4. Pre-Lab
Basic logic circuits are packaged into “integrated circuits”, usually multiple “gates” per package (depending on the number of input and output pins).

4.1 7400 Series
For this lab, a couple of devices from the 74XX device family will be used. Go to wikipedia.org and look up “7400 series”. Review the article and answer the following questions:

i. What is the difference between the 7400 series and the 5400 series?
The main difference is that the 5400 series was designed for military use, while 7400 was designed for commercial use

ii. Integrated circuits of the “HC” device family are popular nowadays. What does “HC” stand for??
High speed CMOS

iii. What is the maximum propagation delay (“TP (max)”) for the “HC” device family?
15 nanaoseconds

4.2 Dual In-Line Package
For this lab, we will be using 74XX devices configured in a “dual in-line package” (DIP). Go to wikipedia.org and look up “dual in-line package”. Review the article and answer the following questions:

i. When was the dual-inline format invented and by whom?
Invented in 1964 by Don Forbes.

ii. Which is PIN #1? How are the rest of the pins numbered?
Pin 1 is the top left pin, the rest of the pins are numbered counter clockwise

4.3 Datasheets
A datasheet is a document that summarizes the performance and other technical characteristics of a device. Go to wikipedia.org and look up “list of 7400 series integrated circuits”. From the list, answer the following questions:

i. What is a 7474 IC?
Pasted from wikipedia: “

dual D positive edge triggered flip-flop, asynchronous preset and clear

“

ii. What is the number for a quad 2-input XOR gate?
74X2G86, which is number 7486

iii. Download and review the "datasheet" for the 7400 - quad 2-input NAND gate (you will need the “pinout” for the lab procedures below).

iv. Download and review the "datasheet" for the 7402 - quad 2-input NOR gate (you will need the “pinout” for the lab procedures below).

4.4 Number Conversion

i. Show a complete process of converting a binary number (1011.101)2 to decimal.

Integer part

1011 = 1 * 2 ** 3 + 0 * 2 ** 2 + 1 * 2 ** 1 + 1 * 2 ** 0
= 8 + 0 + 2 + 1
= 11

Fraction part

101 = 1 * 2 ** (-1) + 0 * 2 ** (-2) + 1 * 2 ** (-3)
= 0.5 + 0 + 0.125
= 0.625

Together

1011.101 = 11 + 0.625 = 11.625

ii. Show a complete process of converting gray code (1011101) to normal binary

Let b = 1011101

Let x be the converted binary number

i (bit index)			
0	b[i] = 1	b[i - 1] = null	x[i] = 1
1	b[i] = 0	b[i - 1] = 1	x[i] = 1
2	b[i] = 1	b[i - 1] = 1	x[i] = 0
3	b[i] = 1	b[i - 1] = 0	x[i] = 1
4	b[i] = 1	b[i - 1] = 1	x[i] = 0
5	b[i] = 0	b[i - 1] = 0	x[i] = 0
6	b[i] = 1	b[i - 1] = 0	x[i] = 1

bianry number is x = 1101001