EXPERIMENT NUMBER: 4

EXPERIMENT NAME: Design of a 4-Bit Binary to Gray Code Converter.

AIM: To design a 4-Bit Binary to Gray Code converter using logic gates and to verify its truth table.

APPARATUS REQUIRED:

Sl. No.	COMPONENT	SPECIFICATION	QUANTITY
1.	X-OR GATE	IC 7486	1
2.	IC TRAINER KIT	-	1
3.	CONNECTING WIRES	-	AS REQUIRED

THEORY:

The availability of large variety of codes for the same discrete elements of information results in the use of different codes by different systems. A conversion circuit must be inserted between the two systems if each uses different codes for same information. Thus, code converter is a circuit that makes the two systems compatible even though each uses different binary code.

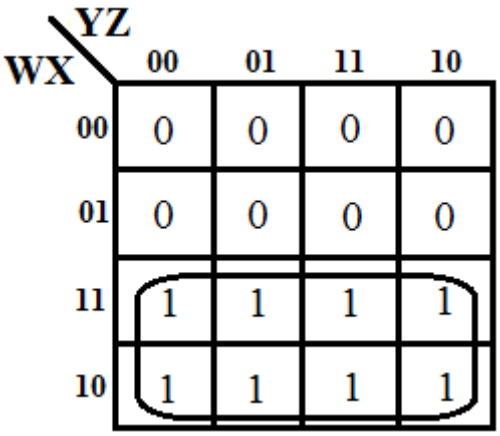
Gray code is a non-weighted code. Total number of bits in binary and its corresponding gray code is equal. In the circuit to be designed, each code uses four bits to represent a decimal digit. Thus, there are four inputs and four outputs.

The input variable are designated as W, X, Y& Z and the output variables are designated as A, B, C & D. from the truth table, combinational circuit is designed. The Boolean functions are obtained from K-Map for each output variable.

TRUTH TABLE:

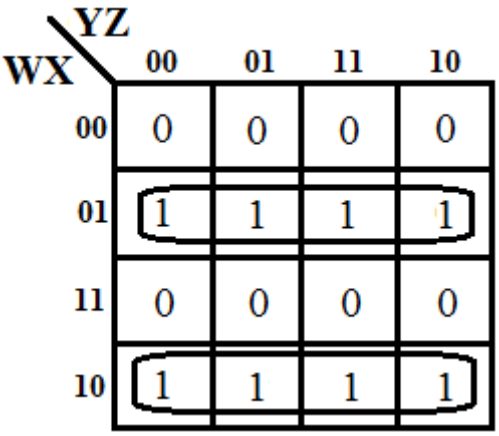
BINARY INPUT				GRAY OUTPUT			
W	X	Y	Z	A	B	C	D
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1
0	0	1	0	0	0	1	1
0	0	1	1	0	0	1	0
0	1	0	0	0	1	1	0
0	1	0	1	0	1	1	1
0	1	1	0	0	1	0	1
0	1	1	1	0	1	0	0
1	0	0	0	1	1	0	0
1	0	0	1	1	1	0	1
1	0	1	0	1	1	1	1
1	0	1	1	1	1	1	0
1	1	0	0	1	0	1	0
1	1	0	1	1	0	1	1
1	1	1	0	1	0	0	1
1	1	1	1	1	0	0	0

K-Map for A:



A=W

K-Map for B:

