EXPERIMENT NUMBER: 2

EXPERIMENT NAME: Design of a 1-bit Comparator

AIM: To design a 1-bit Comparator using logic gates and to verify it.

APPARATUS REQUIRED:

Sl. No.	COMPONENT	SPECIFICATION	QUANTITY
1.	AND GATE	IC 7408	1
2.	X-OR GATE	IC 7486	1
3.	NOT GATE	IC 7404	1
4.	IC TRAINER KIT	-	1
5.	CONNECTING WIRES	-	AS REQUIRED

THEORY:

1-Bit Comparator is a combinational logical circuit that compares two single bits A and B. Result of the comparison is produced at the output. As there can be three different possibilities of result – (i) A>B (ii) A<B or (iii) A=B, there are three outputs of a comparator. Depending upon the applied input bits, any one of the three conditions is satisfied and thus the corresponding output goes HIGH, other two outputs remain LOW.

TRUTH TABLE:

INPUTS		**OUTPUTS**		
A	**B**	**X (A<B)**	**Y (A=B)**	**Z (A>B)**
0	0	0	1	0
0	1	1	0	0
1	0	0	0	1
1	1	0	1	0

K-map for X

A \ B	0	1
0	0	1
1	0	0

$X = \bar{A}\,B$

K-map for Y

A \ B	0	1
0	1	0
1	0	1

$Y = \bar{A}\,\bar{B} + A\,B$

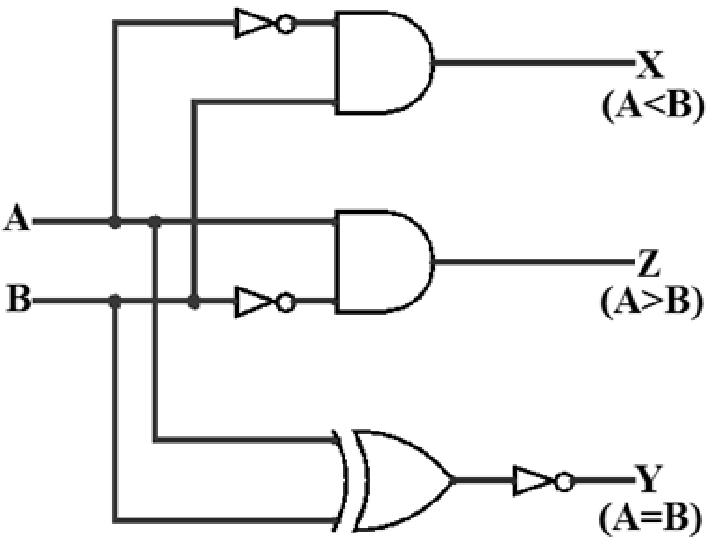
$= \overline{A \oplus B}$

K-map for Z

A \ B	0	1
0	0	0
1	1	0

$Z = A\,\bar{B}$

CIRCUIT DIAGRAM OF A 1 BIT COMPARATOR:



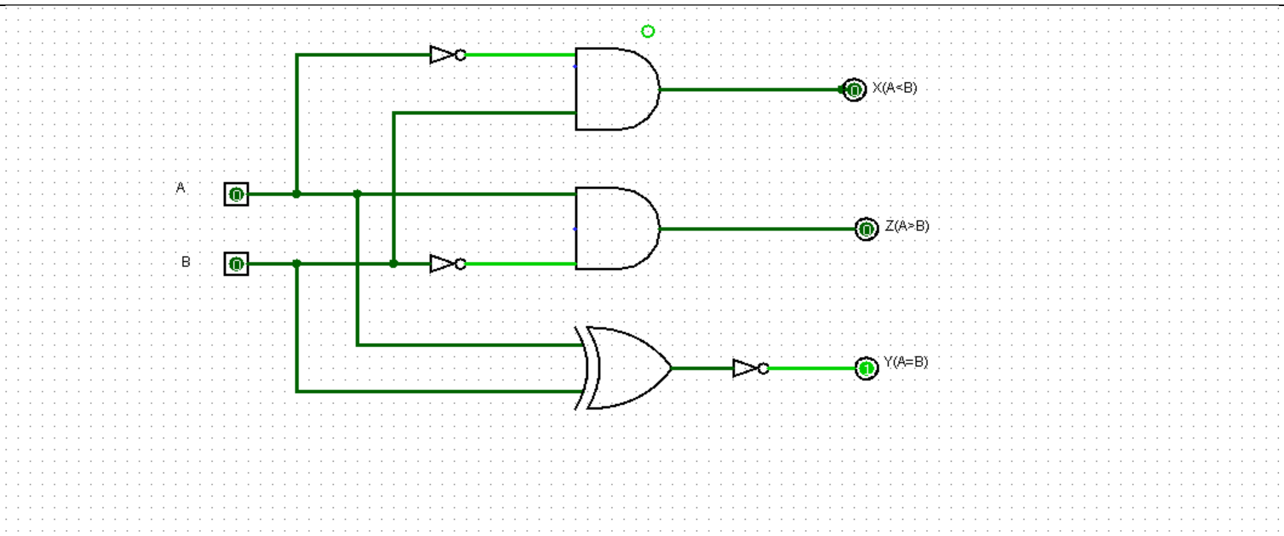
DESIGN PROCEDURE:

