ACOL 215 (15/09/2025) -) binary logic dogic Gates - understand or find out when one circuit is equivalent to another one 6 circuits simplifying them 5 Boolean Algebra

a set of element a set of operators a set of axioms / postulates theorem Example of some common poetwates 1. Closure A set 5 is

closed wrt a sinary operator op

if for every pair of element of 5 ?

specifies how we can obtain a unique element of s. Example M is closed t not closed under

Associative law ob is associative whenever 200 (y0) = (20))0= (x xy) x 2. Yn,y,2 € S x x (y x z) commutative las y x x ES x * y

Identity element is said to have an A set S wrt x (a binary identity element operator) if there exists such that \ e ∈ S Example

Set of integers

binary operator +

binary operator +

identity element is 0

identity element is 0 2 * e = 2 for every x £ S.

(Inverse) A set s having an identity element e wrt a binary operator % is said to have an inverse whenever for every 3 y E S such that a e S ary se. Example Integers + a -a

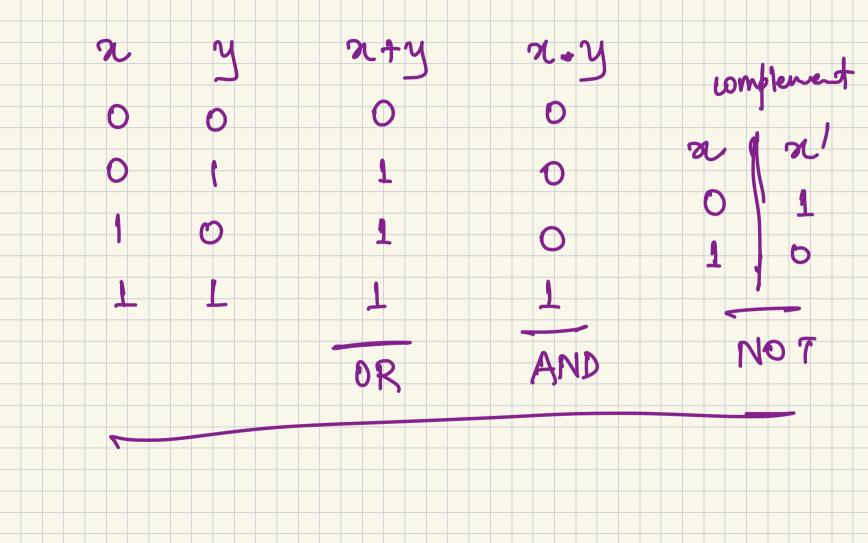
Distributive law If x and + are two binary operator on s, x is said to distribute over + whenever x * (y+z) = (2*y)+(2*z)

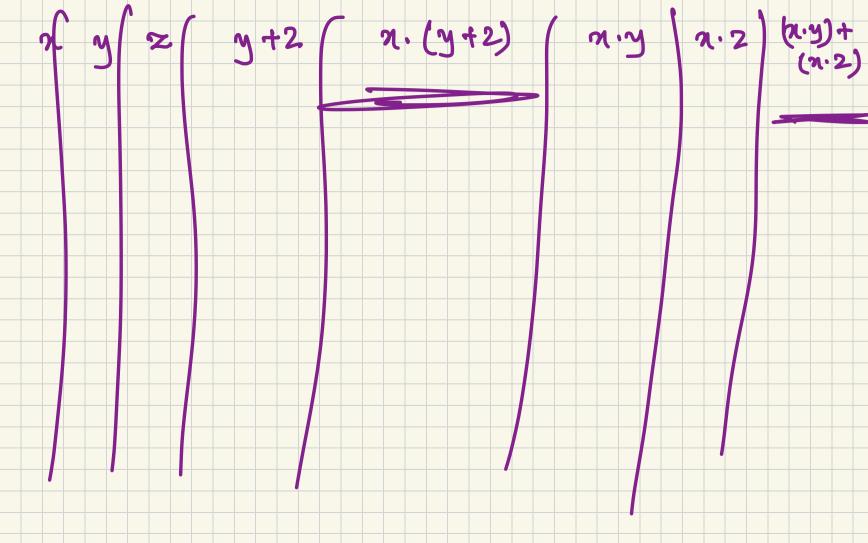
field is an algebraic structure. Example -> forms the field of real numbers addition distributive mutiplication · distributes additive identity 0 multipliadre 17 a (b+c) = ... additive inverse a+ 6:0 \$ (a+c) la if a to mutt. "

Boolean algebra is an algebraic structure defined by a set of elements B, together with binary operators and t provided that the following postulates 1. Closure wrt. (0) is identity wit + 1 is identity wit. - 1.2 = x.1 = x

for every neB, there is an n'eB such that (complement of x) 21 + 2 = 1 2. 21 = 0 There exist at least two elements on and y & B such that n = y

Note that the associative law is not a part of Boolean algebra But it holds. We are going to be looking at
two-valued Boolean akebre $(B = {0,1})(operator, +)$





Two-valued Boolean Algebra Boolean Algebra Switching Alrebra

properties of Boolean Theorems and algebra identity a) n+0 = n b) (n.1 = n) // a) \2+x' = 1 \b) \2.2' = 0 \mall ai nty = ytn 5) n.y = y.n Communitative accociativity a) 2+(y+2)= (x+y)+2 5) 2(y2)=(24)2 a) $n(y+2) = 2y+y^2 = (x+y)$ (x+2) Theorem 2.2 = 2 2+2=2 1. a) b) 2.0 = 0 2. a) n+1 = 1 3. (mvolution) (2') = 2 (x+y) = x'y 4. (DeMorgan) = x'+4 5. (Absorption) 2+24 = 2 2 (2+4)