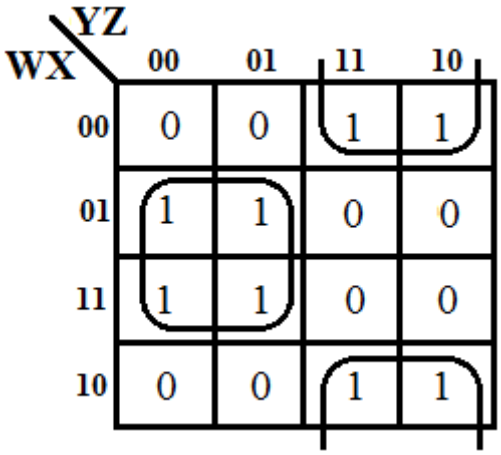


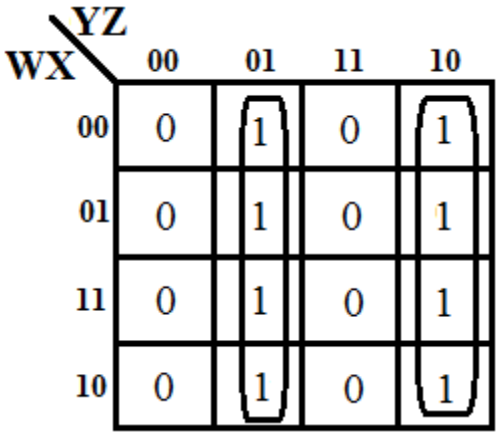
$B = \overline{W}\,X + W\,\overline{X}$

$B = W \oplus X$

K-Map for C:

K-Map for D:





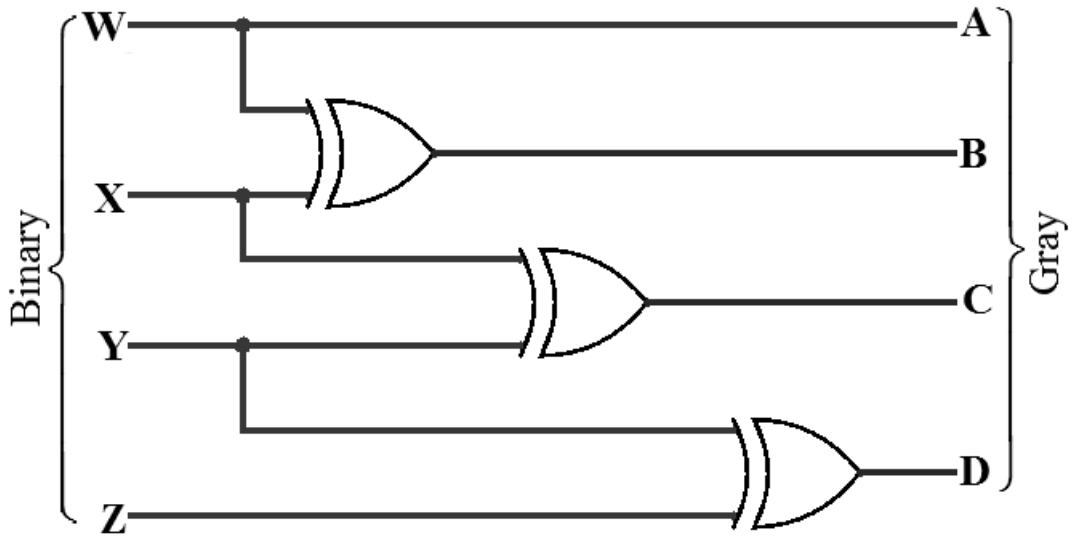
$C = \overline{X}\,Y + X\,\overline{Y}$

$C = X \oplus Y$

$D = \overline{Y}\,Z + Y\,\overline{Z}$

$D = Y \oplus Z$

CIRCUIT DIAGRAM OF A 4 BIT BINARY TO GRAY CODE CONVERTER:



