DESIGN PROCEDURE FOR ASYNCHRONOUS SEQUENTIAL CIRCUIT

DESIGN A FUNDAMENTAL MODE ASYNCHRONOUS SEQUENTIAL NETWORK MEETING THE FOLLOWING REQUIREMENTS

- There are 2 inputs x1 and x2 and a single output z
- The input x1 and x2 never changes simultaneously
- The output is always to be 0 when x1=0, independent of the value of x2
- The output is to become 1 if x2 changes while x1=1 and is to remain 1 until x1 becomes 0 again

EXAMPLE 9.3

Design a fundamental-mode asynchronous sequential network meeting the following requirements:

1. There are two inputs x_1 and x_2 and a single output z.
2. The inputs x_1 and x_2 never change simultaneously.
3. The output is always to be 0 when $x_1 = 0$, independent of the value of x_2.
4. The output is to become 1 if x_2 changes while $x_1 = 1$ and is to remain 1 until x_1 becomes 0 again.

THE PRIMITIVE FLOW TABLE

OBTAINING PRIMITIVE FLOW TABLE

Present state	Next state				Output (z)			
	Input state (x_1x_2)				Input state (x_1x_2)			
	00	01	10	11	00	01	10	11
A	(A)				0			

(a)

Present state	Next state				Output (z)			
	Input state (x_1x_2)				Input state (x_1x_2)			
	00	01	10	11	00	01	10	11
A	(A)	B	C	–	0	–	–	–
B		(B)			–	0	–	–
C			(C)		–	–	0	–

(b)

Present state	Next state				Output (z)			
	Input state (x_1x_2)				Input state (x_1x_2)			
	00	01	10	11	00	01	10	11
A	(A)	B	C	–	0	–	–	–
B	A	(B)	–	D	–	0	–	–
C			(C)		–	–	0	–
D				(D)	–	–	–	0

(c)

Present state	Next state				Output (z)			
	Input state (x_1x_2)				Input state (x_1x_2)			
	00	01	10	11	00	01	10	11
A	(A)	B	C	–	0	–	–	–
B	A	(B)	–	D	–	0	–	–
C	A	–	(C)	E	–	–	0	–
D				(D)	–	–	–	0
E				(E)	–	–	–	1

(d)

Present state	Next state				Output (z)			
	Input state (x_1x_2)				Input state (x_1x_2)			
	00	01	10	11	00	01	10	11
A	(A)	B	C	–	0	–	–	–
B	A	(B)	–	D	–	0	–	–
C	A	–	(C)	E	–	–	0	–
D	–	B	F	(D)	–	–	–	0
E				(E)	–	–	–	1
F			(F)		–	–	1	–

