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STUDY ON FUZZY LOGIC AND BOOLEAN FUNCTION FOR LOGIC GATES

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ABSTRACT

Algebra utilizes factors, which are images that speak to a number and articulations, which are Mathematical proclamations that utilization numbers, or potentially factors. Theoretical algebra is the branch of knowledge of Mathematics that reviews algebraic structures, for example, Groups, Rings, Fields, Modules, Vector Spaces, and Algebras. The expression Abstract Algebra was authored at the turn of the twentieth century to recognize this territory from what was regularly alluded to as Algebra, the investigation of the guidelines for controlling formulae and algebraic articulations including questions and genuine or complex numbers, frequently now called basic algebra. The refinement is once in a while made in more works that are later. Two Mathematical branches of knowledge that review the properties of algebraic structures saw in general are Universal Algebra and Category Theory. Algebraic structures, together with the related homomorphisms, structure classes

Keywords: *fuzzy logic,Boolean, Function, Logic, Gates*

INTRODUCTION

Algebra advanced from the principles and tasks of math, which starts, with the four activities: expansion, subtraction, augmentation and division of numbers. Tasks in algebra pursue indistinguishable principles from those in number jugling. Algebra utilizes factors, which are

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Theoretical algebra is the branch of knowledge of Mathematics that reviews algebraic structures, for example, Groups, Rings, Fields, Modules, Vector Spaces, and Algebras. The expression Abstract Algebra was authored at the turn of the twentieth century to recognize this territory from what was regularly alluded to as Algebra, the investigation of the guidelines for controlling formulae and algebraic articulations including questions and genuine or complex numbers, frequently now called basic algebra. The refinement is once in a while made in more works that are later.

Two Mathematical branches of knowledge that review the properties of algebraic structures saw in general are Universal Algebra and Category Theory. Algebraic structures, together with the related homomorphisms, structure classes. Class hypothesis is an incredible formalism for considering and looking at changed algebraic structures.

The finish of nineteenth and the start of the twentieth century saw an enormous move in strategy of Mathematics. Conceptual algebra rose around the beginning of the twentieth century, under the name Modern Algebra. Its investigation was a piece of the drive for increasingly intelligent thoroughness in Mathematics. At first, the suppositions in traditional algebra, on which the entire of arithmetic (and real parts of the common sciences) depend, appeared as proverbial frameworks. Never again happy with building up properties of solid items, mathematicians began to direct their concentration toward general hypothesis. Formal meanings of certain algebraic structures started to rise in the nineteenth century. For instance, results about different gatherings of stages came to be viewed as occasions of general hypotheses that worry a general thought of a theoretical gathering. Inquiries of structure and order of different scientific articles came to bleeding edge. These procedures were happening all through all of science, however turned out to be particularly articulated in algebra. Formal definition through crude tasks and aphorisms were proposed for some essential algebraic structures, for example, gatherings, rings and fields. Thus, such things as gathering hypothesis and ring hypothesis took their places in unadulterated science .

Boolean algebras, basically acquainted by Boole in 1850's with arrange the laws of thought, have been a well known point of research from that point forward. A noteworthy leap

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forward was the duality of Boolean algebras and Boolean spaces as found by Stone in 1930's. Stone additionally demonstrated that Boolean algebras and Boolean rings are basically the equivalent as in one can change over through terms from one to the next. Since each Boolean algebra can be spoken to as a field of sets, the class of Boolean algebras is at times viewed as being fairly uncomplicated. In any case, when one begins to see fundamental inquiries concerning decidability, unbending nature, direct items and so forth., they are related with the absolute most difficult outcomes .

