

CSSE2010 / CSSE7201 Learning Lab 2

Logic Gates

School of Information Technology and Electrical Engineering
The University of Queensland



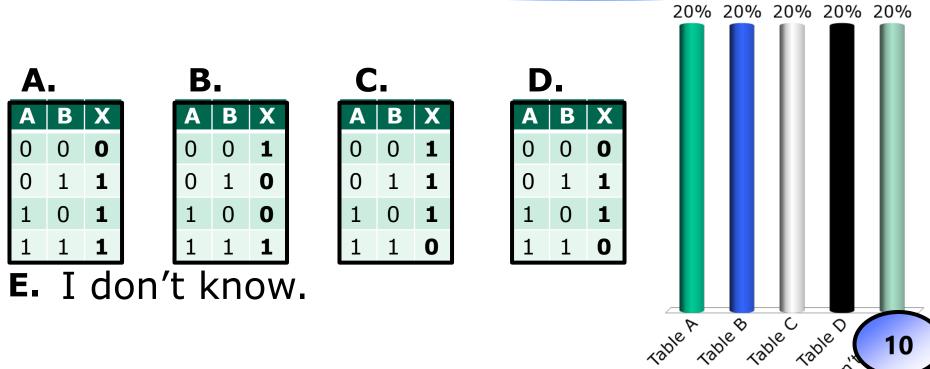
Today

Logic Gates

- Lecture revision
- Introduction to Hardware/Simulation
- Circuit Schematics
- Circuit Building

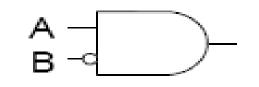


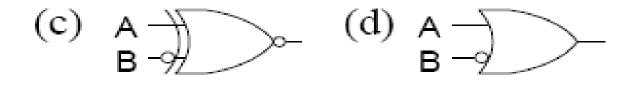
What's the truth table for a 2 input XOR gate

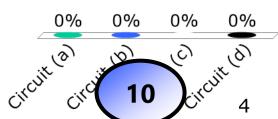




Which of the following circuits is equivalent to ...









Boolean Identities (Reminder from lecture)

Name	AND form	OR form
Identity law	1A = A	O + A = A
Null law	0A = 0	1 + A = 1
Idempotent law	AA = A	A + A = A
Inverse law	$A\overline{A} = 0$	$A + \overline{A} = 1$
Commutative law	AB = BA	A + B = B + A
Associative law	(AB)C = A(BC)	(A + B) + C = A + (B + C)
Distributative law	A + BC = (A + B)(A + C)	A(B + C) = AB + AC
Absorption law	A(A + B) = A	A + AB = A
De Morgan's law	$\overline{AB} = \overline{A} + \overline{B}$	$\overline{A + B} = \overline{A}\overline{B}$



Objective

Main objective today:

Verify the functionality of a simple logic circuit either using a hardware circuit constructed with logic ICs or using simulations in Logisim software

IN students: Use logic chips on your kit or use Logisim if you haven't got your kit yet

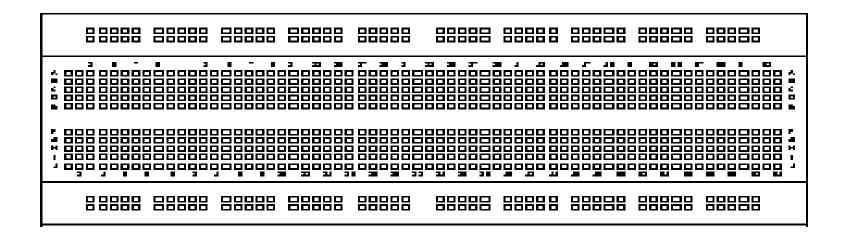
EX students: Use Logisim software (it is free)



Hardware Overview

- Breadboard with IO board
 - Be very careful with the USB connector
- USB cable
- Hookup wire
- Logic chip kit
- IC Extractor

