Solution: The Boolean expression representing the Boolean function is : $xyz + x'yz$, To draw the logic circuit representing this expression, we first feed the inputs x, y, z through an AND gate. we also negate x and feed the output and inputs y, z through an AND gate. Finally we take the outputs of both the AND gates and feed them through an OR gate. The logic circuit is

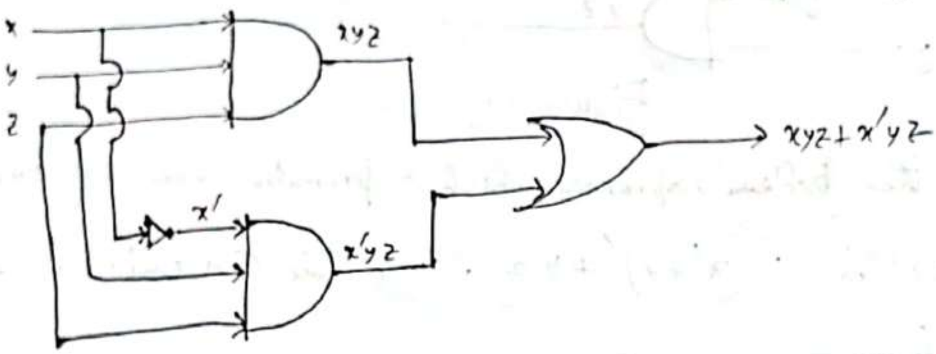


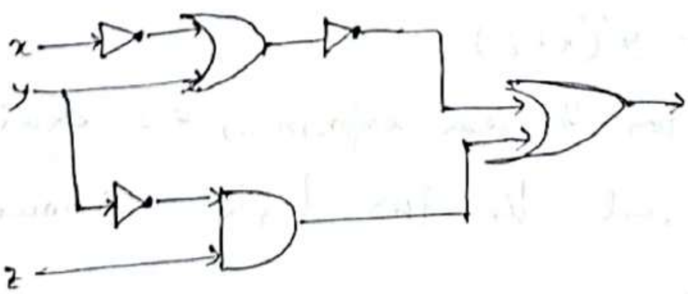
Figure 27

Again $xyz + x'yz = yz(x + x') = yz$. Hence an equivalent simpler circuit is

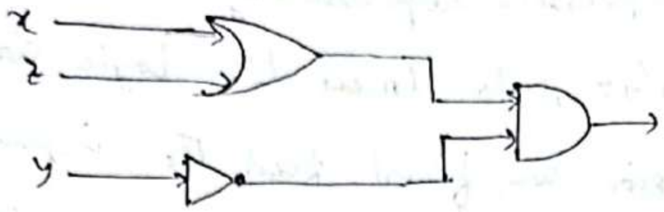
Figure 28

4. Show that following logic circuits given by (a) and (b) are equivalent :

(a)



(b)



Solution: First we find the Boolean expressions which represent the logic circuits given in (a) and (b).
For the circuit in (a), we have,

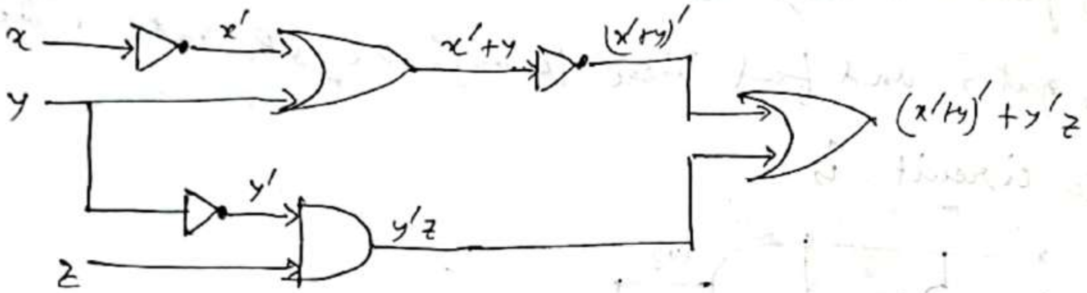


Figure 29

Hence the Boolean expression which represents the circuit in (a) is : $(x'+y)'+y'z$. For the circuit in (b) we have

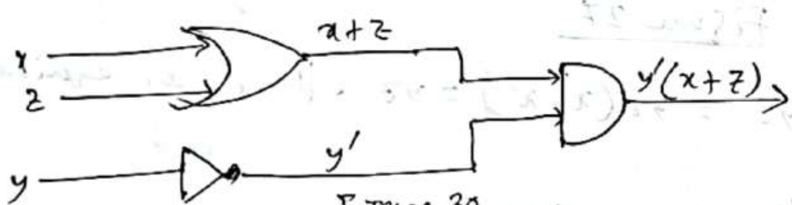


Figure 30

The Boolean expression representing the circuit in (b) is : $y'(x+z)$

Now, $(x'+y)'+y'z = (x')'y'+y'z = xy'+y'z$

$= y'(x+z)$

Thus the two Boolean expressions are equivalent and as such the two logic circuits are equivalent.

