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5. Find the equivalent partition of the following machine.

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	NextState, Z	
PresentState	$X = 0$	$X = 1$
A	$C, 1$	$D, 0$
B	$D, 1$	$E, 0$
C	$B, 1$	$E, 1$
D	$B, 1$	$A, 0$
E	$D, 1$	$B, 1$

Solution: The partitions are

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$$P0 = (ABCDEF)$$
$$P1 = (AD)(BCE)(Dependingono/pfori/p1)$$
$$P2 = (AD)(BE)(C)(Fori/p0, thenextstateofCgoestoanotherset)$$
$$P3 = (A)(D)(BE)(C)(Fori/p0, thenextstateofAandDgoestoadiffernt)$$
$$P4 = (A)(D)(BE)(C)$$

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Minimization: We know that the equivalent partition is unique. So, $P4 = (A)(D)(BE)(C)$ is the unique combination. Here, every single set represents one state of the minimized machine.

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Let us rename these partitions for simplification.

Rename (A) as S_1, (BE) as S_2, (C) as S_3, and (D) as S_4.

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	$NextState, Z$	
$PresentState$	$X = 0$	$X = 1$
$S_1(A)$	$S_3, 1$	$S_4, 1$
$S_2(BE)$	$S_4, 1$	$S_2, 0$
$S_3(C)$	$S_2, 1$	$S_2, 1$
$S_4(D)$	$S_2, 1$	$S_1, 0$

6. Simplify the following incompletely specified machine.

	Next State,Z		
Present State	I_1	I_2	I_3
A	$D, 1$	$E, 1$	$-, -$
B	$B, 0$	$E, -$	$C, -$
C	$C, -$	$C, 0$	$B, -$
D	$B, 0$	$D, -$	$E, -$
E	$--$	$B, 0$	$A, -$

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	Next State,Z		
Present State	I_1	I_2	I_3
A	$D, 1$	$E, 1$	$-, -$
B	$B, 0$	$E, -$	$C, -$
C	$C, -$	$C, 0$	$B, -$
D	$B, 0$	$D, -$	$E, -$
E	$--$	$B, 0$	$A, -$

Solution: Put a temporary state T in the next state place, where the next states are not specified.

If the output is not mentioned, there is no need to put any output.

As a temporary state T is considered, T is put in the present state column with the next state T for all inputs with no output.

The simplified machine becomes

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The simplified machine becomes

	Next State,Z		
Present State	I_1	I_2	I_3
A	$D, 1$	$E, 1$	$T, -$
B	$B, 0$	$E, -$	$C, -$
C	$C, -$	$C, 0$	$B, -$
D	$B, 0$	$D, -$	$E, -$
E	$T, -$	$B, 0$	$A, -$
T	$T, 0$	$T, 0$	$T, 0$

7. Minimize the following incompletely specified machine.

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	Next State,Z		
Present State	I_1	I_2	I_3
A	$A, 1$	$D, -$	$C, -$
B	$A, 0$	$D, -$	$E, -$
C	$E, 0$	$A, 1$	$-, -$
D	$E, -$	$A, 1$	$-, -$
E	$E, 0$	$-, -$	$C, -$

Solution: In an incompletely specified machine, all the next states or all the outputs or both are not mentioned. We can minimize an incompletely specified machine by using the merger graph and, compatible graph method. From the merger graph, we have to find the compatible pair and from that compatible pair and implied pair we have to construct compatible graph. From the compatible graph, we have to find the closed partition. And, the closed partitions are the minimized states of the machine.

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Merger Graph: The machine consists of five states. So, the merger graph consists of five nodes, named A, B, C, D, and E. The outputs of A and B do not differ, and so there is an arc between A and B. For input I3, the next state conflicts—so the arc is an interrupted arc and in the interrupted portion the conflicting next state pair (CE) is placed.

For states A and C, the output conflicts, and so there is no arc between A and C.

For the states C and D, the outputs as well as next states do not conflict. So, an uninterrupted arc is placed between C and D.

By this process, the merger graph is constructed. The merger graph is as follows

As there is no arc between A and E, the arc between (AD), (BE), (BD), and (BC) are also crossed.

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For the states C and D, the outputs as well as next states do not conflict. So, an uninterrupted arc is placed between C and D.

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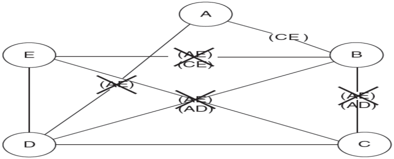

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Compatible Graph: (CE) is the implied pair for (AB). A directed arc is drawn from (AB) to (CE). The compatible graph consists of four vertices (AB), (CD), (DE), and (CE).

