Department of Electronics Engineering
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# Logic design (2017 Fall)

## Quiz # 15

Name:______________________________ID:__________________________________

1. (60%) Given the state table

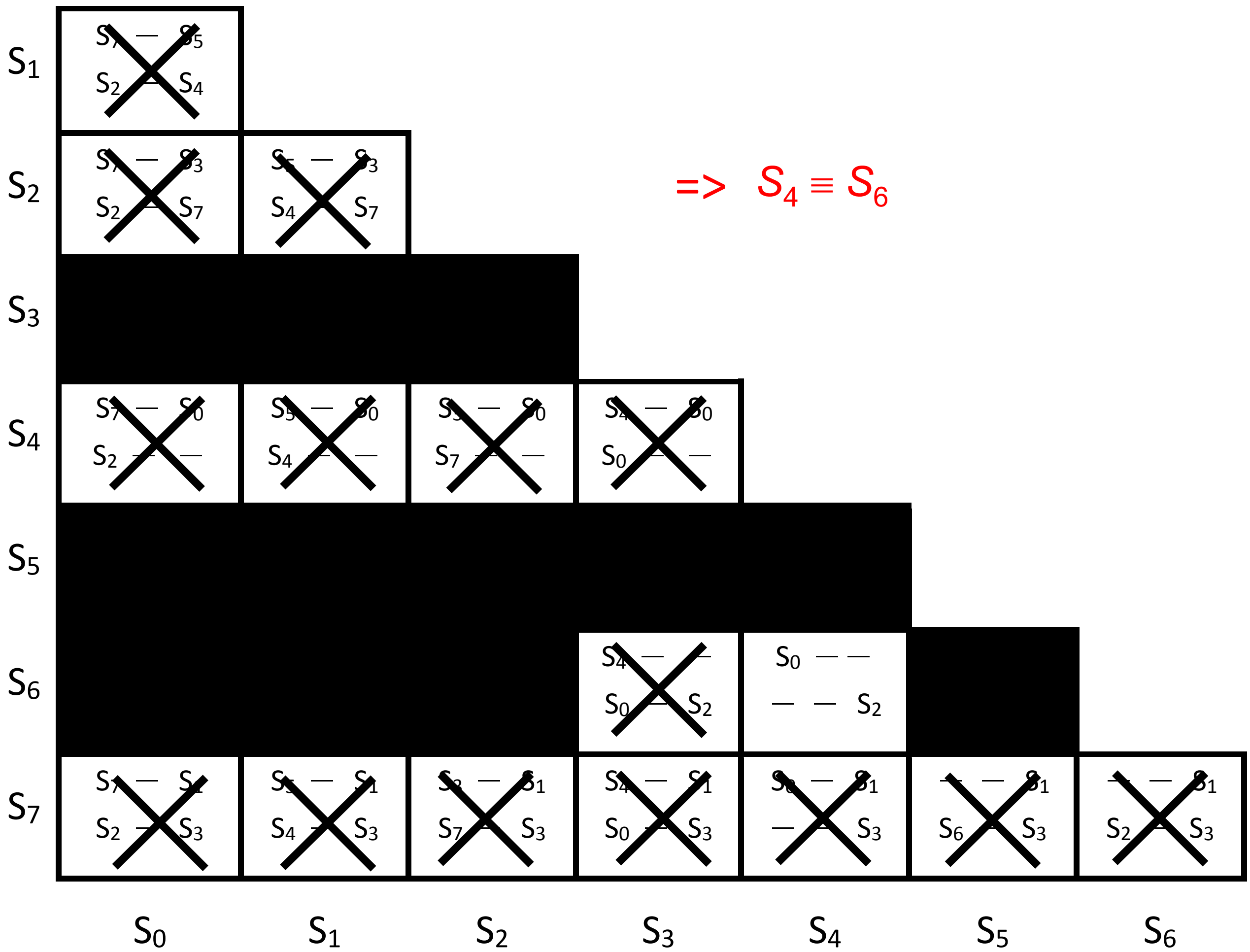
| Present State | Next State X = 0 | Next State X = 1 | Present Output X = 0 | Present Output X = 1 |
|---|---|---|---|---|
| $S_0$ | $S_7$ | $S_2$ | 0 | 0 |
| $S_1$ | $S_5$ | $S_4$ | 0 | 0 |
| $S_2$ | $S_3$ | $S_7$ | 0 | 0 |
| $S_3$ | $S_4$ | $S_0$ | 0 | 1 |
| $S_4$ | $S_0$ | — | 0 | — |
| $S_5$ | — | $S_6$ | 1 | — |
| $S_6$ | — | $S_2$ | 0 | 1 |
| $S_7$ | $S_1$ | $S_3$ | — | — |

(a) (40%) Use implication table to find the equivalent states.

