

Batch: A2 Roll No.: 16010421052 Experiment No.: 4

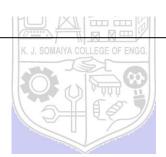
Aim: Design a 4 bit binary to BCD convertor using the Circuitverse simulator.

Resources needed: Circuitverse online simulator

Theory:

- Although the CPU uses binary arithmetic for computation, the result has to be converted into decimal for display purpose. The token counter displays, railway platform displays, even calculator displays are all decimal displays. Conversion from binary to decimal is a non-trivial process. To reduce the processing overhead, BCD format offers a nice alternative.
- In BCD (Binary Coded Decimal) format the decimal digits are stored as separate binary numbers. When these numbers are incremented, decremented or reset, only part of the remaining number needs to be changed. Also, the conversion from binary to decimal and unpacking of the digits is avoided.
- Because the BCD numbers are essentially decimal numbers, only 0-9 digits are used.
 Therefore when we do binary to BCD mapping, we either wrap around the numbers from 10 to 15 or we treat them as don't cares.

Binary Code	Decimal	BCD Code						
ABCD	Number	B_5	B_4	B	B ₂	B ₁		
0000	0	0	0	0	0	0		
0001	1	0	0	0	0	1		
0010	2	0	0	0	1	0		
0011	3	0	0	0	1	1		
0100	4	0	0	1	0	0		
0101	5	0	0	1	0	1		
0110	6	0	0	1	1	0		
0111	7	0	0	1	1	1		
1000	8	0	1	0	0	0		
1001	9	0	1	0	0	1		
1010	10	1	0	0	0	0		
1011	11	1	0	0	0	1		
1100	12	1	0	0	1	0		
1101	13	1	0	0	1	1		
1110	14	1	0	1	0	0		
1111	15	1	0	1	0	1		



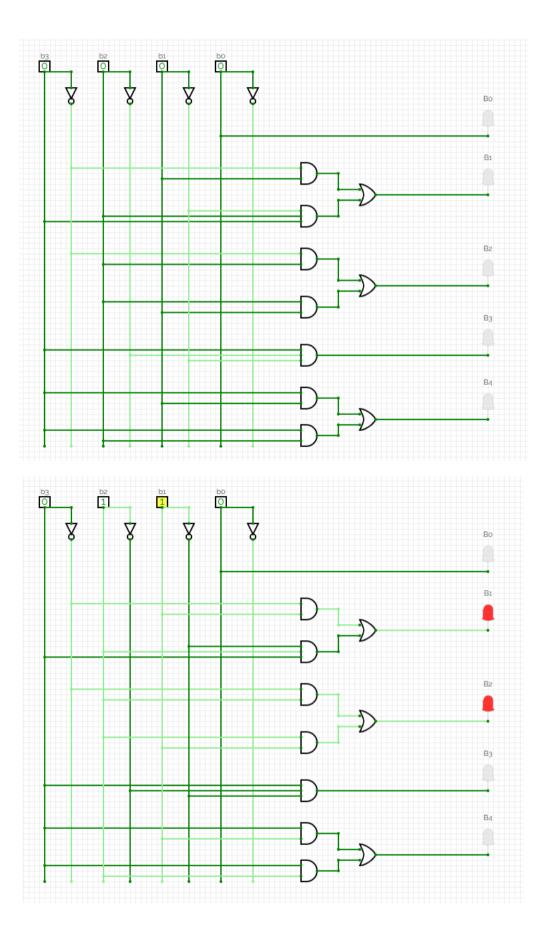
Procedure:

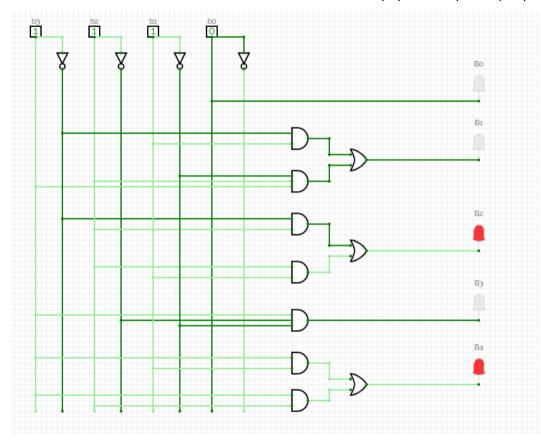
- a) Design logic circuit for the binary to BCD convertor using the following steps:
 - i. Draw the truth table for the 4 bit convertor (already given above)
 - ii. Draw the K map for each of the (four) outputs
 - iii. Calculate the logic equation for each output
 - iv. Draw the circuit on paper
 - v. Verify the circuit using the Circuitverse simulator. (Lab instructor will guide you on how to create an account use the simulator).
- b) Upload the write-up with the solved design problems given in write-up.

Observations and Results: Simulate as per instructions in Lab session. Take snapshots of the results and paste them in the write-ups.

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Outcomes:

CO1: Solve problems on various number systems, Boolean algebra and graphical techniques.

CO2: Understand the basic building blocks, techniques used in digital logic design.

CO3: Design the combinational and sequential circuits using building blocks.

Conclusion: We constructed a binary to BCD convertor using basic logic gates – AND, OR and NOT. We also deduced the required equations using K-Map method.

Grade: AA / AB / BB / BC / CC / CD /DD

Signature of faculty in-charge with date

References:

Books/ Journals/ Websites:

1. R. P. Jain, "Modern Digital Electronics", Tata McGraw Hill.