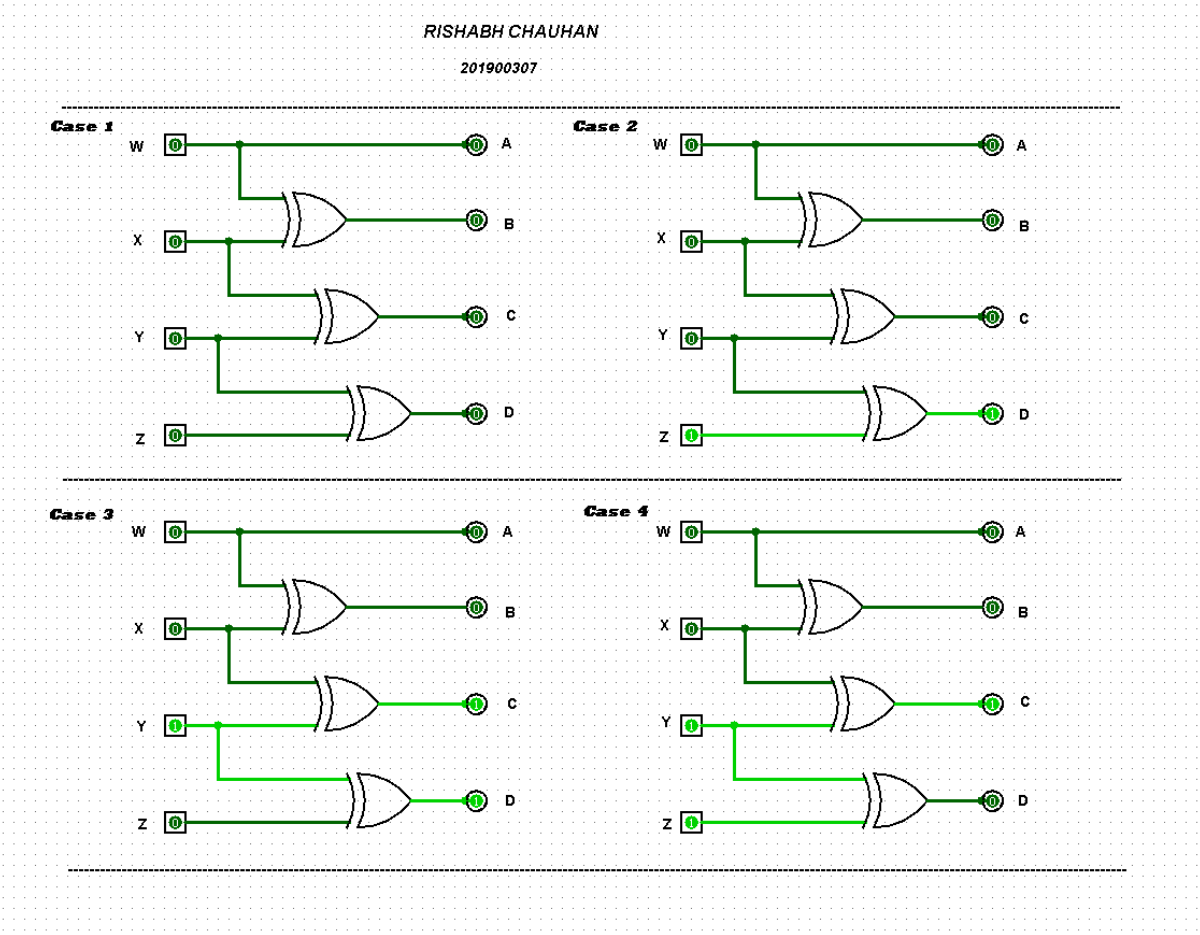
DESIGN PROCEDURE:

1. Truth table of the 4 bit binary to gray code converter is prepared.
2. K-maps for all the output variables (A, B, C and D) are drawn.
3. Simplified expressions for the output variables are obtained using manual simplification.
4. Circuit diagram is drawn as per the simplified expressions of the output variables obtained in step 3.

PRACTICAL PROCEDURE:

1. ICs are placed properly on the bread board of the IC trainer kit.
2. Connections are made as per the designed circuit diagram.
3. Power supply to the board is turned ON.
4. Circuit is verified as per the truth table of the circuit.

Student's worksheet-1



Student's observation and conclusion:

The logic circuit shown above converts the binary code to its gray code equivalent and is known as binary to gray code converter.

- **W=A**
- **B=W XOR X**
- **C=X XOR Y**
- **D=Y XOR Z**

Here, the binary range input varies from 0000-0011 & the output gray code range varies from 0000-0010.

In the truth table for binary to gray code converter two successive binary values differ by only one bit.

