

Switching Circuits and Logic Design

Quiz 2

14:20 ~ 15:10, December 25, 2008

$$Q^+ = JQ' + k'Q$$

$$Q^+ = S + R'Q$$

1. [10 points] Design a positive-triggered J-K flip-flop from S-R latches.

2. Solve the following problems.

- (a) [20 points] Design a 3-bit counter which counts in the sequences $CBA = 000, 111, 001, 110, 010, 101, 011, 100, 000, 111 \dots$ with T flip-flops.

(Hint: The flip-flops are positive-edge triggered.) $Q^+ = T \oplus Q$

- (b) [10 points] Design a 3-bit counter, where two new input pins "count" and "clear_n" are added. The function of this new counter is shown as the following table. (Hint: you don't have to re-design the counter. You can design it by modifying the circuits in (a).)

clock	count	clear_n	$C^+B^+A^+$
\times	\times	0	000
\uparrow	0	1	CBA
\uparrow	1	1	Normal operation

3. A Mealy circuit examines a string of 0's and 1's applied to the X-input and generates an output $Z = 1$ only when the input sequence, 1010, occurs. The output $Z = 1$ is coincident with the second 0 of the input sequence, 1010.

Example:

$X = \boxed{0 \ 1 \ 0 \ 1} \boxed{1 \ 0 \ 1 \ 0} \ 1 \ 0$
 $Z = \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 1 \ 0 \ 1$

- (a) [20 points] Please provide the state graph of the circuit.
 (b) [10 points] Please provide the state table of the circuit.
 (c) [20 points] If D flip-flops are used, please provide the input maps and input equations for the flip-flops; and the output map and output equation for Z.
 (d) [10 points] Please draw the circuit to implement this design.

1010: 如果 construct 到一半 failed 掉的话, 那就还可以继续的构造新的序列。
 (failed term 不构成 state)

S_0 input 0/initial state

S_1 input 1

S_2 10

S_3 101

1010

可当作 S_0

1010 的 redundant state.