(b) (20%) Show the reduced state table.

Ans:

(a)

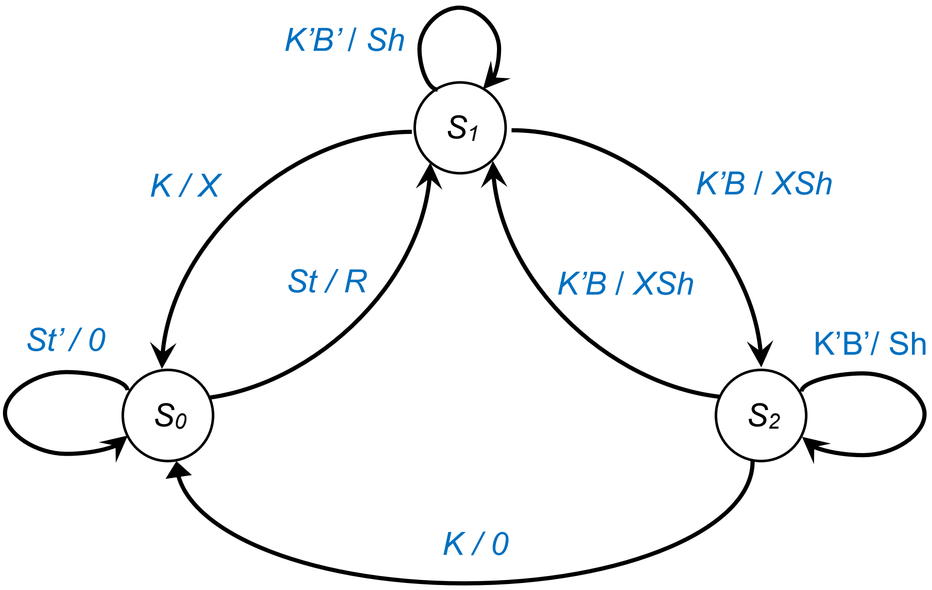



=> $S_4 \equiv S_6$

(b)

| Present State | Next State X = 0 | Next State X = 1 | Present Output X = 0 | Present Output X = 1 |
|---|---|---|---|---|
| $S_0$ | $S_7$ | $S_2$ | 0 | 0 |
| $S_1$ | $S_5$ | $S_4$ | 0 | 0 |
| $S_2$ | $S_3$ | $S_7$ | 0 | 0 |
| $S_3$ | $S_4$ | $S_0$ | 0 | 1 |
| $S_4$ | $S_0$ | $S_2$ | 0 | 1 |
| $S_5$ | — | $S_6$ | 1 | — |
| $S_7$ | $S_1$ | $S_3$ | — | — |

2. (40%) The state graph below represents a sequential circuit that controls an odd-parity generator. The circuit has three inputs *St, K, B* and three outputs *Sh, R* and *X*.




Assume that one-hot assignment is used as the state assignment for this sequential circuit. The three flip-flops used for this one-hot assignment are denoted as $Q_0$, $Q_1$, and $Q_2$, where $Q_0$, $Q_1$, and $Q_2$ correspond to the states $S_0$, $S_1$, and $S_2$, respectively. All flip-flip in this circuit are D flip-flops.

(a) (20%) Derive the next-state equations for $Q_0^+$, $Q_1^+$ and $Q_2^+$.

(b) (20%) Derive the output equations for *Sh, R,* and *X*.

Note that all equations in (a) and (b) needs to be expressed in the minimum sum-of-products form.

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Ans:

$Q_0^+ = St'Q_0 + KQ_1 + KQ_2$

$Q_1^+ = StQ_0 + K'B'Q_1 + K'BQ_2$

$Q_2^+ = K'BQ_1 + K'B'Q_2$

$Sh = K'B'Q_1 + K'BQ_1 + K'B'Q_2 + K'BQ_2$

$= K'Q_1 + K'Q_2$

$R = StQ_0$

$X = KQ_1 + K'BQ_1 + K'BQ_2$

$= KQ_1 + BQ_1 + K'BQ_2$