Appendix B Solutions: For More Practice

B.3 This is easily shown by induction.

Base case: A truth table with one input clearly has two entries (2^1).

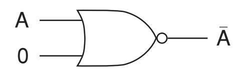
Assume a truth table with n inputs has 2^n entries.

A truth table with $n + 1$ entries has 2^n entries where the $n + 1$ input is 0 and 2^n entries where the $n + 1$ input is 1, for a total of 2^{n+1} entries.

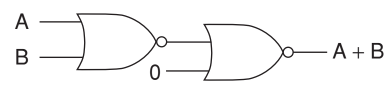
B.4 No solution provided.

B.5

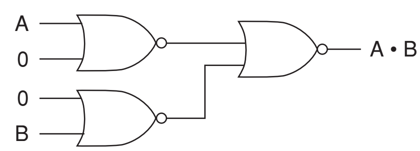
NOT function: $\overline{0 + A} = \bar{A}$ so



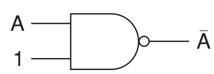
OR function: $\overline{\overline{A + B}} = A + B$ so



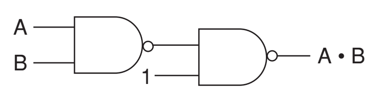
OR function: $\overline{\bar{A} \cdot \bar{B}} = \bar{\bar{A}} + \bar{\bar{B}} = A + B$ so



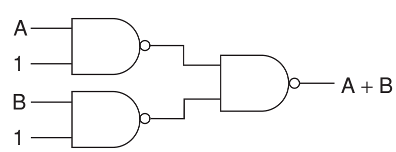
B.6 NOT function: $\overline{1 \cdot A} = \bar{A}$ so



AND function: $\overline{\overline{A \cdot B}} = A \cdot B$ = so



OR function: $\overline{\bar{A} \cdot \bar{B}} = \bar{\bar{A}} + \bar{\bar{B}} = A + B$ so



B.17

Inputs			Output
A	*B*	*S*	*C*
0	X	0	0
1	X	0	1
X	0	1	0
X	1	1	1

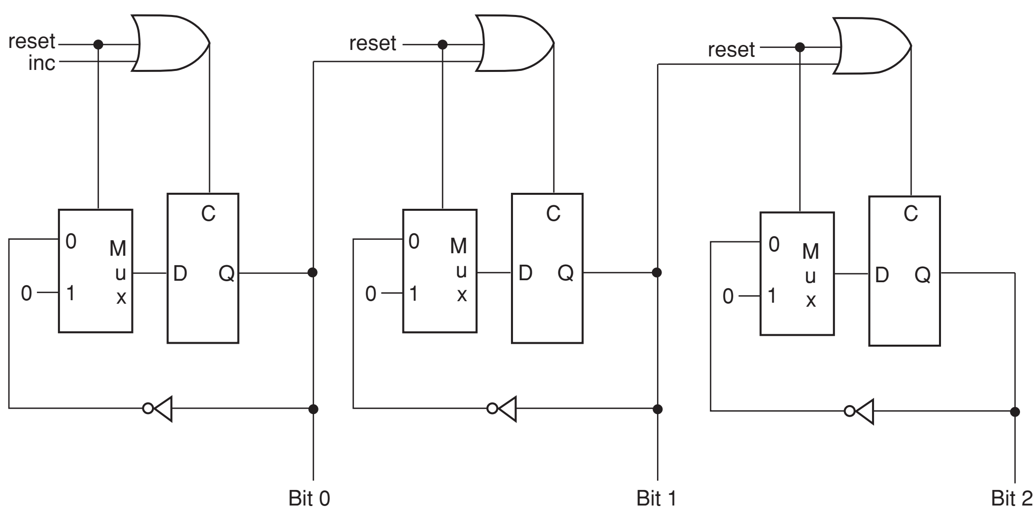
B.35 There will be no difference as long as *D* never changes when *C* is asserted (with respect to the D latch).

B.36 The key is that there are two multiplexors needed and four D flip-flops.

B.37 The point here is that there are two states with the same output (the middle light on) because the next light is either the left or the right one. This example demonstrates that outputs and states are different.

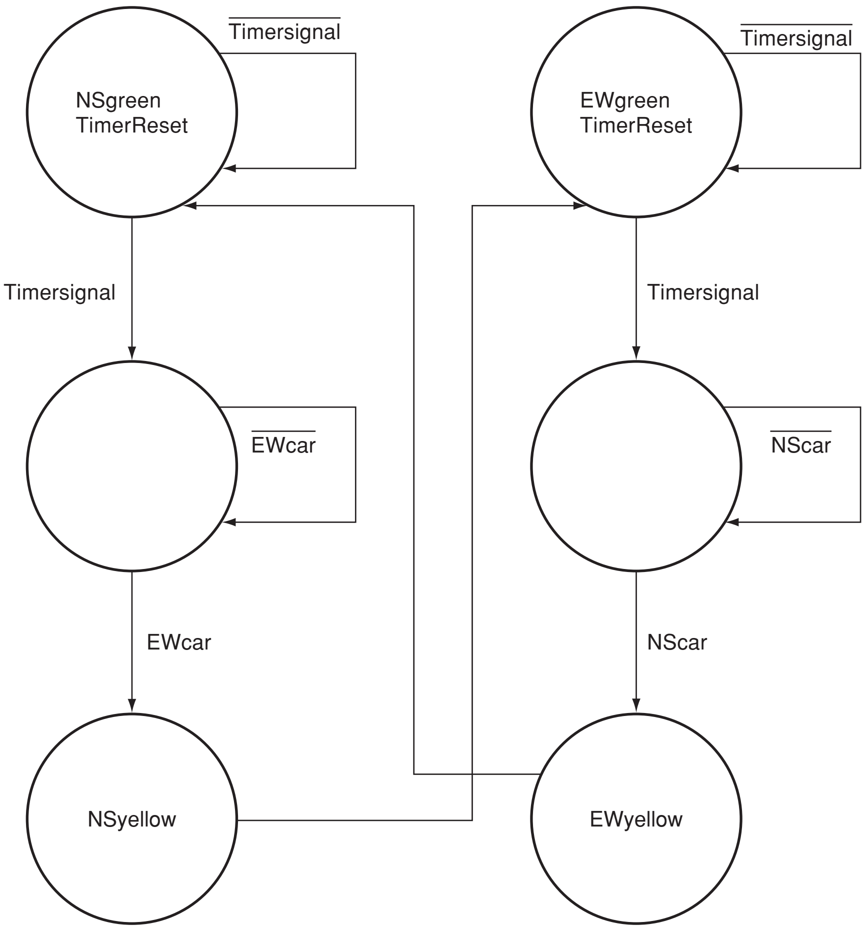
B.38 No solution provided.

B.39 The basic idea is to build a single bit that toggles first. Then build the counter by cascading these 1-bit counters using the output of each stage to cause the toggle of the next; we assume that both inc and reset are not high at the same time. This circuit assumes falling-edge triggered D flip-flops.



B.40 No solution provided.

B.41 We assume that the light changes only if a car has arrived from the opposite direction and the 30-second timer has expired. Here is the FSM. We make a small simplification and actually make the light cycle in 34-second increments. This could be improved by detecting a car and the timer expiration at the same time, but this still means that when a car arrives it may still take up to 4 seconds before the yellow light is signaled.



B.42 No solution provided.

B.43 No solution provided.

B.44 No solution provided.