 0) = B, δ (A, 1) = C
2. δ (C, 0) = B , δ (C, 1) = C

That means, find the two states which have the same value of B and C and remove C

Minimization of DFA – Example 2





THANKS