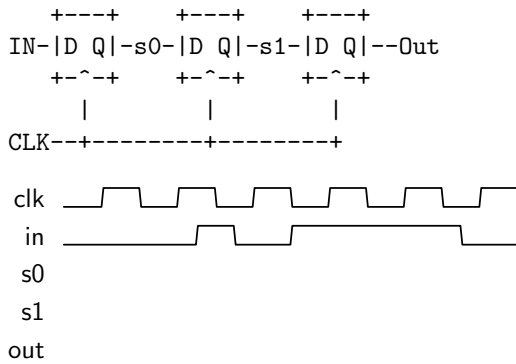
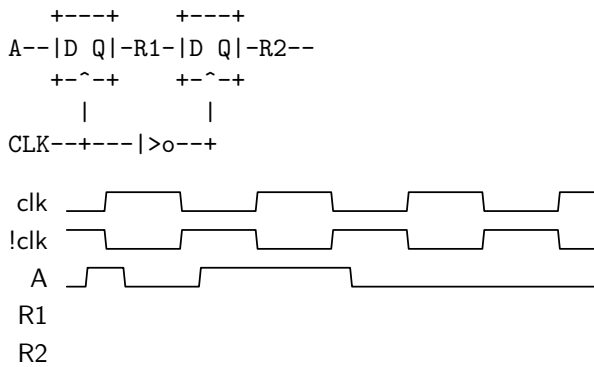


State

- Fill out the timing diagram for the circuit below:

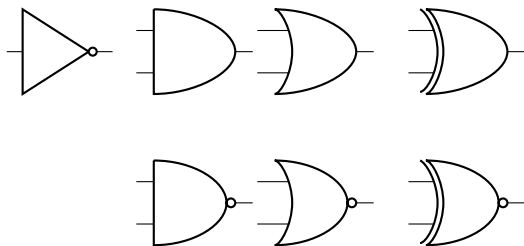


- Fill out the timing diagram for the circuit below:



Logic Gates

- Label the following logic gates:



- Convert the following to boolean expressions:

- NAND
- XOR
- XNOR

3. Create an AND gate using only NAND gates.

4. How many different two-input logic gates can there be? How many n-input logic gates?

Boolean Logic

$$\begin{array}{llll} 1 + A = 1 & A + \bar{A} = 1 & A + AB = A & (A + B)(A + C) = A + BC \\ 0B = 0 & B\bar{B} = 0 & A + \bar{A}B = A + B & \\ \text{DeMorgan's Law: } & \overline{AB} = \bar{A} + \bar{B} & \overline{A + B} = \bar{A}\bar{B} & \end{array}$$

1. Minimize the following boolean expressions:

(a) Standard: $(A + B)(A + \bar{B})C$

(b) Grouping & Extra Terms: $\bar{A}\bar{B}\bar{C} + \bar{A}B\bar{C} + AB\bar{C} + A\bar{B}\bar{C} + ABC + A\bar{B}C$

(c) DeMorgan's: $\overline{A(\bar{B}C + BC)}$