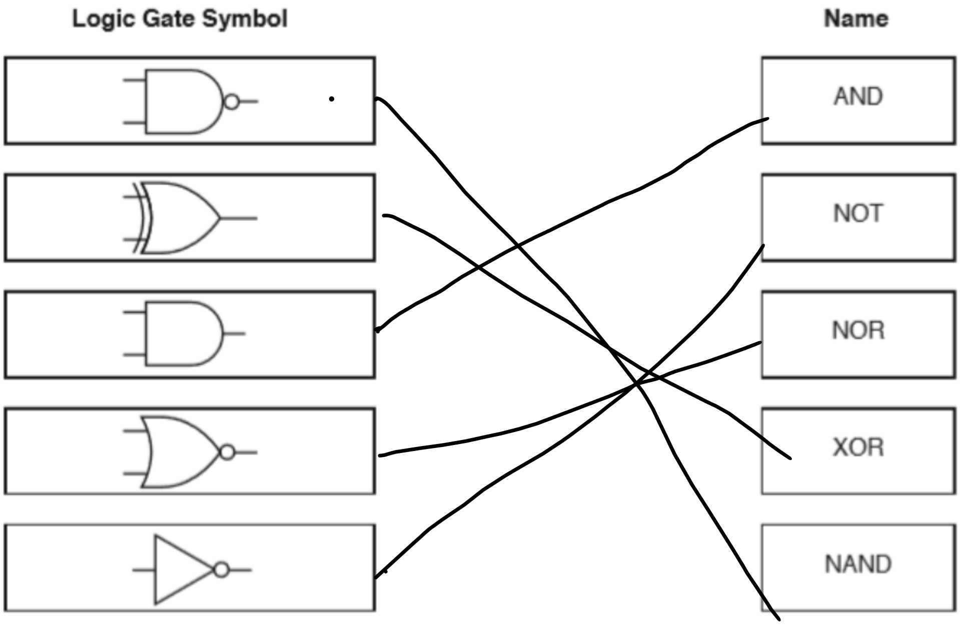
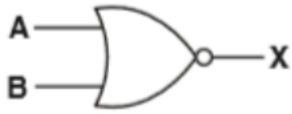
IN0013 week 2 exercise

Logic gates

1. The diagram below shows 5 logic gates and 5 names. Draw a line matching the logic gates with the respective names

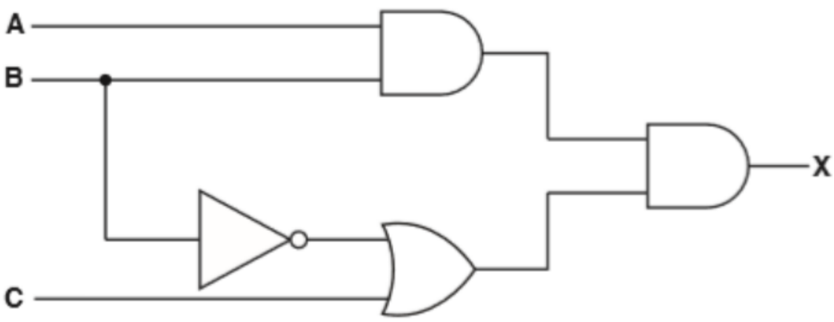


2. Complete the truth table for the NOR gate



A	B	X
0	1	0
1	0	0
1	1	0
0	0	1

3. Write a logic statement that corresponds to the following logic circuit



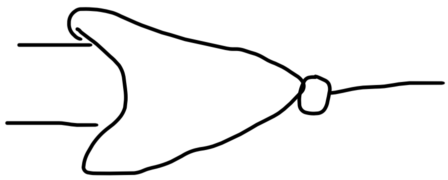
(A AND B) AND (NOT B OR C)

4. One way to think of the basic logic gate types (all but the XOR and XNOR gates) is to consider what single input state guarantees a certain output state. For example, we could describe the function of an OR gate as such:

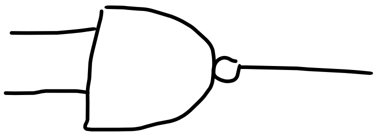
   Any high input guarantees a high output.

