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Digital Logic Design, Winter Semester 2023
Final Project - Milestone 2
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Milestone Overview

In this milestone, you will build a two-bit adder on a breadboard and produce the binary output on LED lamps. The system will include 4 switches, 2 for each number being added. For example, if the numbers to be added are A and B, the four switches are A1, A2, B1, B2. **You can find these in Part (A) and Part (B) in the diagram**

3 lamps are needed to produce the 3-bit output number; a lamp for each result (S1, S2, S3). It is important to note that there are only 3 lamps required for the output due to the fact that the addition of two 2-bit numbers can never produce more than 3 bits. For example, the binary representation of 3 plus 3 is 6, which can be represented as binary 110.

The output of the 4-bit adder will be connected to the LED lamps to produce the output. The project will also involve the use of integrated circuits (ICs) such as a 4-bit binary full adder. **You can find this in the diagram in Part (C)**

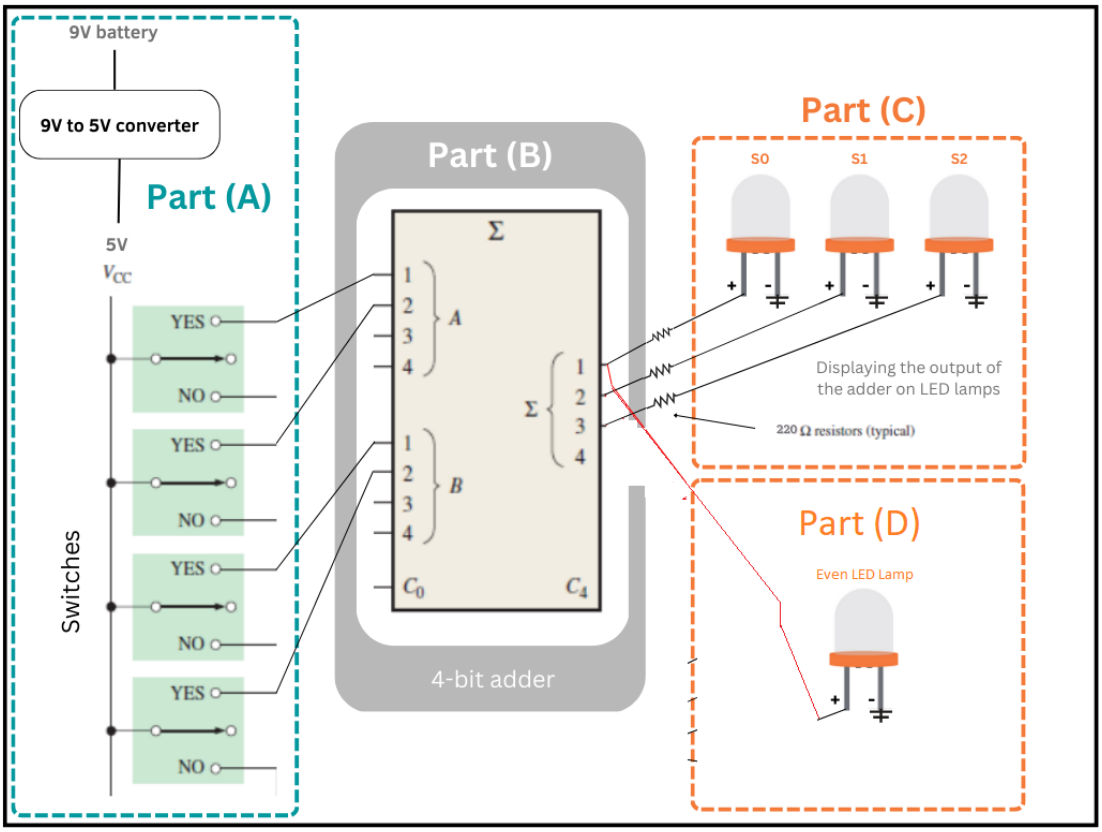
In addition, you should also dedicate a fourth LED lamp that lights up if the total output of the addition is even and turn off if it is an odd result. In order to do that, you should connect S0 (the first output) to a not gate because if it is HIGH then the number is odd and vice versa. Hence, connecting it to a not gate and connect the result after flipping to the fourth LED. **You can find this in the diagram in Part (D)**