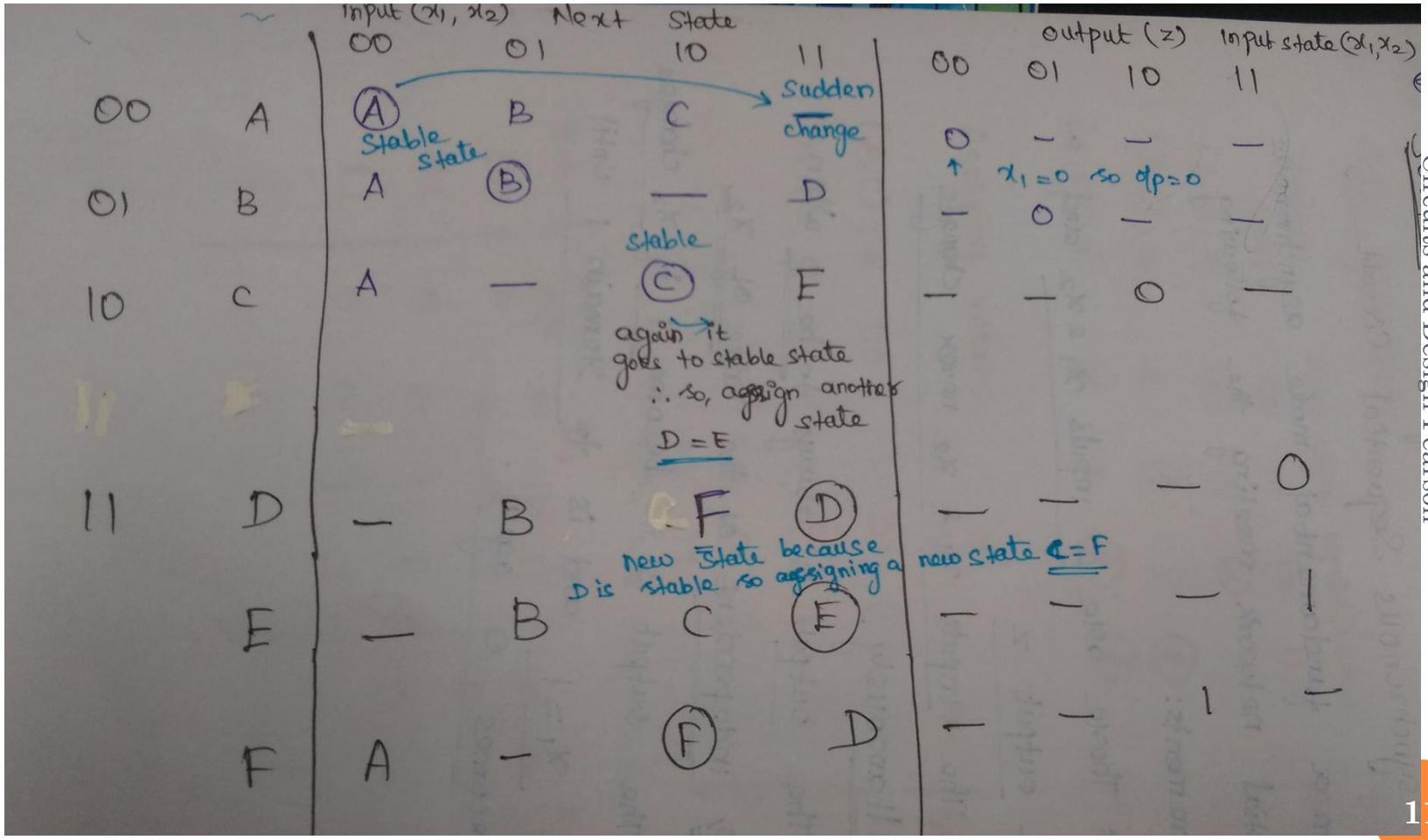
(e)

Table 9.10 (*Cont.*)

Present state	Next state				Output (z)			
	Input state (x_1x_2)				Input state (x_1x_2)			
	00	01	10	11	00	01	10	11
A	(A)	B	C	–	0	–	–	–
B	A	(B)	–	D	–	0	–	–
C	A	–	(C)	E	–	–	0	–
D	–	B	F	(D)	–	–	–	0
E	–	B	F	(E)	–	–	–	1
F	A	–	(F)	E	–	–	1	–

(f)

