

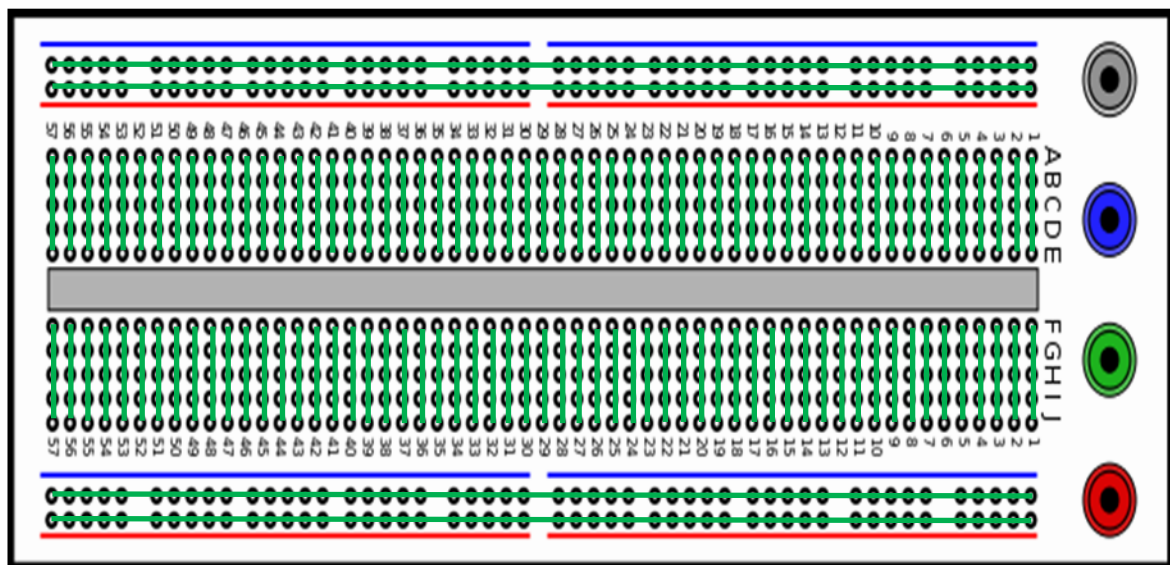
Name: _____ SID: _____ Grade: _____

Lab 1

Breadboard Prototyping

In this lab, you will be designing logic circuits using breadboards with TTL ICs. This lab worksheet will be submitted for grading. Your design will be inspected by the instructor in the lab.

1. Study the ELENCO Digital/Analog Trainer, Model XK-550/700. We will build a real digital circuit on this platform. Pay more attention on the power supply, the LEDs, the switches, and the breadboard.
2. A digital circuit can be built by plugging in ICs and wires on the breadboard. The breadboard is full of sockets. The breadboard on the trainer contains more than 1500 sockets. It is important to know how those sockets are connected. By and large, a red line with “+” sign indicates this line of sockets are connected to be used for VCC, and a blue line with “-” sign indicates this line of sockets are connected to be used for Ground. The letters, “a”, “b”, “c”, etc., show these sockets are connected up to a groove. The following figure shows a typical wiring on a breadboard. The added green lines show how sockets are connected in this breadboard. It would be good, if a multitester is used to verify the socket connections before working on your project.



3. There are 8 switches (sw1 to sw8), each of which is with a 4-pin socket below it. When the switch is on (slide up), the corresponding 4-pin socket will provide 5 volts output, i.e., logic high. When off (slide down), the corresponding 4-pin socket will provide 0 volt output, i.e., logic low.
4. There are 8 red LEDs (A, B, C, ..., H). There are two 4-pin sockets that connect to the LEDs. If a logic high is connected to one of the LEDs, it lights up. Otherwise, it is off.
5. The power supply provides volts of +5, -12, and +12, each of which is with a 4-pin socket. Since TTL requires 5V, all we need is +5V and GND sockets.
6. Steps to build a circuit
 - a. Sketch your circuit with pin numbers of ICs
 - b. Turn off power of the trainer (if you work while power is on, the trainer may break ICs and parts!)
 - c. Insert the IC used in the circuit (the notch indicates pin 1, and pins are arranged in counter clockwise). Use a chip puller whenever necessary. Otherwise, you may bend and break the IC pins.
 - d. Connect components using wires and take advantage of their colors. For example, red is for VCC, green is for ground, etc.
 - e. Connect the power: +5V to pin 14, and GND to pin 7 (for 14-pin TTLs).
 - f. Double check the wiring.
 - g. Turn on the power and test your circuit. Note that some of the ICs may be broken.
7. In order to use the ICs, you have to look up their pin configuration diagrams. The diagrams normally can be found in datasheets. You can Google search it. The following lists pin configuration of 7400.