Boolean algebra relies upon two component logic. Pre A*-algebra is a customary augmentation of Boolean logic to three truth values, where the third truth esteem represents a vague truth esteem. In this section we examine the algebraic structures of Boolean algebra, Pre A*-algebra.the idea of Boolean algebras and Pre A*-algebras This Chapter initiate with the idea of Boolean algebra and some essential thing aftereffects of Boolean algebra. It likewise incorporates the helpful properties of Boolean algebra. We present the idea of Pre A*-algebra and get the helpful portrayals. We get the different strategies for age of Pre A*-algebras from Boolean algebra.

In the primary area we focus on Boolean algebras, another arrangement of least number of maxims for Boolean algebras utilizing Huntington's hypothesis. In the second segment, we ponder the algebraic structure of Pre A* - Algebra which is generated by a Boolean algebra and the methods of generating Pre A*-algebras from Boolean algebras.

First we start with the concept of Boolean algebras.

BOOLEAN ALGEBRA:

Definition: A Boolean algebra is an algebra (B,∨, ∧, (-)~ , 0, 1) with two binaryoperations, one unary operation (called complementation), and two nullary operations which satisfies :

(1)(B, ∨, ∧) is a distributive lattice;

(2) x∧ 0 = 0, x ∨ 1 = 1 for all x ∈B; (3) x ∧ x′ = 0 x ∨ x′ = 1 for all x ∈B.

We can easily prove that x ″ = x, (x ∨ y)′ = x ′ ∧ y ′, (x ∧ y) ′ = x ′ ∨ y′ for all x, y ∈ B..

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Definition: Let X be a set. The Boolean Algebra of subsets of X, P(X), has asits universe P(X) and as operations ∨, ∧, ′, φ, X. The Boolean Algebra **2 =** {0, 1} is given by **(**2, ∨,∧,′,0,1), where ((2, ∨,∧) is a 2 element lattice with 0 < 1 and where 0′ = 1, 1′ = 0.

Alternative systems of postulates for Boolean Algebras were intensively studied during the decades 1900 - 1940. E.V. Huntington wrote an influential early paper on this subject. No attempt will be made here to survey the extensive literature on such postulate systems. We present here Huntington's postulates.

Huntington's Theorem : Let B have one binary operation∨and oneunary operation (-)′ and define (i) a ∧ b = (a ′ ∨ b′)′ for all a, b ∈ B. Suppose for all a, b, c ∈ B, (ii) a ∨ b= b ∨ a; (iii) a ∨ (b ∨ c) = (a ∨ b) ∨ c and (iv) (a ∧ b) ∨ (a ∧ b′) = a.

Then B is a Boolean algebra.

Theorem : Let B have one binary operation∧and one unary operation (-)′and define (i) a ∨ b = (a′ ∧ b′)′ for all a, b ∈ B. Suppose for a, b, c ∈ B,

(ii) a∨ b = b ∨ a, (iii) (a ∨ b) ∨ c = a ∨ (b ∨ c) (iv) (a ∧ b) ∨ (a ∧ b′) = a

Then B is a Boolean algebra.

Pre A* - Algebra:

Definition: An algebra (A, ∨, ∧, (-)~) satisfying:

(a) (x~) ~ = x, ∀ x ∈ A

(b) x∧ x = x, ∀ x ∈ A

(c) x∧ y = y ∧ x, ∀x,y∈ A

(d) (x∧ y)~ = x ~ ∨ y ~ , ∀x,y∈ A

(e) x∧ (y ∧ z) = (x ∧ y) ∧ z , ∀x,y,z∈ A

(f) x∧ (y ∨ z) = (x ∧ y) ∨ (x ∧ z), ∀x,y,z∈ A

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(g) x∧ y = x ∧ (x~ ∨ y), ∀x,y∈ A

is called a Pre A* - algebra.

Note : If (mn) is an axiom in Pre A* - algebra, then (mn)˜is its dual.