Breadboard



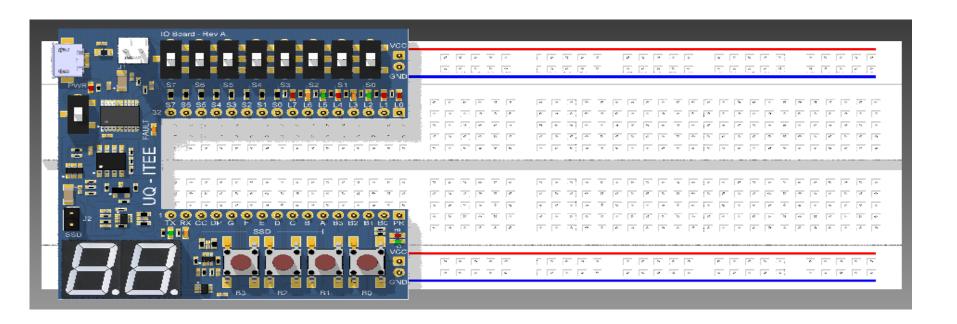


Logic Chips





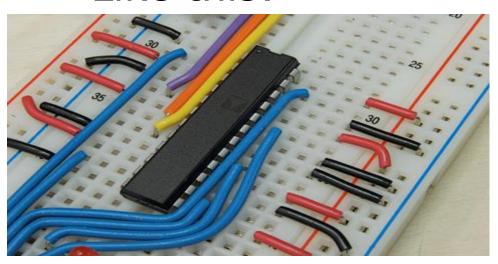
Breadboard with IO board



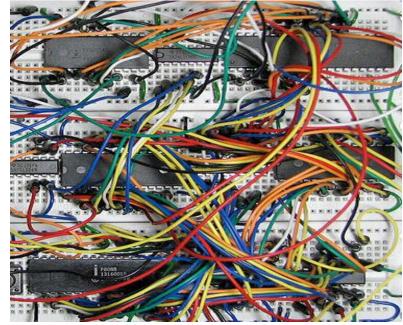


Wire neatly!

Like this:



Not this:





Device Information

- See course Blackboard site for
 - Guide to circuit schematics
 - Examples coming up
 - Device pinouts



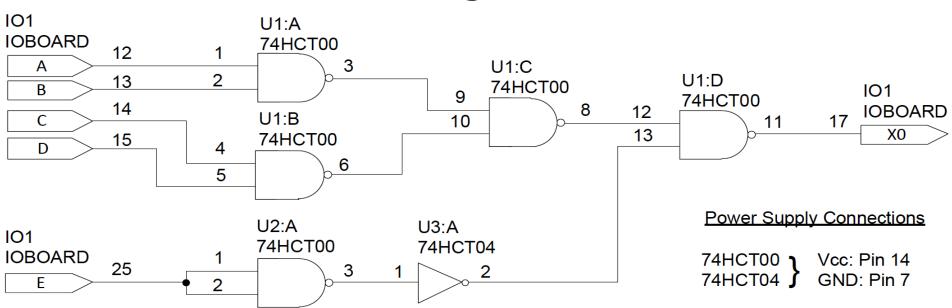
Circuit Schematic Diagram

- More than a logic diagram, a circuit schematic tells you how to **build** the circuit
- You'll need to draw these for pracs and exams
- Schematics include
 - Labelled inputs
 - Labelled outputs
 - Labelled devices (logic chips & IO Board)
 - Logic chips: U1, U2, U3, ...
 - Label gates within a chip (:A, :B, :C)
 - IOBoard: IO1
 - Power supply connections for logic chips
 - Pin numbers



Circuit Schematic Example

From Blackboard guide





Circuit Schematic Example

3 input NOR gate

- Now wire this up or simulate in Logisim software & systematically determine truth table
- If you are testing on hardware, double check your circuit (especially power and ground) before you power it on



3-input Majority Function

- True if at least two of the inputs (A,B,C) are true
 - Z=A.B+A.C+B.C
- This function was shown in lecture 2 (though not in this form)
- Truth Table: Logic Diagram:

- Convert to NAND only circuit using Boolean algebra
- Draw circuit schematic inputs are <u>switches</u>, output is <u>LED</u>
- Wire up circuit/simulate in Logisim and determine truth table
- Repeat using AND and OR gates