

Exam 1

Today: 10/15/19

6 - 8 pm

LC - A1

7 questions (some with multiple parts)

3 over Arduino stuff

4 over Homework stuff

zyBooks Information

- Chapter 1 - Introduction to Embedded Systems

1. What is an embedded system

2. Basic Components

3. Timing diagrams

- Chapter 2 - Combinational Logic

1. Electronics and digital systems

- Ohm's Law

$V = IR$

series vs parallel circuit (no combined circuit on exam)

in a series circuit CURRENT remains constant

Total Resistance: $R_t = R_1 + R_2 + \dots + R_n$

Voltage Drop across R_x is the percentage of R_x to the R_t

in a Parallel circuit Voltage remains constant

Total Resistance: $1/R_t = 1/R_1 + 1/R_2 + \dots + 1/R_n$

Current across each path (across each Resistor)

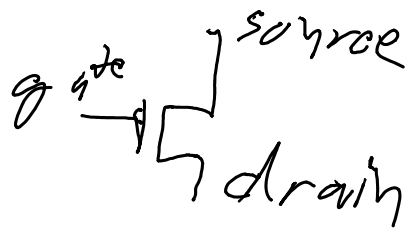
- transistor

3 parts

gate

source

drain



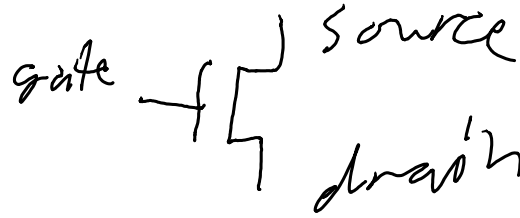
whether or not there is current at the gate will determine if the source is connected to the drain

- nMOS

if the gate has a logical value of 1, the source and drain are connected

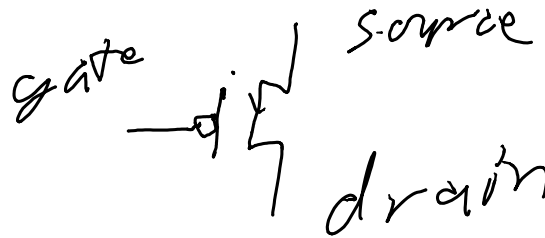
- nMOS

if the gate has a logical value of 1, the source and drain are connected



- pMOS

if the gate has a logical value of 0, the source and drain are connected

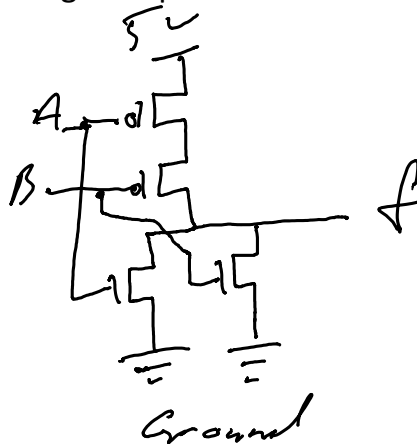


- CMOS

- C => Complementary Symmetry

- nMOS gets replaced with pMOS across the symmetric boundary

- parallel connections gets replaced with series connections across the symmetric boundary



$$f(A, B) = (A + B)'$$

A	B	f
0	0	1
0	1	0
1	0	0
1	1	0

1. Gates (know boolean operator, circuit symbol)

- i. NOT

- ii. AND

- iii. OR

- iv. NAND

- v. NOR

- vi. XOR

- vii. XNOR

2. Boolean algebra and equations

3. Basic circuit drawing conventions

4. Digital circuit simulator

5. Timing diagrams

6. Equations to/from circuits

- i. precedence

7. Sum-of-products form

- Determining if two equations are the same

8. Sum-of-minterms form

- Boolean Properties
- all literals of the function are included in each product term
- $F(a,b,c) = a'c + a'b'$ (in Sum of products, not in sum of minterms)
- $= a'c1 + a'b'1$
- $= a'c(b + b') + a'b'(c + c')$
- $= a'cb + a'cb' + a'b'c + a'b'c'$
- $= a'bc + a'b'c + a'b'c + a'b'c'$
- $= a'bc + a'b'c + a'b'c'$

- Sum-of-products form to/from Sum-of-minterms form
- Determining if two equations are the same or not the same

9. Truth Tables

- Determining if two equations are the same or not the same
- Truth Tables to/from Equations
 - Sum-of-Products form
 - Products-of-Sum form (from lecture: Lec05)

10. Why study digital design

Arduino Information

- setup() function
- loop() function
- wiring an LED (including the resistor)
- Digital Pins
 - initializing for use - pinMode()
 - setting the value - digitalWrite()
 - getting the value - digitalRead()
 - uses logical values of 0,1 (or LOW, HIGH)
- Analog Pins
 - getting the value - analogRead()
 - uses logical values of: 0 - 1023
- power (5V and 3.3V)
- Ground
- delay() function
- map() function may be useful
- wiring a switch
- switch bounce problem
- code to debounce a switch
 - <https://www3.cs.uic.edu/bin/view/CS362/BrooklynDebounce>
- debugging using Serial.print()
 - Serial.begin()

Additional Lecture Information

- Stages of Team Development
- Original 4 Stages:
 1. Forming
 - Morale is High
 - Skills/Performance is Low
 2. Storming
 - Morale is Low
 - Skills/Performance is Low
 3. Norming
 - Morale is Low
 - Skills/Performance is High
 4. Performing
 - Morale is High
 - Skills/Performance is High
- 5th Stage added later
 - Stage 5 - Adjourning

From <<https://www3.cs.uic.edu/bin/view/CS362/ExamTopicsF19>>