Department of Computer Science
Forman Christian College
(A Chartered University)
Lahore

Digital Logic Design
COMP 206

DIGITAL LOGIC DESIGN
COMP 206
LAB 04- RUBRIX

DESCRIPTION	MARKS ALLOCATED
Attendance	5%
Proper handling of components, ICs and wiring	20%
Hardware wired completely(for all circuits)	30%
Truth Table 1	10%
K-Map	10%
Circuit Diagram	5%
Implementation	10%
Self Task	10%

Marks will be deducted in case if students have not completely and correctly filled the data tables.
Note that these marks are max in each category. We may assign less than the given percentage of marks in case students have not successfully completed all the requirements.
This lab is time constrained. Please note that you must finish your work and submitted duly filled handout to the lab engineer within given time.

LAB 04 :
Design and Implementation of Combinational Circuits

Name:

Roll Number:

Date:

1. Objectives

Having completed this experiment you will be able to

- Understand the technical problems in a more logical way.
- Recognize and implement the logic gates in combinational digital circuit design.
- Understand the relationship between logic circuit, Boolean function and the Truth table.

2. Introduction:

a. Combinational Logic Circuit

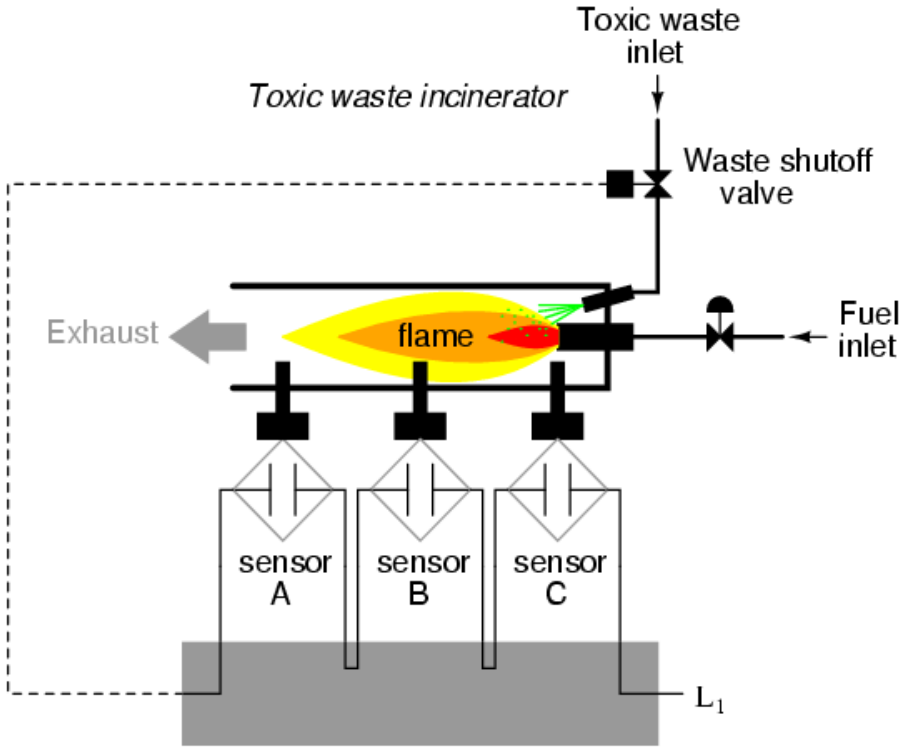
A combinational circuit consists of logic gates whose ***output at any time is determined directly from the present combination of inputs without regard to previous inputs***. A combinational circuit performs a specific information-processing operation fully specified logically by a set of Boolean function.

