

Quiz 7a Solution

50 minutes

1. (20) Show a state table or a state diagram for a system with one input, x , and one output, z , such that $z = 1$ if and only if the input has followed a pattern of 10101

- a) If overlapping is allowed.
- b) If overlapping is not allowed

(Full credit for a system with 5 states in each.)

Example

x	0	0	1	0	1	0	1	0	1	0	1	0	1	1	0	1	0	1	1			
z (a)	0	0	0	0	0	0	1	0	1	0	1	0	1	0	0	0	0	1	0	0	0	0
z (b)	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0

q	q^*		z	
	$x = 0$	$x = 1$	$x = 0$	$x = 1$
A	A	B	0	0
B	C	B	0	0
C	A	D	0	0
D	E	B	0	0
E	A	A/D	0	1

On a 1 input, state E goes to A if overlapping is not allowed and to D if it is allowed.

2. (15) For the following state table, indicate which of the listed partitions are SP and which are output consistent.

q	q *		z
	x = 0	x = 1	
A	B	D	0
B	E	D	1
C	B	A	1
D	B	C	1
E	B	D	1

- $P_1 = (A) (B) (C) (D) (E)$ SP oc
 $P_2 = (A) (B E) (C D)$ oc
 $P_3 = (A B E) (C) (D)$ SP
 $P_4 = (A B E) (C D)$ neither
 $P_5 = (A B C D E)$ SP
 $P_6 = (A C D E) (B)$ SP

3. (15) For the following state table (no output column shown)

q	q *	
	x = 0	x = 1
A	B	D
B	A	C
C	B	C
D	B	A

a) Find all of the non-trivial SP partitions.

$(A\ B) \rightarrow (C\ D) \rightarrow (A\ C) \rightarrow \rightarrow P_N$
 $(A\ C) \rightarrow (C\ D) \rightarrow \rightarrow P_1 = (A\ C\ D)\ (B)$
 $(A\ D) \rightarrow \checkmark \rightarrow \rightarrow P_2 = (A\ D)\ (B)\ (C)$
 $(B\ C) \rightarrow (A\ B) \rightarrow \rightarrow P_N$
 $(B\ D) \rightarrow (A\ B) \rightarrow \rightarrow P_N$
 $(C\ D) \rightarrow (A\ C) \rightarrow \rightarrow P_1$

b) Find an output column that

i. does not allow the system to be reduced to fewer than 4 states

A and D must have different outputs. 0 1 1 1

ii. allows it to be reduced to 2 or 3 states.

Either P_1 or P_2 must be output consistent

0 1 1 0 reduces it to three states

0 1 0 0 reduces it to two states

iii. that allows it to be reduced to 1 state.

P_N must be output consistent; either 0 0 0 0 or 1 1 1 1