

# DIGITAL CIRCUITS

## LAB-4 REPORT

### K-map implementation

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**Aim:** To use K-Map logic to build a logic-gate system that can act as an Industrial Alarm

**Summary of the experiment:**

K-Map implementation to get the final boolean expression and implementing it using only NAND gates

**Components used:** IC 7400(NAND), 7408(AND), 7432(OR), 7404(NOT), 1Kohm resistor array, DIP switches, LED displays, breadboard, power supply.

**Design Procedure:**

Read the questions and make final Boolean expression by implementing K-Map logic.

Make the circuit diagram of the final Boolean output.

Make the connections on the breadboard.

Select inputs from the truth table.

Make the changes in the switch accordingly so that LED glows according to the output of truth table.

Notations:

Water Sensor: W

Temperature Sensor: T

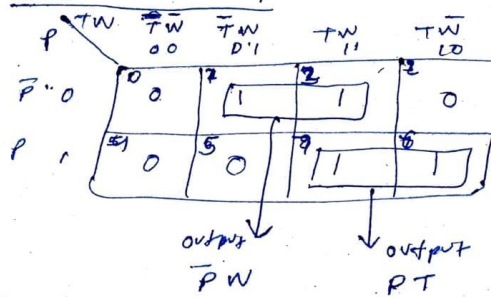
Pressure Sensor: P

| P | T | W |
|---|---|---|
| 0 | 0 | 1 |
| X | 1 | 1 |
| 1 | 1 | X |

So final inputs given table

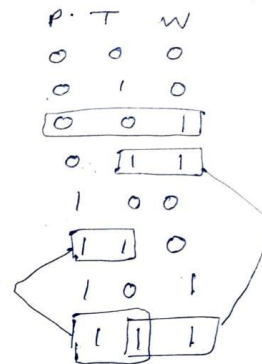
| No. In K-map | P | T | W | output of Alarm |
|--------------|---|---|---|-----------------|
| 1            | 0 | 0 | 1 | 1               |
| 3            | 0 | 1 | 1 | 1               |
| 6            | 1 | 1 | 1 | 1               |
| 7            | 1 | 1 | 0 | 1               |

3 P/P K-map



total output (SOP) =  $\bar{P}W + PT$

3 P/P truth table



two possible are for P & W, one is common.

**Truth Table:**

NOT

| A | X |
|---|---|
| 0 | 1 |
| 1 | 0 |

AND

| A | B | X |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |

### NAND

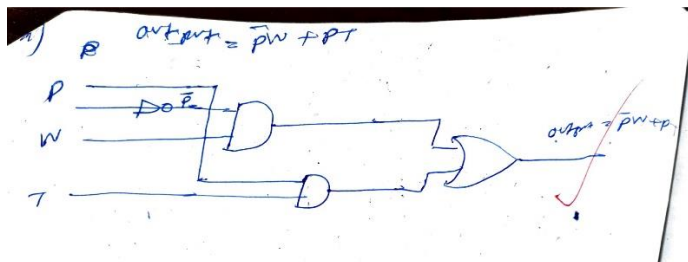
| A | B | X |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |

### OR

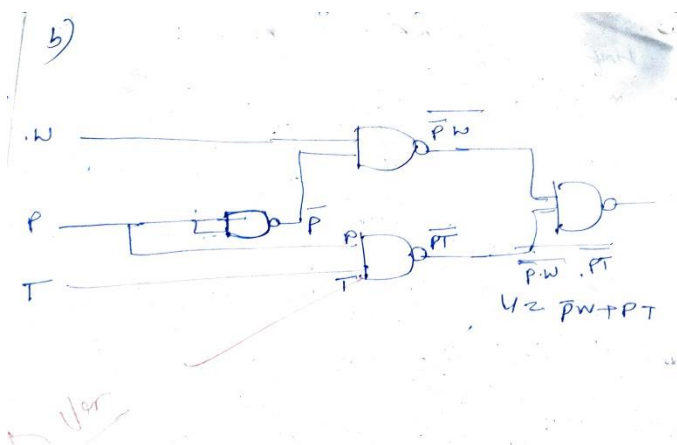
| A | B | X |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 1 |

### Circuit diagram:

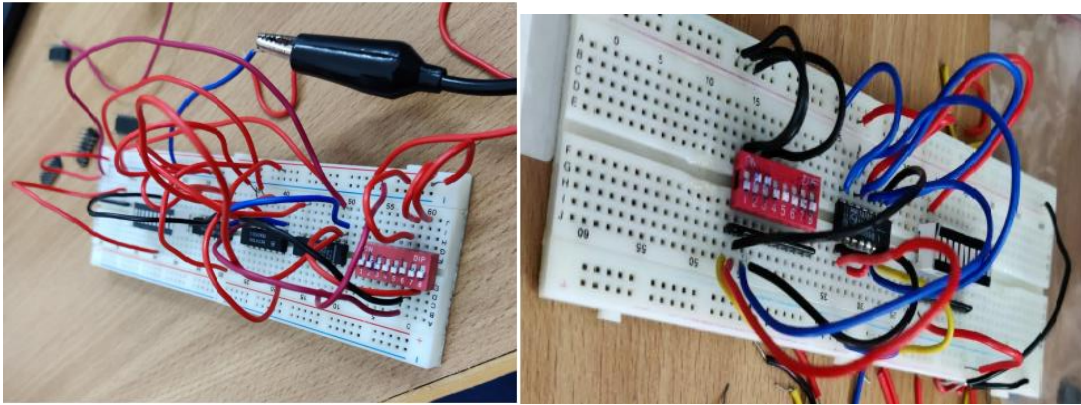
Circuit diagram of 1 question:



Circuit diagram of 2 question:



## Circuit and Simulation (for CPLD experiments) Snapshots :



### Results and Discussions:

We finally understood how we can use K-Map to directly get the simplest boolean expression and build a logic-gate system that act as an Industrial Alarm which uses three different sensor(pressure,temperature,water) we gave sensor input through switch, And alarm output through LED display, And Designed a digital circuit once with basic gates( AND, OR, NOT)and secondly with only 2 input NAND gate that controls the buzzer action for the given conditions.

### Conclusion:

I was able to verify the K-map boolean logic theoretically with its practical implementation by making industrial alram, once using simple logic gates(AND, OR, NOT) and once using only NAND gates.

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