Examples: 3 = {0,1,2} with ∨, ∧, (-)~ defined below is a Pre A* - algebra

∧	0	1	2
0	0	0	2
1	0	1	2
2	2	2	2

∨	0	1	2
0	0	1	2
1	1	1	2
2	2	2	2

x	x˜
0	1
1	0

Example : 2 = {0,1} with ∨, ∧, (-)~ defined below is a Pre

∧	0	1
0	0	0
1	0	1

x	x˜
0	1
1	0

∨	0	1
0	0	1
1	1	1

Actually (B, ∨,∧, (-)˜) is a Boolean algebra. So every Boolean algebra is a Pre A* - algebra.

Note: -The elements 0,1,2 in examples satisfy the following laws.

(a) 2~ = 2 ;

(b) 1 ∧ x = x, ∀ x ∈ 3 (‘1’ the identity for ∧)

(c) 1~ = 0 ;

(d) 2 ∧ x = 2, ∀ x ∈ 3

(e) 0 ∨ x = x, ∀ x ∈ 3 (‘0’ is the identity for ∨)

Note: -Let A be a Pre A* - algebra with 0 and1. Then by 1.3,

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B(A) = {x ∈ A / 1 ∨ x = 1} becomes a Boolean Algebra with ∨, ∧, (-)~ , 0.

Theorem: Let (B, ∧, (-)′, 0) be a Boolean Algebra.

Then, A(B) = {(a_1, a_2) / a_1, a_2∈B and a_1∧ a_2 = 0} becomes a Pre A* - algebra with 1 = (1,0), 0 = (0,1) and for all a, b ∧ A(B),

(i) a∧ b = (a_1b_1, a_1b_2 + a_2b_1 + a_2b_2) (where juxta position, +, (-)∧ respectively

v,∧, (-)' in Boolean Algebra B).

(ii) a V b = (a_1b_1+ a_1b_2 + a_2b_1 , a_2b_2)

(iii) $a^{\sim}$ = (a_2, a_1)

OBJECTIVES OF THE STUDY

1. To study on logic gates operation for switching circuit analogy
2. To study on fuzzy logic

FUZZY LOGIC

Fuzzy logic is an expansion of Boolean logic by LotfiZadeh in 1965 dependent on the scientific hypothesis of fuzzy sets, which is a speculation of the traditional set hypothesis. By presenting the idea of degree in the confirmation of a condition, hence empowering a condition to be in a state other than obvious or false, fuzzy logic gives a truly significant adaptability to thinking, which makes it conceivable to consider errors and vulnerabilities. One favorable position of fuzzy logic so as to formalize human thinking is that the tenets are set in normal language. For instance, here are a few standards of direct that a driver pursues, accepting that he wouldn't like to lose his driver's permit [4]:

If the light is red...	if my speed is high...	and if the light is close...	then I brake hard.
If the light is red...	if my speed is low...	and if the light is far...	then I maintain my speed.
If the light is orange...	if my speed is average...	and if the light is far...	then I brake gently.
If the light is green...	if my speed is low...	and if the light is close...	then I accelerate.

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Pre -Algebra As A Semilattice

The concept of *Pre A*-algebra as a semilattice.* In this Chapter, we define semilattice on a Pre A*-algebra with respect to the binary operation(meet) and as well as * (join) and obtain the properties of semilattice on a Pre A*-algebra. We establish Pre A*-algebra as a semilattice. We prove necessary conditions for a semilattice to become a lattice with respect to meet and as well, as join. We define greatest lower bound of an element on Pre A* - algebra and least upper bound of an element on Pre A* - algebra and we provide examples of these. We define semi-*-complement for semilattice on Pre A* - algebra and we prove some theorems on these. We define atoms, dual atoms, irreducible elements with respect to meet as well as join for semilattice on Pre A*-algebra. We obtain various theorems on these atoms, dual atoms, irreducible elements for semilattice on Pre A*-algebra. We establish the atomic, dual atomic semilatticeson*Pre* A*-algebra.