Schematics

- The basic system is shown in **Figure 1** (present in page 2) for a setup with four switches connected to a power source, these are connected to the 4-bit adder. The output of the 4-bit adder is connected to the LED lamps to produce the output (a lit lamp means '1' and a dim lamp means '0').
- The diagram **present in page 24** displays a top view for the connection diagram dip of a 4-bit binary adder [SN74LS283N] and the top view for the Not Gate IC [SN74LS04N]
- The resistors from the inputs of the full-adder go to ground. When a switch is pushed, a HIGH level (VCC) is applied to the associated full adder input.
- VCC means to connect this pin with HIGH or (+) while GND is a shortcut for ground which is to indicate to connect this pin with LOW or the (-)

Requirements (the hardware to buy)

- Breadboard and wires



(a) Project Overview

- resistors (220 ohms for lamps)
- Switch pins
- LED lamps
- Power supply (5V or 9V and connect the voltage regulator to damp it to 5V)
- 4-Bit Binary full adder
- Voltage regulator (9V to 5V)

Useful links (you may purchase these components)

You may use these links to directly purchase some of the components. However, it is completely up to you to decide which components to buy, work on, and present. **Hint:** This is the precise amount of components needed but make sure to get some spare parts.

- **4 bit Adder**
  Name: #74283 (4-bit Binary Full Adder with Fast Carry)
  Link: https://ram-e-shop.com/product/74ls283/
  Quantity: 1
- **ON/OFF Switches**
  Name: On/Off PCB Mounted 6pin
  Link: https://ram-e-shop.com/product/press6pin-on-off/
  Quantity: 4

- **Battery 9V**
  Name: Battery 9V (PHILIPS) Long-Life
  Link: https://ram-e-shop.com/product/battery-9v-philips-longlife/
  Quantity: 1

- **Battery Converter from 9V to 5V**
  Name: Kit Battery (9V Input and Output 9V & 5V) to Breadboard
  Link: https://ram-e-shop.com/product/kit-battery-9v/
  Quantity: 1

- **Breadboard**
  Name: Breadboard 630-Tie Point "BB-01"
  Link: https://ram-e-shop.com/product/bb01-bread-board/
  Quantity: 1

- **Jumpers**
  Name: PHcr- 20Cm Male to Male 40 Jumper Set Connecting Wire
  Link: https://ram-e-shop.com/product/ph61-mm-20cm/
  Quantity: 1 pack

