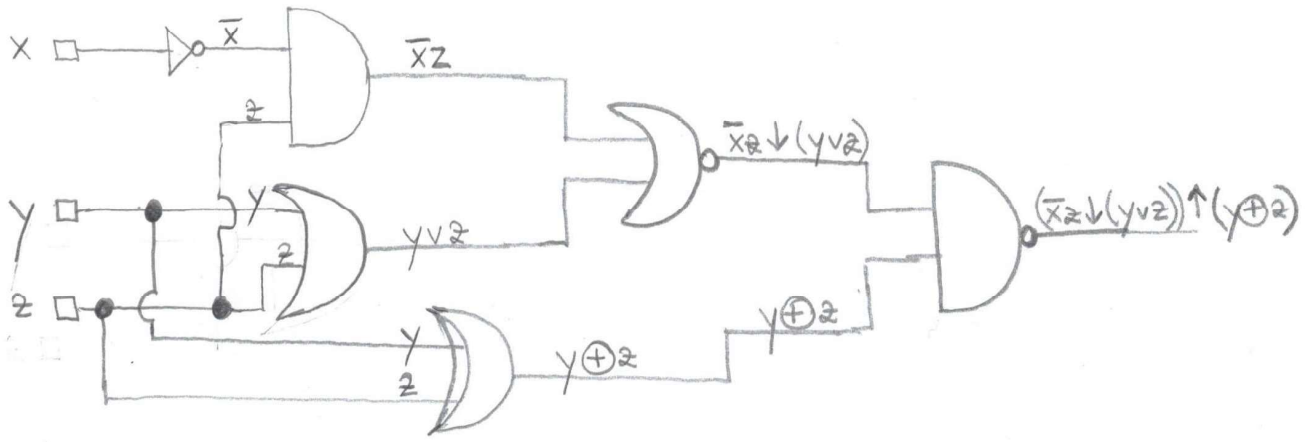
EX 1 LOGIC CIRCUITS

Write the corresponding Boolean function associated to the following logic circuit, then simplify it and ~~write~~ draw a simplified equivalent circuit using only basic gates.

1.2.



THEORETICAL RESULT

→ to derive the Boolean expression for a given logic circuit, we begin with the leftmost inputs and work towards the final output, writing the expression for each gate

$$f(x,y,z) = (\bar{x}z \downarrow (y \downarrow z)) \uparrow (y \oplus z)$$

replace $\uparrow$

$$= \overline{((\bar{x}z \downarrow (y \vee z)) \wedge (y \oplus z))}$$

replace $\downarrow$

$$= \overline{\overline{\bar{x}z \vee (y \vee z)} \wedge (y \oplus z)}$$

replace $\oplus$

$$= \overline{\overline{\bar{x}z \vee y \vee z} \wedge (\bar{y}z \vee y\bar{z})}$$

absorption: $U \vee (U \wedge V)$ with $U = z$, $V = \bar{x}$

$$= \overline{\overline{y \vee z} \wedge (\bar{y}z \vee y\bar{z})}$$

deMorgan

$$= \overline{\overline{y \vee z}} \vee \overline{\bar{y}z \vee y\bar{z}}$$

deMorgan

$$= y \vee z \vee (\overline{\bar{y} \wedge z} \wedge \overline{y \wedge \bar{z}})$$

$$= y \vee z \vee ((\bar{\bar{y}} \vee \bar{z}) \wedge (\bar{y} \vee \bar{\bar{z}}))$$

$$= y \vee z \vee ((y \vee \bar{z}) \wedge (\bar{y} \vee z))$$

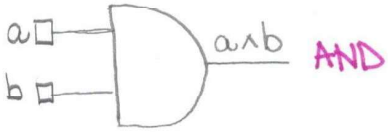
$$= y \vee z \vee ((y \wedge \bar{y}) \vee (y \wedge z) \vee (\bar{z} \wedge \bar{y}) \vee (\bar{z} \wedge z))$$

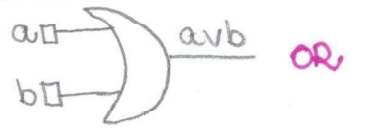
$(y \wedge \bar{y}) = F$, $(\bar{z} \wedge z) = F$

$$= y \vee z \vee (y \wedge z) \vee (\bar{z} \wedge \bar{y})$$

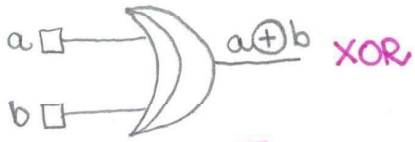
absorption

BASIC GATES

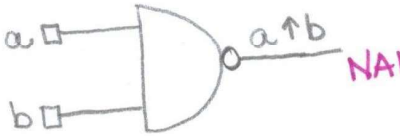




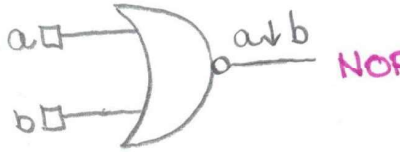
DERIVED GATES



$a \oplus b = \bar{a}b \vee a\bar{b}$



$a \uparrow b = \overline{ab} = \bar{a} \vee \bar{b}$



$a \downarrow b = \overline{a \vee b} = \bar{a}\,\bar{b}$