METHODOLOGY

Research is a systematic attempt to get answers to significant questions about wonders or occasions through the use of techniques. It begins with an issue, gathers information or realities, examinations them basically and achieves choices in view of the genuine confirmations. Along these lines it is a watchful and unending quest for truth and an interminable mission for learning. This is conceivable just with the utilization of right methodology. Despite the fact that diverse techniques like easygoing, comparative, historical, trial and case think about are accessible for the specialist, he/she chooses one of them based on nature of the issue and the sort of information to be gathered. On the choice of appropriate technique, the specialist could spare his chance and vitality alongside the confirmation of right answer for the issue. Deals with the different gates, different logical operators with timing diagrams. Also explain on conversions of gates are analyzed

RESULT

Logic Gates Operation For Switching Circuit Analogy

Logic gates are the fundamental parts in cutting edge system. Such gates are the NOT, AND, OR, NAND, NOR, Exclusive OR and the Exclusive NOR gates are available in strong consolidated circuit structure. The entrance used in a high level circuit with something like

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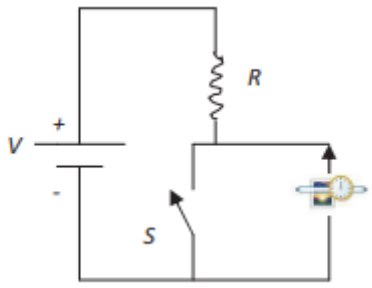
one information voltage anyway only one outcome voltage. By interacting the different gates in different ways we can gather circuits that fill math and other job related with the human frontal cortex since they recreate mental cycles. The action of a logic entryway can be helpfully seen with help of truth table.

The execution of logic circuit using fundamental gates, we require ICs for AND, OR and NOT gates. Consider a combinational circuit which requires two 2-data AND gates and one 2-data OR gates. Right when we use two ICs like IC 7408 and IC 7432 this see that 2-data AND gates are unused and three 2-data OR gates are unused. Consequently the utility variable is incredibly poor. This utility component can be extended by using comprehensive gates to execute logic function. In this part we talk concerning how to execute logic circuit using far and wide gates.

Logical operators

It is known to handle number juggling explanation, we use number-crunching administrators, for instance, +, - , x, and ÷. Moreover we can use logical administrators to address and handle logical explanation. There are three crucial logical administrators to address the trading circuit affirmation. Logical administrators NOT/INVERTER, the inversion administrators created as a bar over its conflict. Right when the switch S is open light is ON and switch S is close the light will turn OFF.

Logical operator, AND



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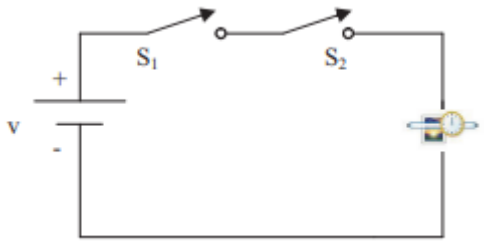
Input	Output
Switch open(Low)	lamp On (High)
Switch close(High)	lamp Off (Low)

Fig. 1 Switching circuit analogy of AND function

The logical administrator's are meant by "*" AND " ". These sign's are like common variable based math. For instance A B, A*B or AB has an equivalent importance. A B might be perused as An and B or Multiple times B., A B is high in the event that An and B are both are high and in any case low. The logic administrator AND can be better perceived assuming the exchanging circuit acknowledgment of AND function as displayed in Fig 1 is thought of. Furthermore door indicates most reduced worth of the factors.



INPUT		OUTPUT
S_1	S_2	
Open(Low)	open(Low)	lamp OFF(Low)
Open(Low)	close(High)	lamp Low(Low)
close(High)	open(Low)	lamp OFF(Low)
close(High)	close(High)	lamp ON(High)

Fig. 2 Switching circuit analogy of OR function in Series

From the above Fig 2 shows that the light will be ON(glow) just when both the switches S1 and S2 are shut all the while, just when S1 AND S2 are ON at the same time, when any of two switches is OFF the light is OFF.