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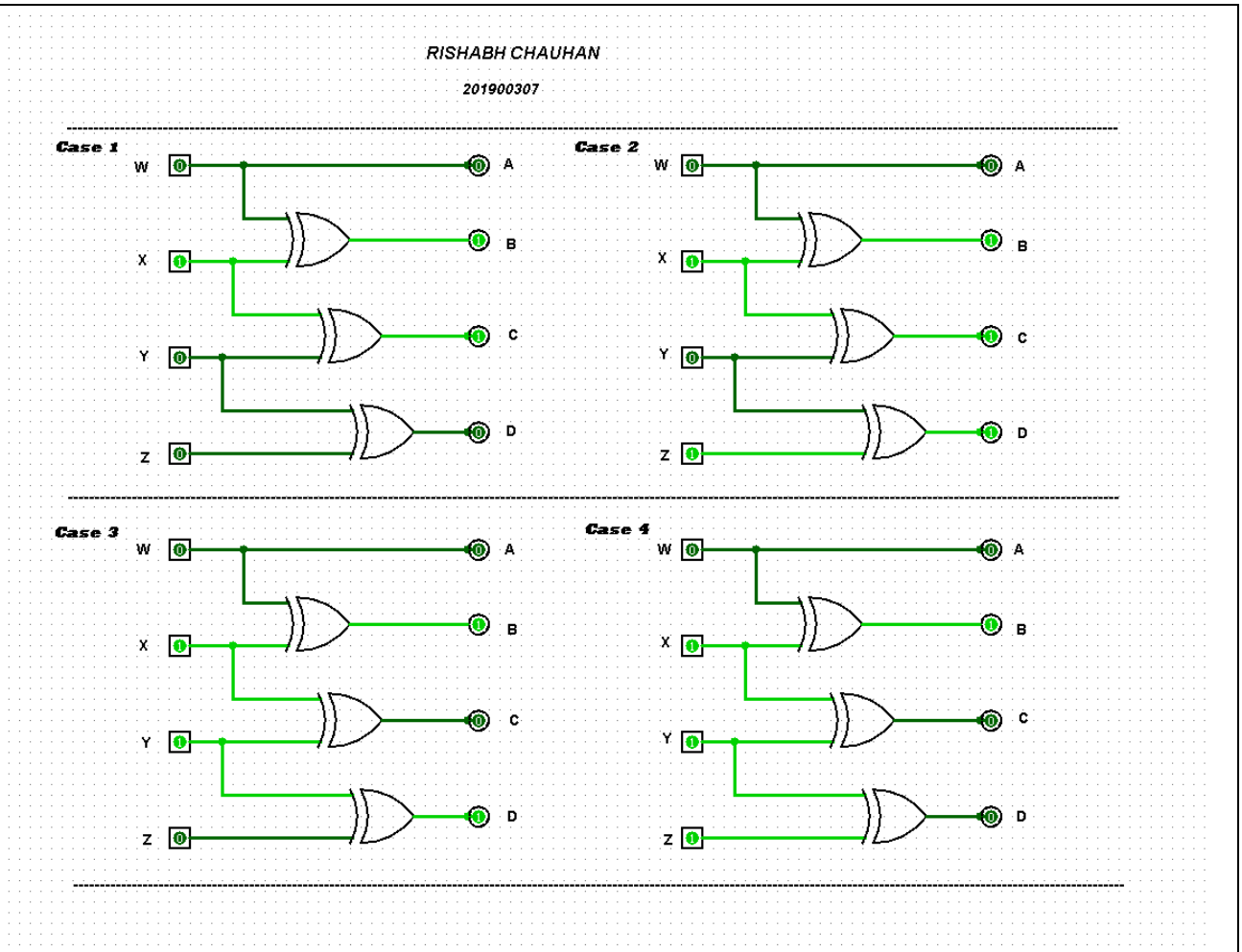
Date :01/09/2020

Student's worksheet-2



Student's observation and conclusion:

The logic circuit shown above converts the binary code to its gray code equivalent and is known as binary to gray code converter.

- **W=A**
- **B=W XOR X**
- **C=X XOR Y**
- **D=Y XOR Z**

Here, the binary range input varies from 0100-0111 & the output gray code range varies from 0110-0100. In the truth table for binary to gray code converter two successive binary values differ by only one bit.