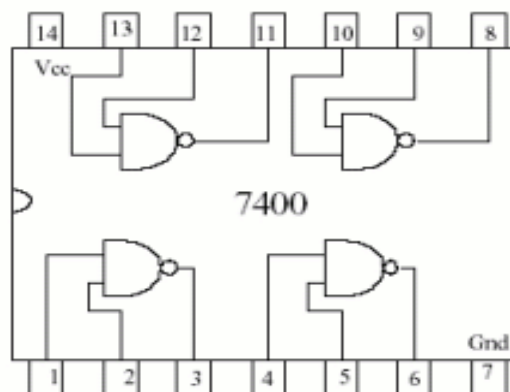


Figure 1 7400 Pin Configuration

8. The first circuit we will build is a simple two-input NAND gate. The inputs will be controlled by switches and the output will light up an LED. Since there are 4 NAND gates in 7400, we will pick any of them, say the upper left one with pins 11, 12, and 13. The input pins (12 and 13) will be connected to switches (sw1 and sw2). The output pin 11 will be connected to LED A. Don't forget. We also need to connect the VCC (pin 14) and GND (pin 7). Before you turn on the power, fill in the following truth for the NAND gate.

sw1	sw2	LED	Instructor check
OFF	OFF		
OFF	ON		
ON	OFF		
ON	ON		

Turn on the power and check the LED according to the switch settings. When you are done, ask the instructor to check.

9. Redo the circuit but with 7402 instead, and fill in the following truth table. Note you may need to rewire for this.

sw1	sw2	LED	Instructor check
OFF	OFF		
OFF	ON		
ON	OFF		
ON	ON		

Turn on the power and check the LED according to the switch settings. When you are done, ask the instructor to check.

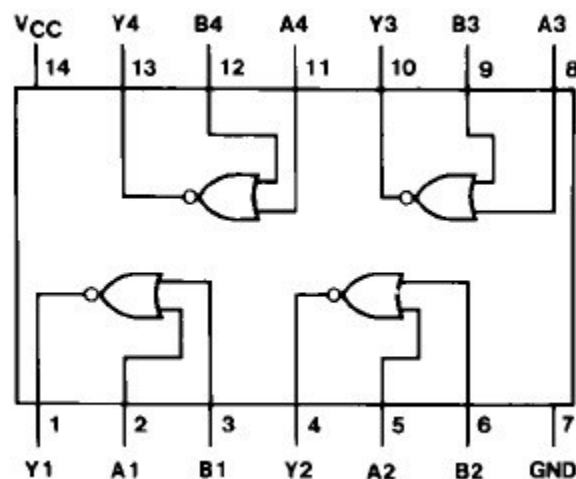


Figure 2 7402 Pin Configuration

10. Redo the circuit but with 7408 instead, and fill in the following truth table. Note you may need to rewire for this.

sw1	sw2	LED	Instructor check
OFF	OFF		
OFF	ON		
ON	OFF		
ON	ON		

Turn on the power and check the LED according to the switch settings. When you are done, ask the instructor to check.

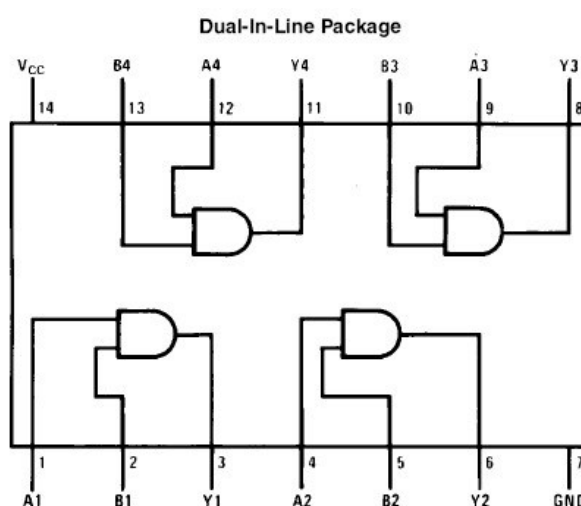


Figure 3 7408 Pin Configuration

11. Redo the circuit but with 7432 instead, and fill in the following truth table.

sw1	sw2	LED	Instructor check
OFF	OFF		
OFF	ON		
ON	OFF		
ON	ON		

Turn on the power and check the LED according to the switch settings. When you are done, ask the instructor to check.