   Identify what type of gate is represented by each of the following phrases:

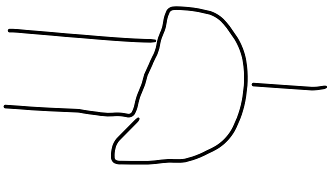
   - Any high input guarantees a low output: NOR



   - Any low input guarantees a high output: NAND



   - Any low input guarantees a low output: AND



5. Design a logic circuit to model the requirement for a gym membership. To become a member of this prestigious gym (X = 1), the 4 criteria requirements are listed below

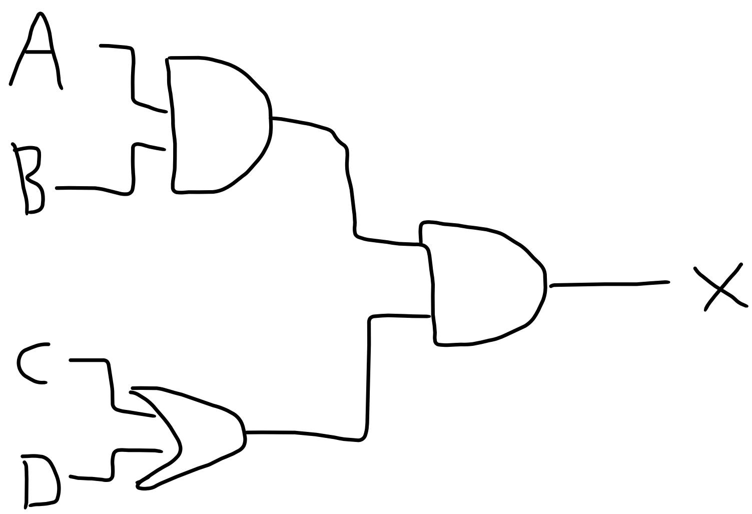
Parameter	Description of parameter	Binary value	Condition
A	Over 18	1	True
		0	False
B	Recommended	1	True
		0	False
C	Full-time	1	True
		0	False
D	Retired	1	True
		0	False

   Membership is approved (X = 1) if the person:

   - is over the age of 18 and has been recommended by a pre-existing member and
   - either is working full-time or is retired, but not both.

   Draw a logic circuit to represent the membership requirement and draw the truth table showing the logic results. X = (A and B) and (C xor D)

A	B	C	D	A AND B	C XOR D	(A AND B) AND (C XOR D)
0	0	0	0	0	0	0
0	0	0	1	0	1	0
0	0	1	0	0	1	0
0	0	1	1	0	0	0
0	1	0	0	0	0	0
0	1	0	1	0	1	0
0	1	1	0	0	1	0
0	1	1	1	0	0	0
1	0	0	0	0	0	0
1	0	0	1	0	1	0
1	0	1	0	0	1	0
1	0	1	1	0	0	0
1	1	0	0	1	0	0
1	1	0	1	1	1	1
1	1	1	0	1	1	1
1	1	1	1	1	0	0



Binary

1. Write the following decimal number as a binary number
   a. 4 = 100
   b. 11 = 1011
   c. 16 = 10000
   d. 19 = 1 0011
   e. 59 = 11 1011
2. Write the following binary number as a decimal number
   a. 11 = 3
   b. 110 = 6
   c. 1100 =2^3 + 2^2 + 0 + 0 = 8 + 4 = 12
   d. 1101 = 13
   e. 101111 = 47
3. Add these binary numbers
   a. 11 + 11 = 110
   b. 1100 + 0101

$$\begin{array}{r} 1100 \\ +\,0101 \\ \hline 10001 \end{array}$$

   c. 1000 +0011 = 1011
   d. 10101+01111

$$\begin{array}{r} 10101 \\ +\,01111 \\ \hline 100100 \end{array}$$

4. Two complements – use two complements to compute these binary operations
   a. 110 – 101 = 001

$$\begin{array}{r} 110 \\ +\,011 \\ \hline 1001 \end{array}$$

001

101
010

   b. 1001 – 0111 = 0010

1001
+1001
10010

c. 1000 – 0011 = 1000 + (1100) = 1000 + (1101) = 0101

d. 10101 – 01111 = 110   1000 0   1

10101
+10001
100110

5. ASCII numbers – transform these letters into ascii or the other way around
   a. computer = 99 111 109 112 117 116 101 114
   b. fundamental = 102 117 110 100 97 109 101 110 116 97 108
   c. 80 121 116 104 111 110 = Python