5. Draw a circuit using only NAND gates that represents the Boolean functions.

(a) $f(x,y) = x+y$

(b) $f(x,y) = xy$

Solution: (a) we know that $x' = x|x$

and $(xy)' = x|y$

Now $x+y = ((x+y)')' = (x'y')' = ((x|x)(y|y))'$

$= (x|x)|(y|y)$.

Hence the required circuit is

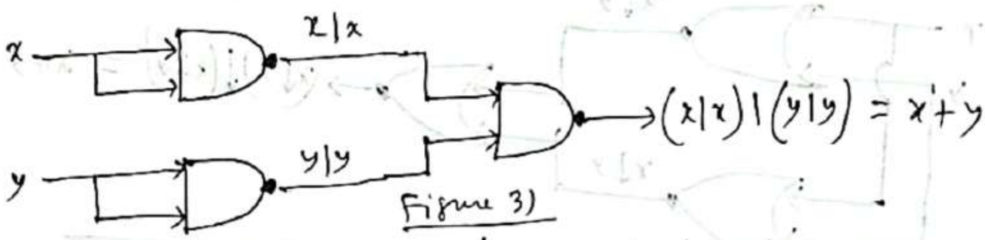


Figure 31

(b) $xy = ((xy)')' = (x|y)' = (x|y)|(x|y)$. Hence the required circuit is :

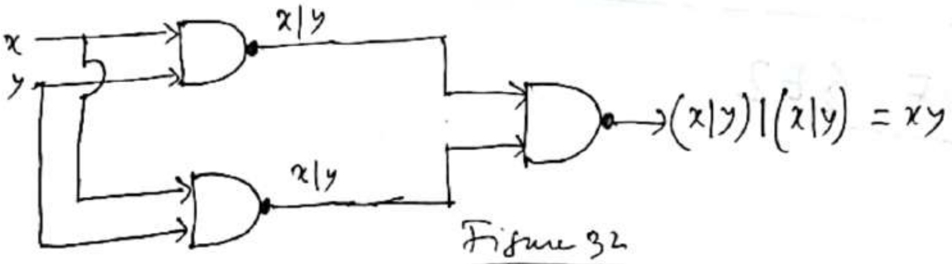


Figure 32

REMARK: Any Boolean function can be realized solely from NOR gates or solely from NAND gates.

~~Example~~ 6. Draw a circuit using only NOR gates that represents the Boolean expression

(a) xy

(b) $x+y$

Solution: (a) $xy = ((xy)')' = (x'+y')'$

Now $x \downarrow x = x'$ $(x+y)' = x \downarrow y$

So, $xy = (x\downarrow x + y \downarrow y)' = (x\downarrow x)\downarrow(y\downarrow y)$

Hence the required circuit is

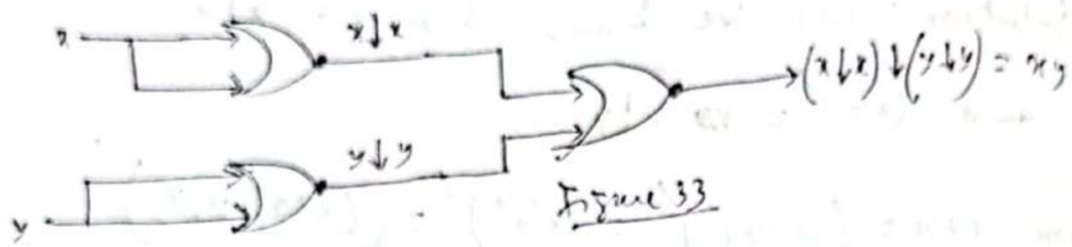
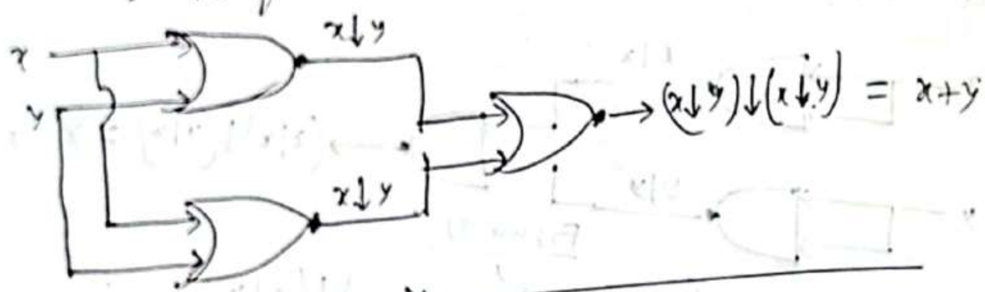


Figure 33

(b) $(x+y) = ((x+y)')' = (x\downarrow y)' = (x\downarrow y)\downarrow(x\downarrow y)$

Hence the required circuit is



X

THIS IS THE END OF MY PART OF NOTES OF GE2