SOLUTION

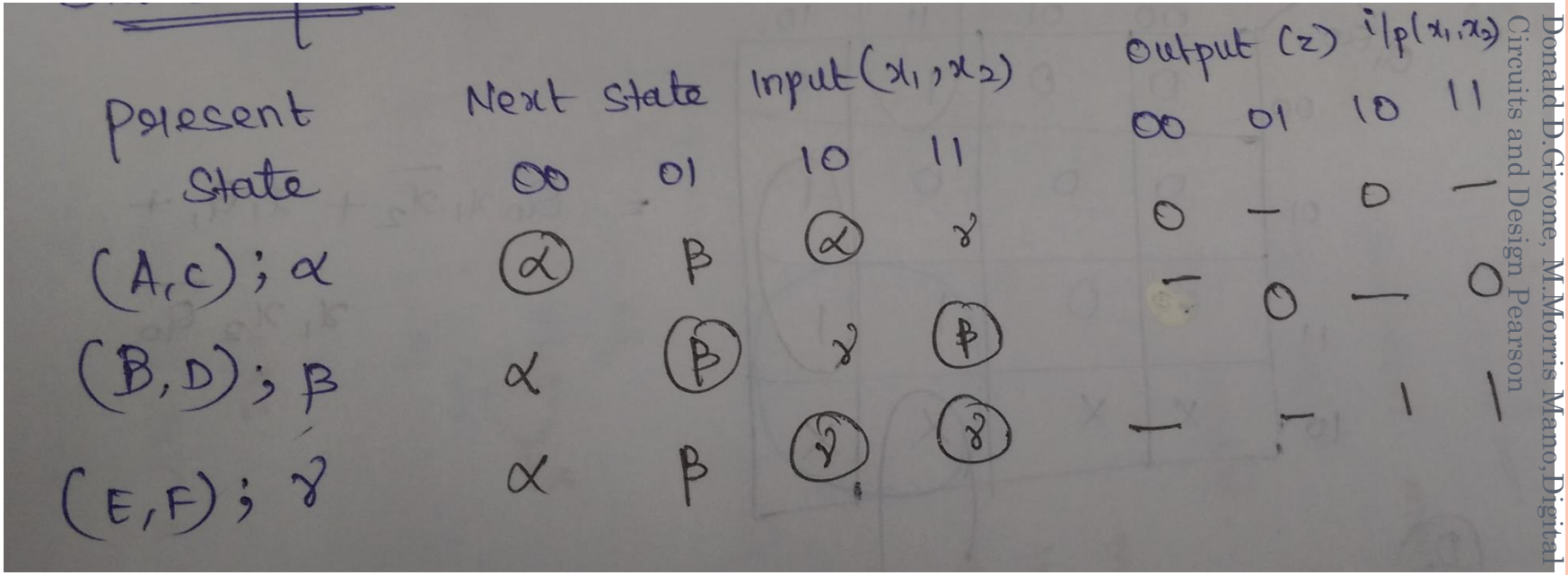

Input (x1, x2)
Next State
00
01
10
11
Output (z)
Input state (x1, x2)
Sudden change
Stable state
Stable
again it goes to stable state
∴ so, assign another state
D = E
new state because D is stable so assigning a new state C = F
x1 = 0 so dp = 0

CONSTRUCTING THE MINIMUM ROW FLOW TABLE

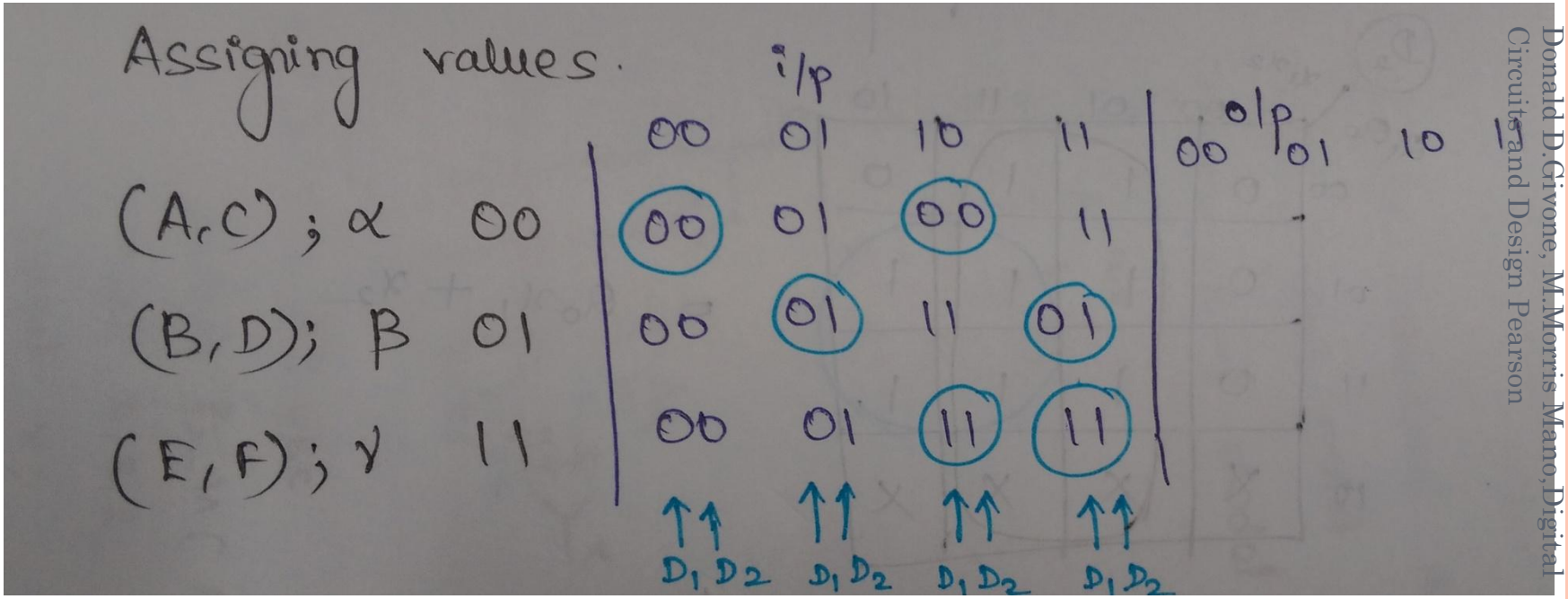
Table 9.16 Minimal-row flow table for Example 9.3