1. Truth table of the One bit comparator is prepared.
2. K-map for each output variable present in the truth tables is drawn.
3. Simplified expression for each output variable is obtained.
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:

- In this figure we can see a combinational logic circuit with two inputs (A, B) and three outputs (X, Y, Z).
- When A=0 and B=0, the output Y i.e. (A=B) is LOW the other two output Z i.e. (A>B) and X i.e. (A<B) remains HIGH.
- The Boolean expression of each gate is X=$(\overline{A}.B)$, Z=$(A.\overline{B})$, Y=$\overline{(A+B)}$.

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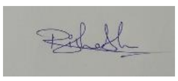
Digital Signature: 

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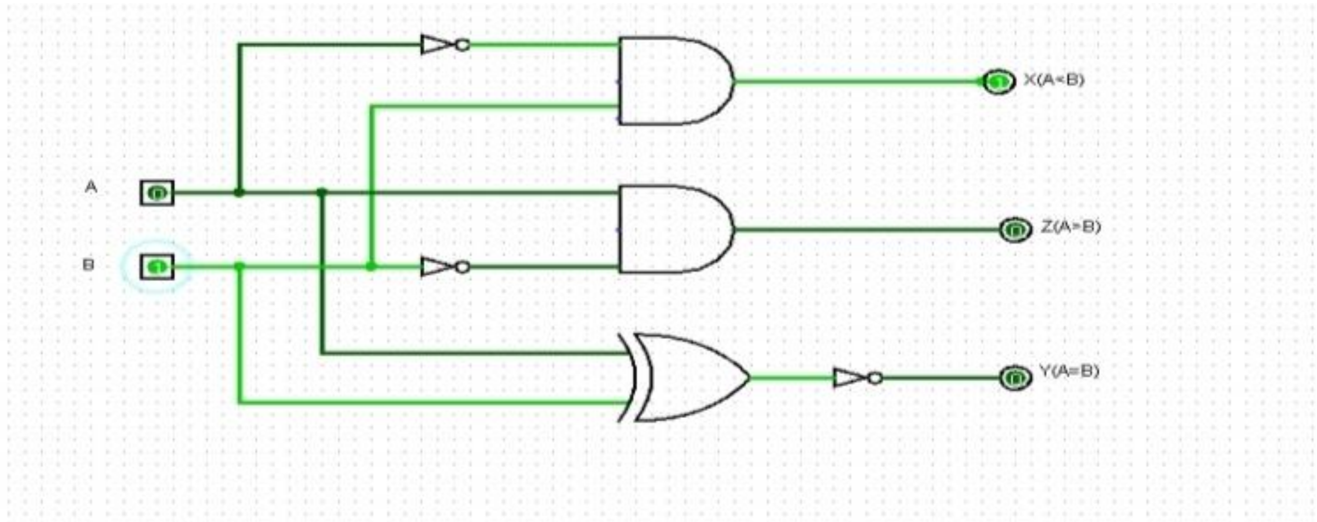
Student’s worksheet 2



Student’s observation and conclusion:

- **In this figure we can see a combinational logic circuit with two inputs (A, B) and three outputs (X, Y, Z).**

- **When A=0 and B=1, the output X i.e. (A<B) is HIGH the other two output Z i.e. (A>B) and Y i.e. (A=B) remains LOW.**

- **The Boolean expression of each gate is X=$(\overline{A}.B)$, Z=$(A.\overline{B})$, Y=$\overline{(A+B)}$.**

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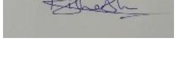
Digital Signature: 