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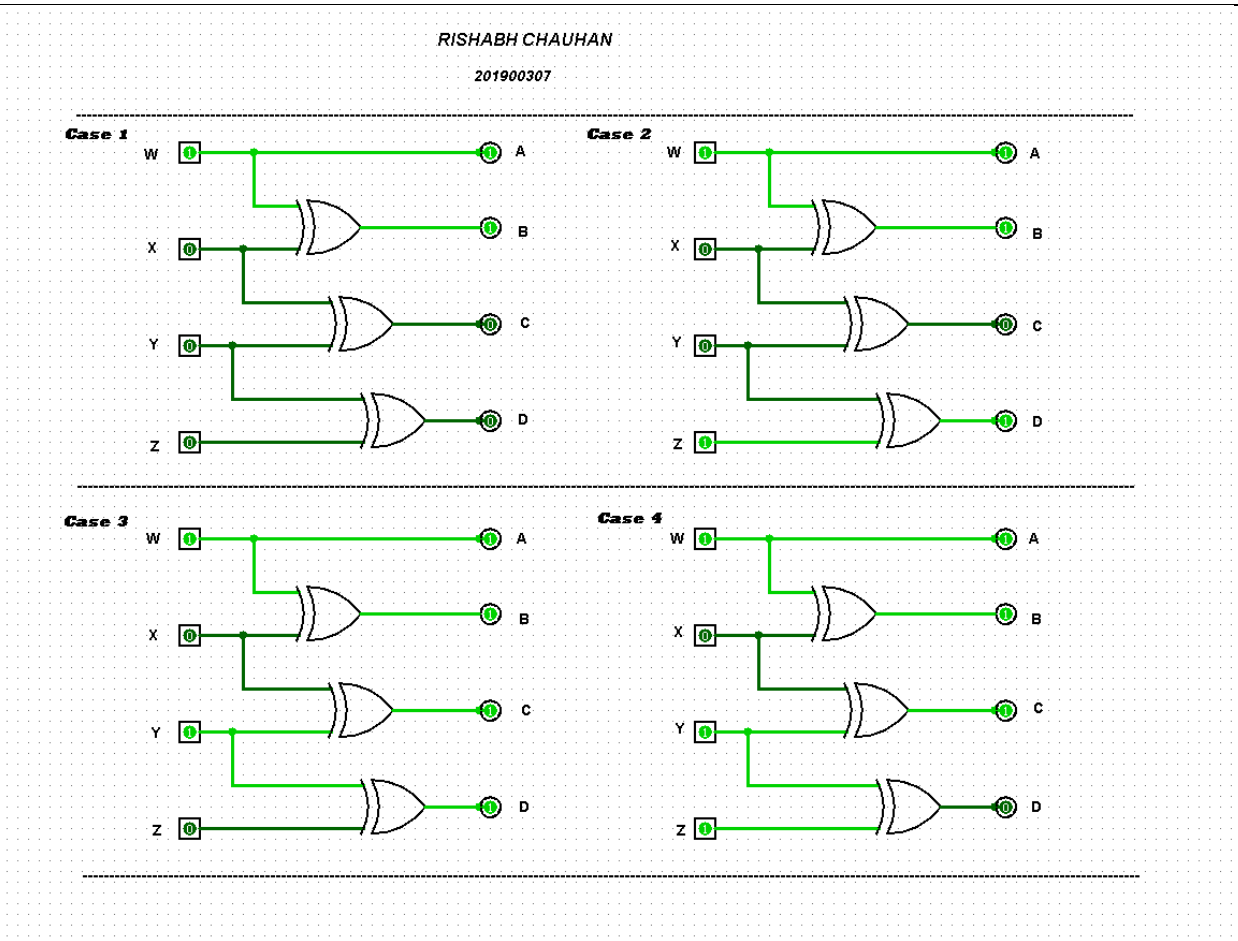
Student's worksheet-3



Student's observation and conclusion:

The logic circuit shown above converts the binary code to its gray code equivalent and is known as binary to gray code converter.

- **W=A**
- **B=W XOR X**
- **C=X XOR Y**
- **D=Y XOR Z**

Here, the binary range input varies from 1000-1011 & the output gray code range varies from 1100-1110. In the truth table for binary to gray code converter two successive binary values differ by only one bit.

