MECHTRON 3TA4 Summary

Author: Kemal Ahmed
Instructor: Dr. Mark Lawford
Date: Fall 2014

Math objects made using [MathType](#); graphs made using [Winplot](#).

Please join GitHub and contribute to this document. There is a guide on how to do this on my GitHub.

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Chapter 1

Market Window (W): the amount of time, in months, between the on-time entry of the company and peak revenue. It is also the amount of time from peak revenue to when revenue gets to 0. In other words, the entire lifecycle of a product is 2×W

Delay (D): the entry point of a company given a delay

$$\text{Revenue loss depending on entry} = \frac{\text{On-time} - \text{Delayed}}{\text{On-time}} \times 100\%$$

$$\text{Percentage revenue loss} = \frac{D(3W - D)}{2W^2} \times 100\%$$

Design Metrics

Non-Recurring Engineering (NRE) cost: one-time cost to design a system. No more design costs are needed
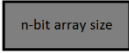
Unit cost: cost of manufacturing one instance of design

Chapter 2

Datapath

1. Identifying variables
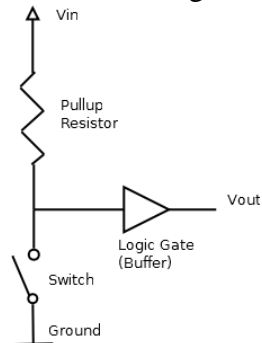2. Identifying operations

State machine data-path symbols:

- Register: `bits:name`

- Multiplexor: `n-bit array size`
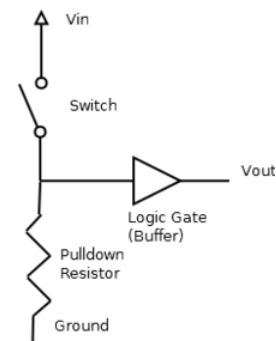- Operations: regular white rectangles

Op-Amps

Slew rate: maximum rate of change of voltage / s

Gain: $\dfrac{V_{out}}{V_{in}} = 20\text{dB} \cdot \log\left(\dfrac{V_{out}}{V_{in}}\right)$

Pull up resistor: When the switch is open, the pull-up resistor brings the voltage up, while when it's closed, V goes to ground

Pull down resistor:

Pulse-Width Modulation (PWM): a technique for getting analog results with digital means
e.g. To create a 3V signal given a digital source that can be either high (on) at 5V or low (off) at 0V, you can use PWM with a duty cycle of 60% which outputs 5V 60% of the time. If the digital signal is cycled fast enough, then the voltage seen at the output appears to be the average voltage

Transfer function: a function that represents what the system does to the voltage

$$G(s) = \frac{V_{out}}{V_{in}} = \frac{Z_2}{Z_1 + Z_2}$$