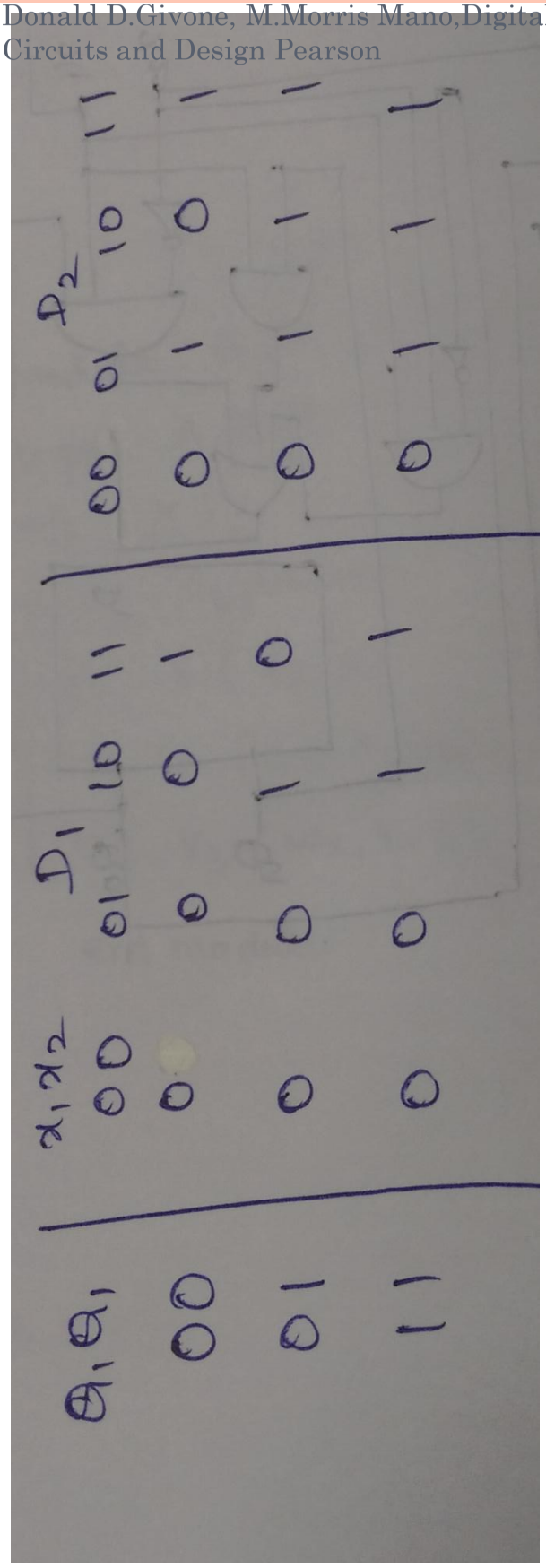
Present state	Next state				Output (z)			
	Input state (x_1x_2)				Input state (x_1x_2)			
	00	01	10	11	00	01	10	11
$\{A,C\}: \alpha$	(α)	β	(α)	γ	0	–	0	–
$\{B,D\}: \beta$	α	(β)	γ	(β)	–	0	–	0
$\{E,F\}: \gamma$	α	β	(γ)	(γ)	–	–	1	1