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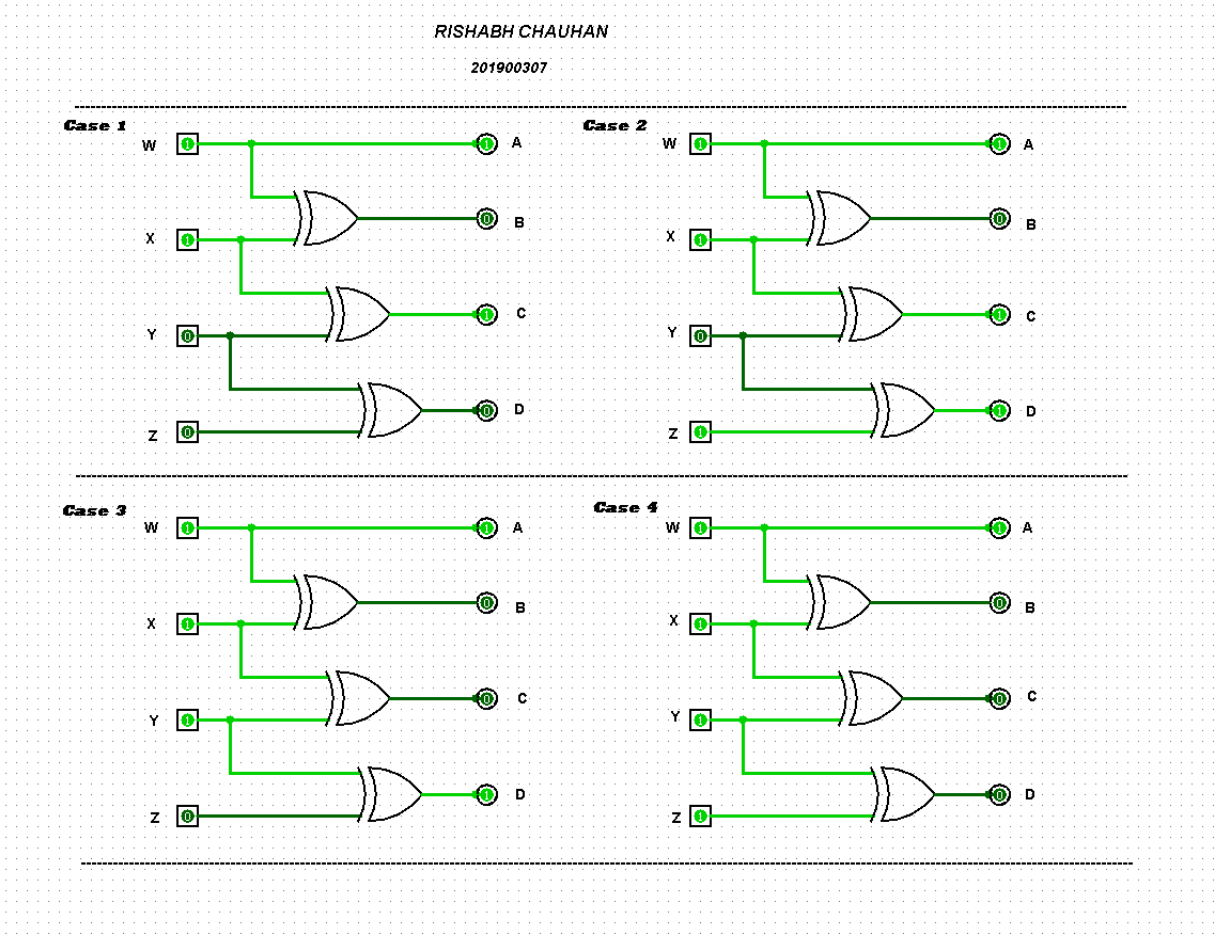
Student's worksheet-4



Student's observation and conclusion:

The logic circuit shown above converts the binary code to its gray code equivalent and is known as binary to gray code converter.

- **W=A**
- **B=W XOR X**
- **C=X XOR Y**
- **D=Y XOR Z**

Here, the binary range input varies from 1100-1111 & the output gray code range varies from 1010-1000. In the truth table for binary to gray code converter two successive binary values differ by only one bit.

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