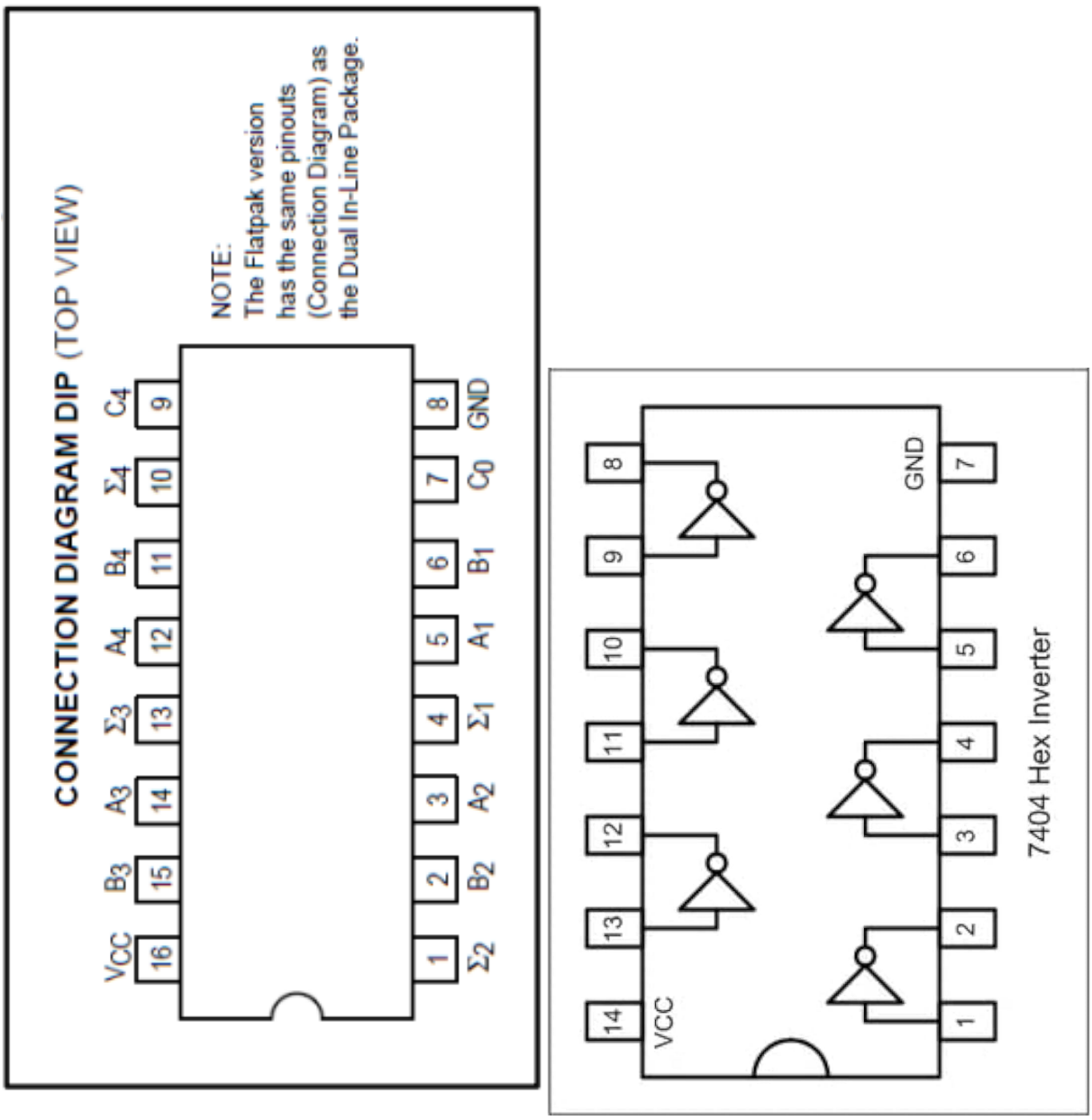
- **220 Ohm Resistor**
  Name: Carbon Resistor 220.0 ohm 1/4W – 5x Resistors
  Link: https://ram-e-shop.com/product/fixed-resistances-44/
  Quantity: 1-2 packs

- **Switches 1K Ohm Resistor**
  Name: Carbon Resistor 1.0K ohm 1/4W – 5x Resistors
  Link: https://ram-e-shop.com/product/fixed-resistances-63/
  Quantity: 1-2 packs

- **LED Light**
  Name: LED 5 mm Blue Color
  Link: https://ram-e-shop.com/product/led-wb/
  Quantity: 3

- **LED Light Resistors**
  Name: Carbon Resistor 220.0 ohm 1/4W – 5x Resistors'
  Link: https://ram-e-shop.com/product/fixed-resistances-44/
  Quantity: 1 pack

- **Not Gates**
  Name: 7404 IC NOT Gate
  Link: https://www.amazon.eg/-/en/Generic-7404-IC-NOT-Gate/dp/B0BXFK9S46
  Quantity: 1



(a) four-bit adder diagram

(b) Not Gate Diagram

Figure 2: Top-View Schematics of both needed ICs