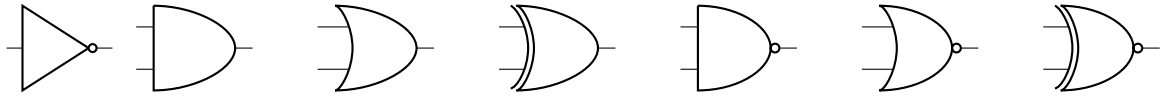
CS61C Fall 17 Discussion 5 – Logic, SDS, & FSM

Logic Gates

1. Label the following logic gates:



2. Convert the following to boolean expressions:
   (a) NAND
   (b) XOR
   (c) 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

$1 + A = 1$	$A + \bar{A} = 1$	$A + AB = A$	$(A + B)(A + C) = A + BC$
$0B = 0$	$B\bar{B} = 0$	$A + \bar{A}B = A + B$	
DeMorgan's Law:	$\overline{AB} = \bar{A} + \bar{B}$	$\overline{A + B} = \bar{A}\bar{B}$	

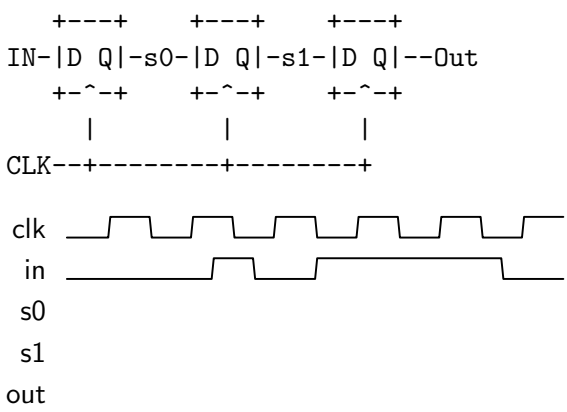
1. Minimize the following boolean expressions:
   (a) Standard: $(A + B)(A + \bar{B})C$

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

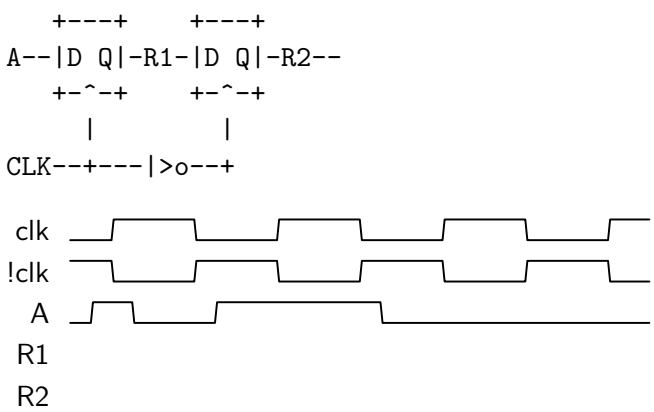
   (c) DeMorgan's: $\overline{A(\bar{B}\bar{C} + BC)}$

State

1. Fill out the timing diagram for the circuit below:



2. Fill out the timing diagram for the circuit below:



FSM

1. Fill in the following FSM for outputting a 1 whenever we have two repeating bits as the most recent bits, and a 0 otherwise. You may not need all states.