Consider the following problem.

A system used 3 switches A, B and C; a combination of switches determines whether an alarm, X, sounds:

If switch A or switch B are in the ON position and if switch C is in the OFF position then a signal to sound an alarm, X is produced.

It is possible to convert this problem into a logic statement.

So we get:

If (A = 1 OR B = 1) AND (C = NOT 1) then X = 1

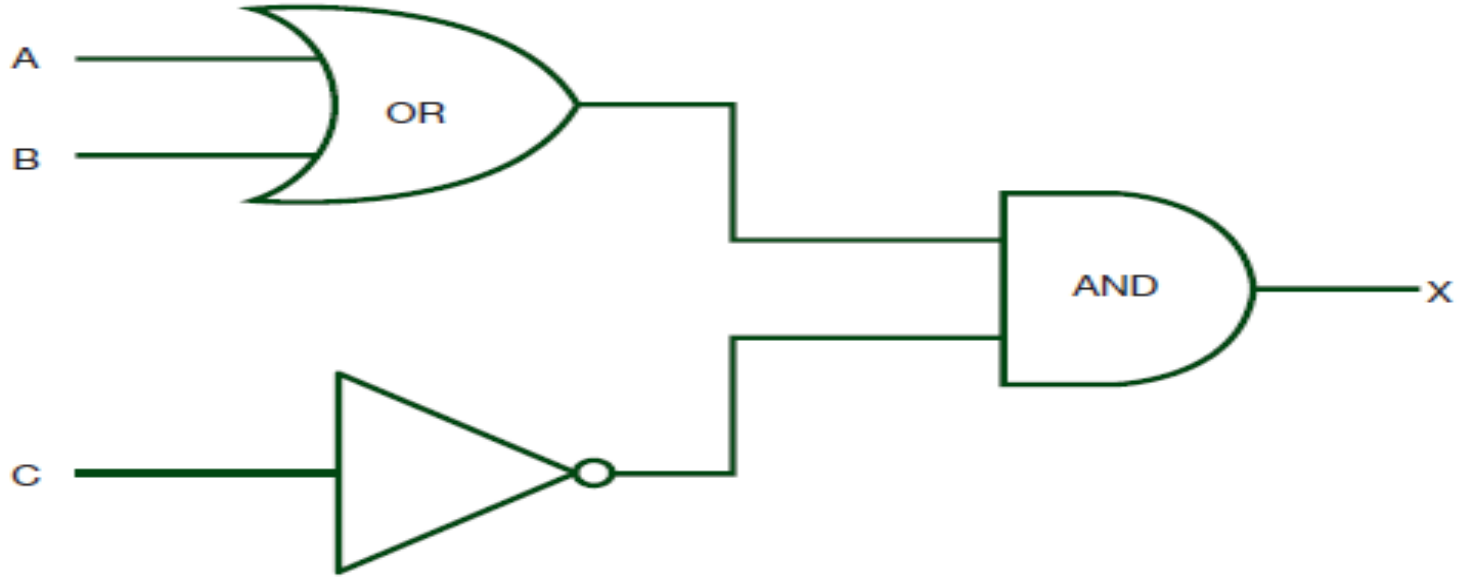
The first part is two inputs (A and B) joined by an OR gate

The output from the first part and the third part are joined by an AND gate

The third part is one input (C) which is put through a NOT gate

Remembering that ON = 1 and OFF = 0; also remember that we write 0 as NOT 1.

So we get the following logic circuit (network):



This gives the following truth table:

INPUT A	INPUT B	INPUT C	OUTPUT X
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

- A traffic light system uses logic gates as part of the control system. The system is operated when the output D has the value 1. This happens when:

either (a) signal A is red

or (b) signal A is green and signals B and C are both red

(NOTE: You may assume for this problem that red = 0 and green = 1).

Design a logic circuit (network) and draw the truth table for the above system.

- A chemical process gives out a warning signal (W = 1) when the process operates incorrectly. A logic circuit (network) is used to monitor the process and to determine whether W = 1.

Inputs	Binary values	Description of plant status
C	1	Chemical rate = 20 litres/second
	0	Chemical rate < 20 litres/second
T	1	Temperature = 91°C
	0	Temperature > 91°C
X	1	Concentration > 5M
	0	Concentration = 5M

A warning signal (W = 1) will be generated if:

either (a) Chemical rate < 20 litres/second

or (b) Temperature > 91ºC and Concentration > 5M

or (c) Chemical rate = 20 litres/second and Temperature > 91C

Draw a logic circuit (network) and truth table to show all the

possible situations when the warning signal could be received.

- A nuclear power station has a safety system based on three inputs to a logic circuit (network). A warning signal (S = 1) is produced when certain conditions in the nuclear power station occur based on these three inputs.

Inputs	Binary values	Description of plant status
T	1	Temperature > 115°C
	0	Temperature <= 115°C
P	1	Reactor pressure > 15 bar
	0	Reactor pressure <= 15 bar
W	1	Cooling water > 120 litres/hour
	0	Cooling water <= 120 litres/ hour

A warning signal (S = 1) will be produced when any of the following occurs:

either (a) Temperature > 115 C and Cooling water <= 120 liters/hour

or (b) Temperature <= 115 C and Reactor pressure > 15 bar or Cooling water <= 120 liters/hour

Draw a logic circuit (network) and truth table to show all the possible situations when the warning signal (S) could be received.