

GATE 2009, ECE Question Number 38

Abstract

Simulation of latch behavior using Raspberry Pi Pico to demonstrate NAND and NOR latch transitions for the input combinations $(0,1) \rightarrow (1,1)$.

1. Components

Component	Qty
Pico2w	1
Push Buttons	2
LEDs	2
220Ω Resistors	4
Breadboard	1
Jumper Wires	10
Laptop with Thonny IDE	1

Table: Components used

2. Setup

- GP15: Input P1 (Push Button)
- GP14: Input P2 (Push Button)
- GP16: NAND Q Output (LED)
- GP17: NOR Q Output (LED)
- GND and VBUS properly connected

3. Observation

- **NAND Latch:** $(0,1) \rightarrow (1,0) \rightarrow$ holds at $(1,0)$
- **NOR Latch:** $(0,1) \rightarrow (1,0) \rightarrow$ transitions to $(0,0)$

4. Truth Tables

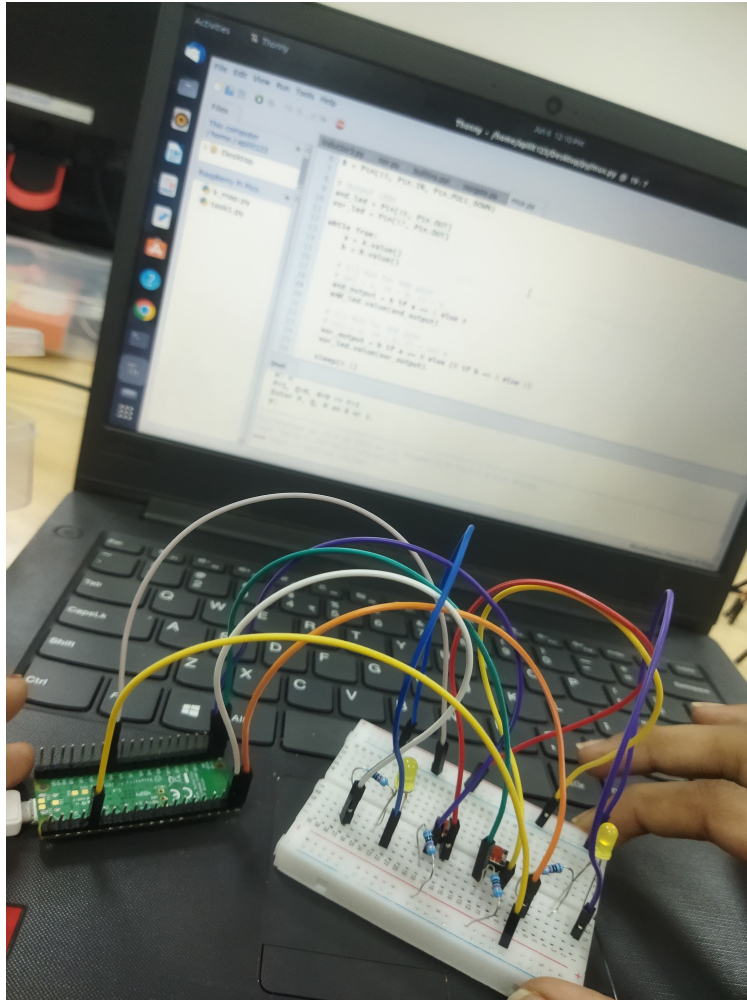
NAND Latch

P1	P2	Output (Q1, Q2)
0	1	$(1, 0)$
1	1	$(1, 0)$ (holds)

NOR Latch

P1	P2	Output (Q1, Q2)
0	1	$(1, 0)$
1	1	$(0, 0)$

5. Circuit Image



6. Hardware Code – MicroPython

```
from machine import Pin
import utime

P1 = Pin(15, Pin.IN, Pin.PULL_DOWN)
P2 = Pin(14, Pin.IN, Pin.PULL_DOWN)

nand_q = Pin(16, Pin.OUT)
nor_q = Pin(17, Pin.OUT)

nand_q_state = 1
nor_q_state = 1

while True:
    p1 = P1.value()
    p2 = P2.value()

    if p1 == 0 and p2 == 1:
        nand_q_state = 1
```

```
elif p1 == 1 and p2 == 1:
    nand_q_state = nand_q_state

if p1 == 0 and p2 == 1:
    nor_q_state = 1
elif p1 == 1 and p2 == 1:
    nor_q_state = 0

nand_q.value(nand_q_state)
nor_q.value(nor_q_state)

print("P1_", p1, "P2_", p2,
      "NAND_Q_", nand_q_state,
      "NOR_Q_", nor_q_state)

utime.sleep(0.2)
```

7. GitHub Code Link

https://github.com/amuru052004/Likhitha_fwc/tree/main/Hardware/assembly

8. Conclusion

This project successfully demonstrates latch behavior for NAND and NOR gates using MicroPython and Raspberry Pi Pico.