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A subgraph of a compatibility graph is said to be closed cover for the machine, if for every vertex in the subgraph, all outgoing edges and their terminal vertices also belong to the subgraph, and every state of the machine is covered by at least one vertex of the subgraph.

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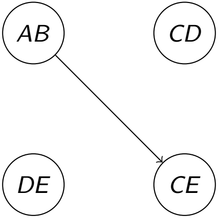
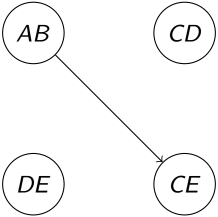
A subgraph of a compatibility graph is said to be closed cover for the machine, if for every vertex in the subgraph, all outgoing edges and their terminal vertices also belong to the subgraph, and every state of the machine is covered by at least one vertex of the subgraph.

For the constructed compatible graph, (AB), (CD), and (CE) form a closed covering. The states of the minimized machine are (AB) and (CDE). Rename (AB) as S_1 and (CDE) as S_2.



AB
CD
DE
CE



The minimized machine is

	Next State,Z		
Present State	I_1	I_2	I_3
S_1	S_1,1	S_2,-	S_2,-
S_2	S_2,0	S_1,1	S_2,-

8. Construct a compatible graph for the following incompletely specified machine.

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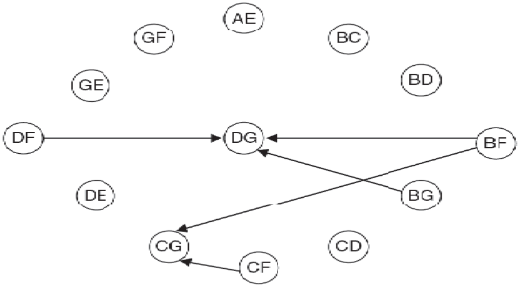
	Next State, Z			
Present State	I_1	I_2	I_3	I_4
A	A, O_1	E, O_2	$-, -$	A, O_2
B	$-, -$	C, O_3	B, O_1	D, O_4
C	A, O_1	C, O_3	$-, -$	$-, -$
D	A, O_1	$-, -$	$-, -$	D, O_4
E	$-, -$	E, O_2	F, O_1	$-, -$
F	$-, -$	G, O_3	F, O_1	G, O_4
G	A, O_1	$-, -$	$-, -$	G, O_4

Solution: To construct a compatible graph, we have to first find compatible pairs. To find the compatible pairs, we need to construct a merger graph. But this machine has seven states, and so it is difficult to construct a merger graph for this machine. So, we have to construct a merger table to find compatible pairs.

	A	B	C	D	E	F
B	×					
C	×	√				
D	×	√	√			
E	√	×	×	√		
F	×	(CG)(DG)	(CG)	(DG)	×	
G	×	(DG)	√	√	√	√

Compatible pairs are (AE), (BC). (BD), (CD), (CG), (DE), (DG), (EG), (GF), (BF), (BG), (CF) and (DF). If (CG) and (DG) are compatible, then (BF) is compatible. If (DG) is compatible, then (BG) is compatible. If (CG) is compatible, then (CF) is compatible. If (DG) is compatible, then (DF) is compatible.

Compatible Graph



The closed partitions are (AE), (BF), (BG), (CF), (CG), (DF), and (DG). The states of the minimized machine are (AE), (BCDFG). Rename them as S1, S2.

The minimized machine is

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	Next State,Z			
Present State	I_1	I_2	I_3	I_4
S_1	S_1,O_1	S_1,O_2	S_2,O_1	S_1,O_2
S_2	S_1,O_1	S_2,O_3	S_2,O_1	S_2,O_4

9. Consider the following machine M_1

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Present State	Next State,Z			
	I_1	I_2	I_3	I_4
A	$-,-$	$C,1$	$E,1$	$B,1$
B	$E,0$	$F,1$	$-,-$	$-,-$
C	$F,0$	$F,1$	$-,-$	$-,-$
D	$-,-$	$-,-$	$B,1$	$-,-$
E	$-,-$	$F,0$	$A,0$	$D,1$
F	$C,0$	$-,-$	$B,0$	$C,1$

a) Construct a merger table for M_1.

b) Find the set of compatibles.

c) Draw a compatibility graph for M_1. Describe the procedure used by you.

d) Obtain a closed covering of M_1. e) Construct a minimized machine M_1* of M_1.