DATE

SHEET NO.

GROUP NO: 44

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AIM OF EXPERIMENT (Part 2) :-

Design a 3-bit to 8-bit encoder using NAND and NOR gates, having the following input/output behaviour.

x	y	z	a	b	c	d	e	f	g	h
0	0	0	0	0	0	0	0	0	0	1
0	0	1	0	0	0	0	0	0	1	1
0	1	0	0	0	0	0	0	1	1	1
0	1	1	0	0	0	0	1	1	1	1
1	0	0	0	0	0	1	1	1	1	1
1	0	1	0	0	1	1	1	1	1	1
1	1	0	0	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1

APPARATUS REQUIRED:

(i) 74LS00 x 3

(ii) 74LS02 x 1

Theory :-

NAND and NOR are universal gates, that is any boolean function can be realized by using only NAND gates or only NOR gates.
We have:

$$x' = (1 \cdot x)' \quad [\text{NOT}]$$

$$xy = ((xy)')' = (1 \cdot (xy)')' \quad [\text{AND}]$$

$$x+y = (x'y')' = ((1 \cdot x)'(1 \cdot y)')' \quad [\text{NOR}]$$

This means that the three basic Boolean operations AND, OR and NOT can be realized by NAND gates.
For NOR gates, we have dual formulas :-

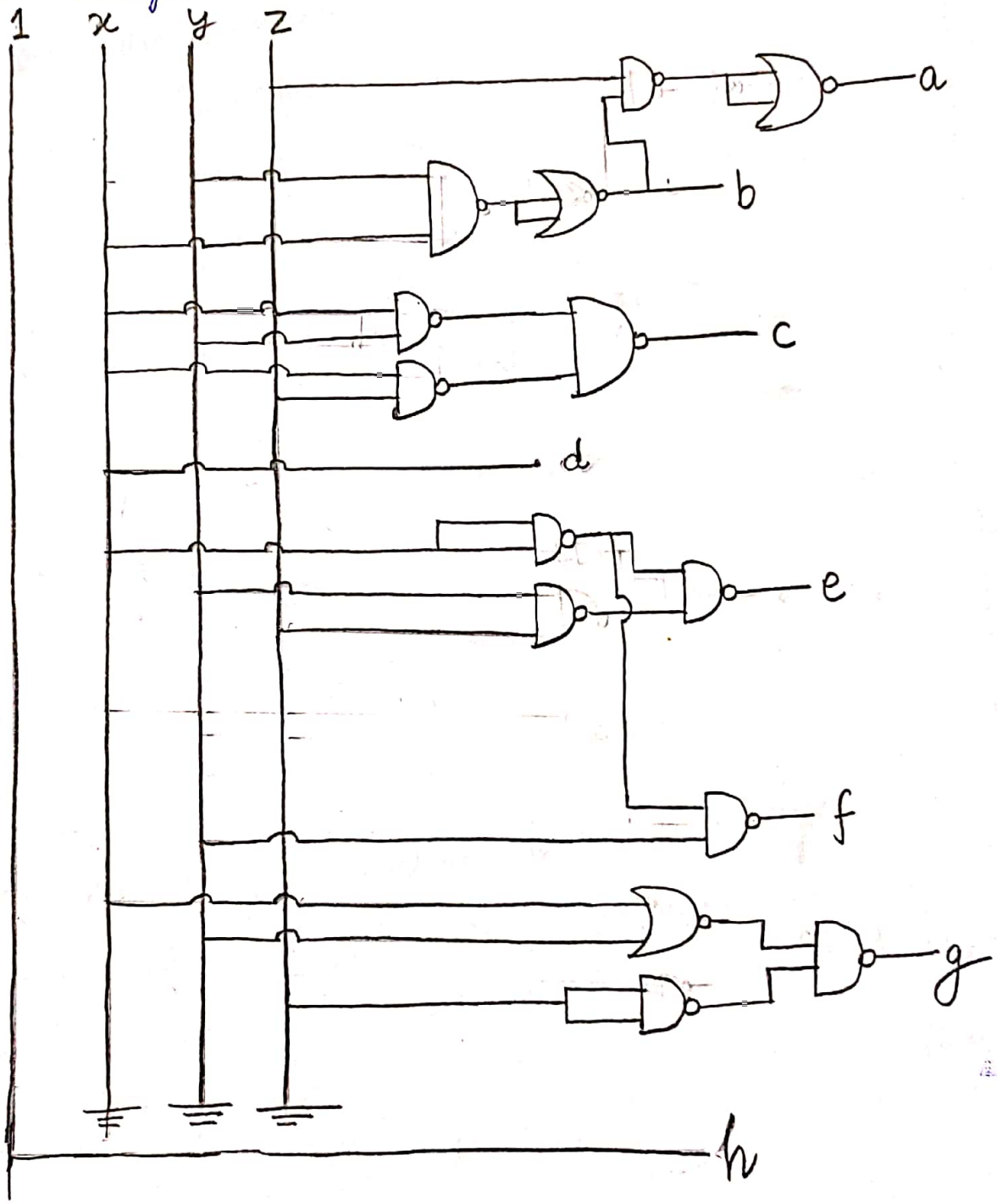
$$x' = (0+x)' \quad [\text{NOT}]$$

$$x+y = ((x+y)')' = (0+(x+y)')' \quad [\text{OR}]$$

$$xy = (x'+y')' = ((0+x)' + (0+y)')'$$

Circuit Diagram :-

We used the following combinational logic circuit to design the 3-bit to 8-bit encoder :-



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OBSERVATIONS

we observed the following are switching functions for the output

	Implementation
$a = xyz$	$\overline{\overline{xy} \cdot z} = xyz$
$b = xy$	$\overline{\overline{x \cdot y}} = xy$
$c = xy + xz$	$\overline{\overline{x \cdot z} + \overline{xy}} = xz + xy$
$d = x$	x
$e = x + yz$	$\overline{\overline{yz} \cdot \overline{x}} = x + yz$
$f = x + y$	$\overline{\overline{x} \cdot \overline{y}} = x + y$
$g = x + y + z$	$\overline{\overline{x+y} \cdot \overline{z}} = x + y + z$
$h = 1$	1.

For above switching functions, and the circuit diagram, when input x, y, z were provided, we got the desired outputs. when red light showed, it implied high (1) and Green light showed, it implied low (0).

Result :-

The following switching functions correctly produce ~~procedure~~ the desired output :-

$a = xyz$

$b = xy$

$c = xy + xz$

$d = x$

$e = x + yz$

$f = x + y$

$g = x + y + z$

$h = 1$

- The above implementation required 12 NAND gates and 4 NOR gates. Thus, we required 74LS00 (number = 3) and 74LS02 (number = 1) to successfully implement the 3-bit to 8-bit encoder.