Example:

To illustrate this procedural method, we should begin with a realistic design problem. Suppose we were given the task of designing a flame detection circuit for a toxic waste incinerator. The intense heat of the fire is intended to neutralize the toxicity of the waste introduced into the incinerator. Such combustion-based techniques are commonly used to neutralize medical waste, which may be infected with deadly viruses or bacteria. So long as a flame is maintained in the incinerator, it is safe to inject waste into it to be neutralized. If the flame were to be extinguished, however, it would be unsafe to continue to inject waste into the combustion chamber, as it would exit the exhaust un-neutralized, and pose a health threat to anyone in close proximity to the exhaust. What we need in this system is a sure way of detecting the presence of a flame, and permitting waste to be injected only if a flame is "proven" by the flame detection system.

Several different flame-detection technologies exist: optical (detection of light), thermal (detection of high temperature), and electrical conduction (detection of ionized particles in the flame path). To make the system robust and error free, it is decided that the flame detection system be made redundant (multiple sensors), so that failure of a single sensor does not lead to

an emission of toxins out the exhaust. Each sensor gives a 1 if the flame is present and 0 otherwise.



Suppose that one of the three sensors were to fail in such a way that it indicated no flame when there really was a good flame in the incinerator's combustion chamber. That single failure would shut off the waste valve unnecessarily, resulting in lost production time and wasted fuel (feeding a fire that wasn't being used to incinerate waste).

It would be nice to have a logic system that allowed for this kind of failure without shutting the system down unnecessarily. Therefore one of the solutions is to use three sensors, such that the waste valve is opened if at least two out of the three sensors show good flame.

3. Experimental Work:

Components required:

- 7432, 7408, 7404
- Connecting Wires
- Logic Trainer

In this experiment, you are required to design a minimal circuit for the above mentioned purpose.

a. Fill out the truth table for the said system

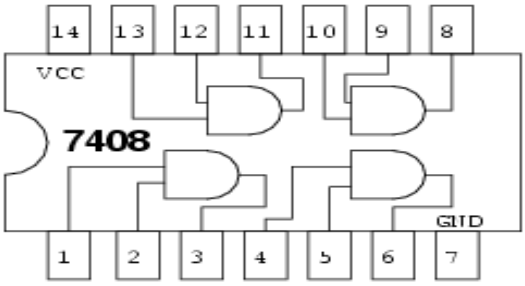
Input A	Input B	Input C	Output F
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

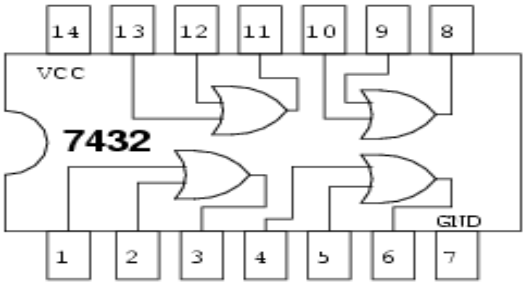
b. Draw the K-Map

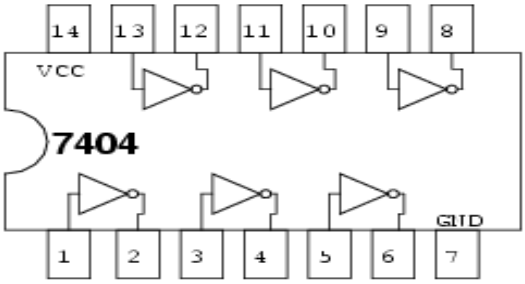
c. Obtain the Minimal Sum of Products & Product of Sums expression

d. Draw the circuit diagram for SOP & implement the circuit on the breadboard

Pin Configurations







In case of Trouble.

- Check the power supply.
- Check the Vcc and GND at pin number 14 and 7 of the IC under test.
- Check all the wire connections and remove the breaks.
- Check the IC under test using truth table.

Self-Task:

- Another Combinational circuit has four input and one output the output is equal to 1 when
  a) **All the input is are equal to "1".**
  b) **None of the inputs are equal to one.**
  c) **The odd number of inputs equal to one**
- Obtain the truth table.
- Find the simplified output function in SOP.
- Draw the logic diagram.

Note: Online Students must submit simulation on Logisim.