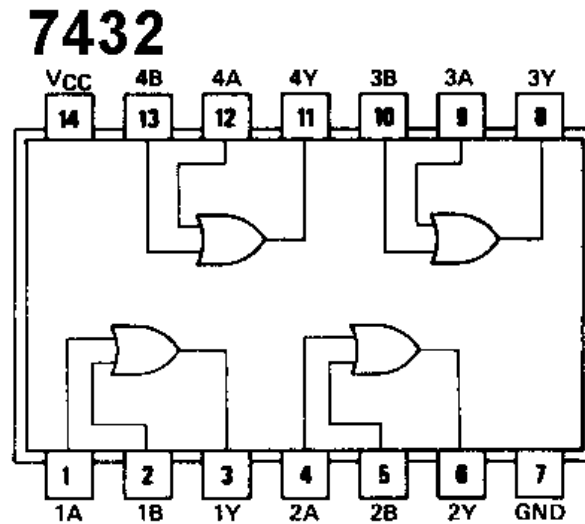


Figure 4 7432 Pin Configuration

12. Redo the circuit but with 7486 instead, and fill in the following truth table.

sw1	sw2	LED	Instructor check
OFF	OFF		
OFF	ON		
ON	OFF		
ON	ON		

Turn on the power and check the LED according to the switch settings. When you are done, ask the instructor to check.

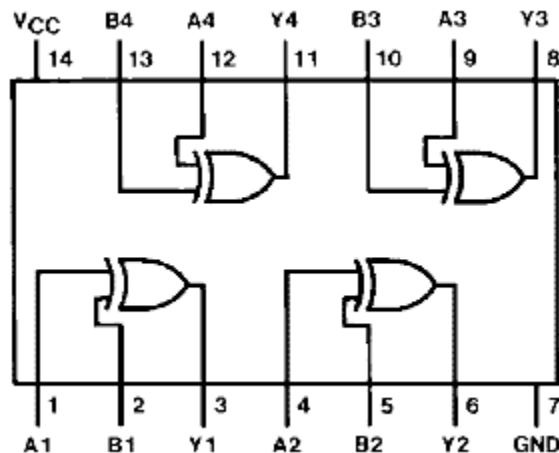


Figure 5 7486 Pin Assignment

13. Redo the circuit but with 74138 instead, and fill in the following truth table. Note that the LEDs from A to H have to be connected to the corresponding Yi's. Also, the chip enables

G2A and G2B have to be connected to the ground, and the G1 have to be connected to VCC for the IC to work properly.

sw1 (A)	sw2 (B)	Sw3 (C)	A (Y0)	B (Y1)	C (Y2)	D (Y3)	E (Y4)	F (Y5)	G (Y6)	H (Y7)	Instructor check
OFF	OFF	OFF									
OFF	OFF	ON									
OFF	ON	OFF									
OFF	ON	ON									
ON	OFF	OFF									
ON	OFF	ON									
ON	ON	OFF									
ON	ON	ON									

Turn on the power and check the LED according to the switch settings. When you are done, ask the instructor to check.

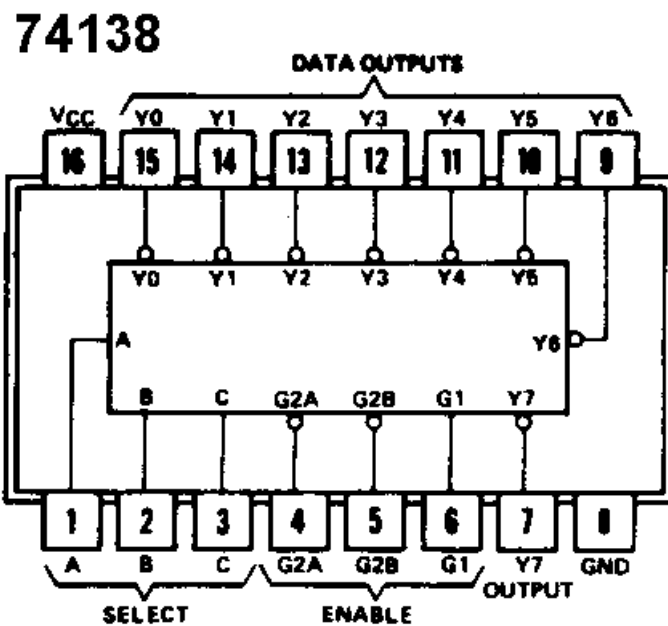


Figure 6 74138 Pin Assignment