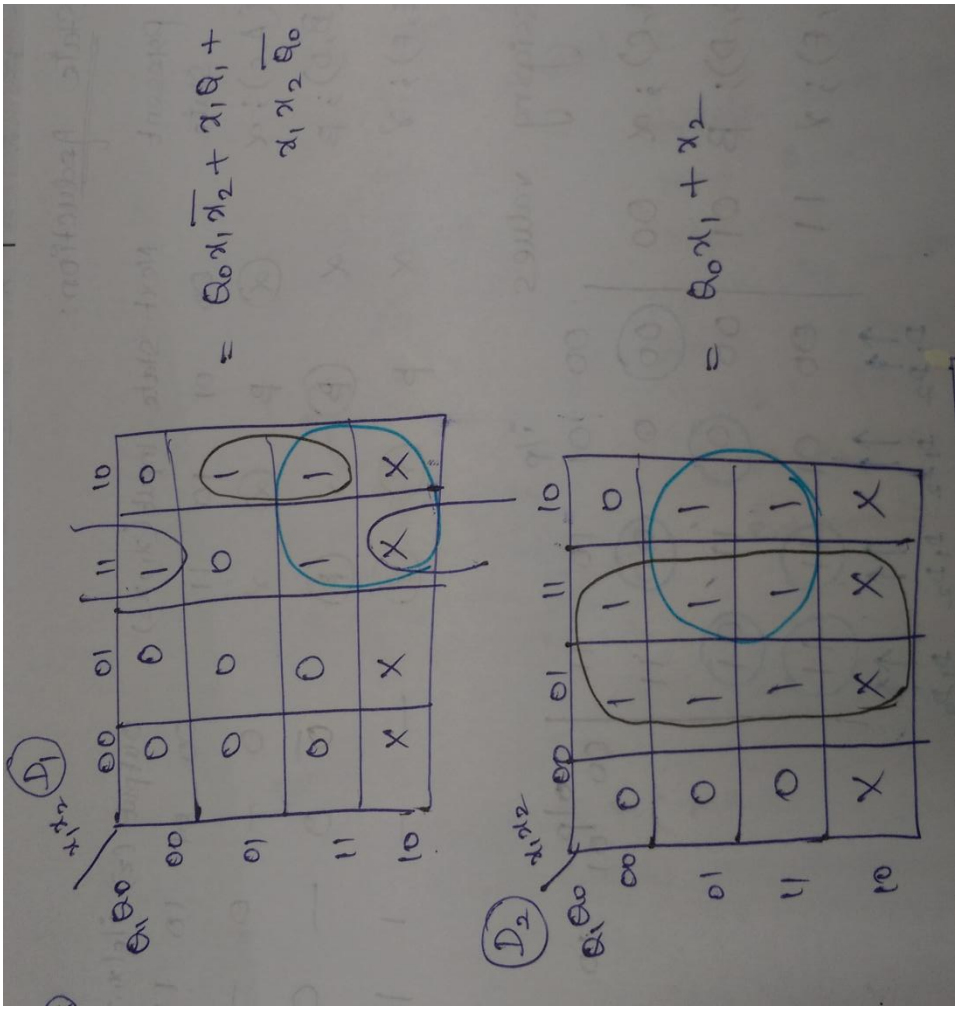
STATE REDUCTION



Present State	Next State		Input (x_1, x_2)		Output (z)		i/p (x_1, x_2)	
	00	01	10	11	00	01	10	11
(A, C); α	(α)	β	(α)	γ	0	–	0	–
(B, D); β	α	(β)	γ	(β)	–	0	–	0
(E, F); γ	α	β	(γ)	(γ)	–	–	1	1


Assigning values.
i/p
00 01 10 11
o/p
00 01 10 11
(A, C); α 00
(B, D); β 01
(E, F); γ 11
D1 D2 D1 D2 D1 D2 D1 D2


D2
D1
x1x2
A1A0


$D_1 = Q_0 x_1 \bar{x}_2 + x_1 Q_1 + \bar{x}_1 x_2 \bar{Q}_0$
$D_2 = Q_0 x_1 + x_2$
D_1
D_2
$Q_1 Q_0$
$x_1 x_2$
00
01
11
10

CIRCUIT DIAGRAM