

CS31 Worksheet: Week 3 Digital Circuits

Q1. Bitwise operations

- $0101 \& 1101$
- $0101 | 1101$

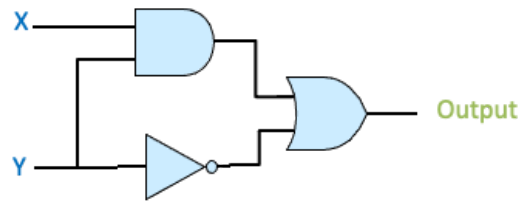
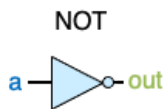
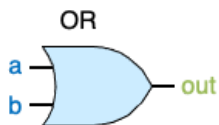
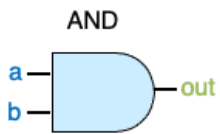
Logical (unsigned) bit shift:

- $1010 \ll 2$
- $1010 \gg 2$

Arithmetic (signed) bit shift:

- $1010 \ll 2$
- $1010 \gg 2$

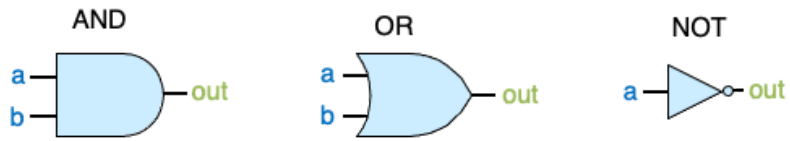
Q2. What does this circuit output?



Clicker Choices

| X | Y | Out _A | Out _B | Out _C | Out _D | Out _E |
|---|---|------------------|------------------|------------------|------------------|------------------|
| 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 0 | 1 | 0 | 0 | 1 |
| 1 | 0 | 1 | 0 | 1 | 1 | 1 |
| 1 | 1 | 0 | 0 | 1 | 1 | 0 |

Q3. Using AND, OR and NOT gates, draw out an XOR Circuit



| A | B | $A \wedge B$ |
|---|---|--------------|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

Q4. Given the following truth table, draw out a one-bit adder.

| A | B | Sum (A + B) | C _{out} |
|---|---|-------------|------------------|
| 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 1 |

Q5. Let's now draw out a one-bit full adder

Write Boolean expressions
for $\text{Sum} = 1$ and $\text{C}_{\text{out}} = 1$

| A | B | C _{in} | Sum | C _{out} |
|---|---|-----------------|-----|------------------|
| 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 1 | 0 |
| 1 | 0 | 0 | 1 | 0 |
| 1 | 1 | 0 | 0 | 1 |
| 0 | 0 | 1 | 1 | 0 |
| 0 | 1 | 1 | 0 | 1 |
| 1 | 0 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 |

When is $\text{Sum} = 1$?

When is $\text{C}_{\text{out}} = 1$?

Q6. Which of these circuits lets us select between two inputs?