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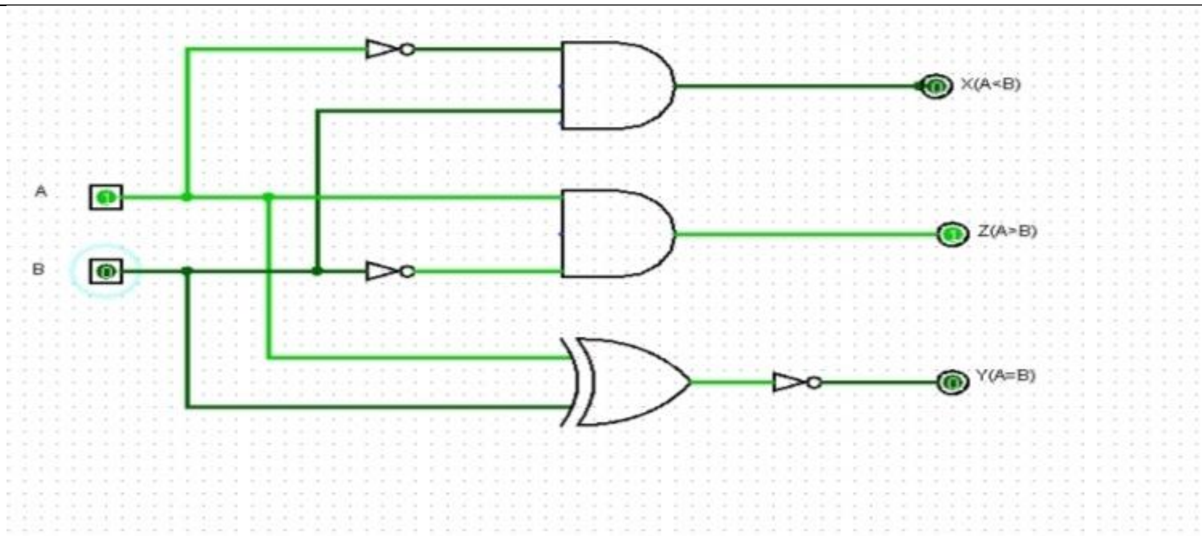
Student's worksheet-3



Student's observation and conclusion:

- In this figure we can see a combinational logic circuit with two inputs (A, B) and three outputs (X, Y, Z).
- When A=1 and B=0, the output Z i.e. (A>B) is HIGH the other two output X i.e. (A<B) and Y i.e. (A=B) remains LOW.
- The Boolean expression of each gate is X=$(\overline{A}.B)$, Z=$(A.\overline{B})$, Y=$\overline{(A+B)}$.

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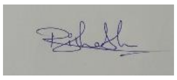
Digital Signature: 

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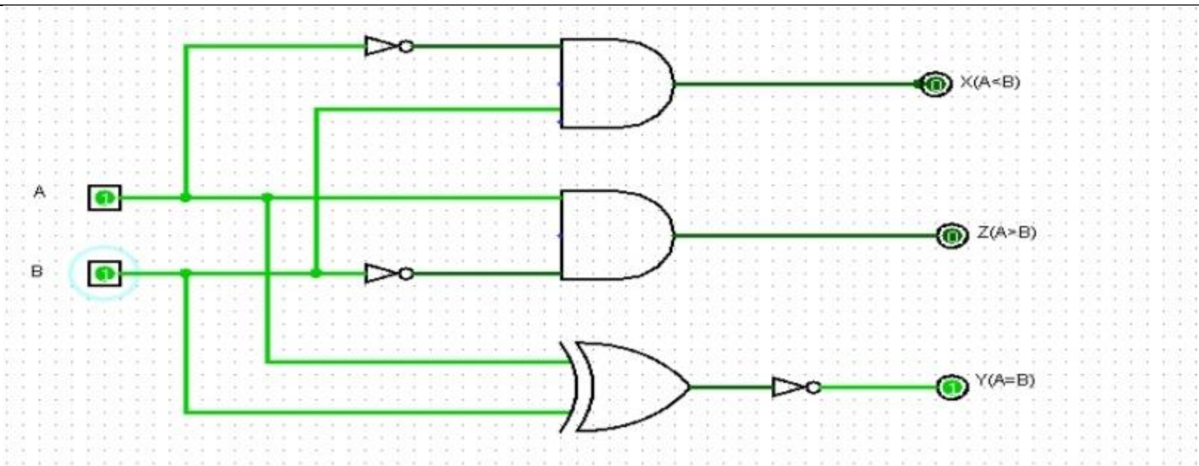
Student’s worksheet-4



Student’s observation and conclusion:

- **In this figure we can see a combinational logic circuit with two inputs (A, B) and three outputs (X, Y, Z).**

- **When A=1 and B=1, the output Y i.e. (A=B) is HIGH the other two output Z i.e. (A>B) and X i.e. (A<B) remains LOW.**

- **The Boolean expression of each gate is X=$(\overline{A}.B)$, Z=$(A.\overline{B})$, Y=$\overline{(A+B)}$.**

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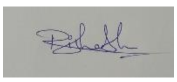
Digital Signature: 

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