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Logical operator OR

Or then again logical administrator is signified as '+' signs. A+B is perused as An OR B. A+B is high if either An is high or B is high or both are high. The exchanging circuit acknowledgment of OR function is displayed in Fig 3. Or on the other hand entryway indicates most elevated worth of the factors.

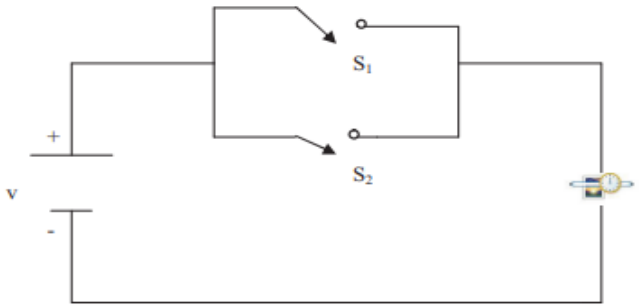

Fig. 3 Switching circuit analogy of OR function in Parallel

If both of two separate switches S1 OR S2 is shut, the light will be ON just when both S1 and S2 are OFF, then, at that point, the light will be OFF.

Logic gates

Logic gates are the fundamental components that make up an advanced framework the gadgets door is a circuit that can work on various paired contributions to request to fill a specific logical role. The sorts of gates accessible are NOT, AND, OR, NAND, NOR, Exclusive OR and the Exclusive NOR entryway they are accessible in solid coordinated circuit structure.

Conversion of AND/ OR / NOT logic to NAND / NOR

At the point when we carried out any Boolean articulation it includes different logic gates. The logic gates are accessible in standard IC bundle. To execute given Boolean articulation we really want different standard ICs and frequently all gates inside the standard ICs are not use. For instance to carry out Boolean articulation AB + C'D we require two AND gates, one OR entryway and one inverter. This requires three standard ICs, two AND gates from AND

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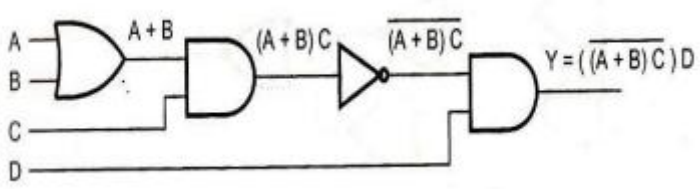
IC and just one OR entryway and on inverter are used from OR and inverter ICs, individually. Different gates from these three ICs are not used. To further develop usage of ICs and to lessen number of ICs required, we can utilize just NAND/NOR gates to carry out Boolean articulation. To use this, graphical methodology to change over given AND/OR/NOT Boolean articulation logic to NAND/NOR logic.

Example : Boolean Expression: ((A + B) C)' D



Boolean function for Logic gates

1. NOT gate function:

The activity of an inverter (NOT circuit) can be communicated as follows. On the off chance that the info variable is An and the result variable is Y, then, at that point, Y= A.

2. AND gate function:

Leave the two info factors alone An and B and the result factors Y then the Boolean articulation is Y= AB. Assuming there are four info factors A, B, C, D, then, at that point, the result Y=ABCD.

The output is 1 (HIGH) only when all the inputs are 1s (high)

3. OR gate function:

Assuming that one information is A, the other info is B, and the result is Y, then, at that point, the Boolean articulation for OR function is Y= A+B. On the off chance that there are four information factors A, B, C and D, then, at that point, the result is Y = A+B+C+D. The result is a 1(HIGH) when any at least one of the NAND function is Y= (A+B)

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NOR Function

NOR function is created utilizing just NAND gates as follows the Boolean articulation for NOR door is Similar to NAND entryway, the BNOR entryway is additionally a widespread entryway, since it tends to be utilized to produce the NOT, AND, OR, and NAND function. An inverter can be produced using a NOR entryway by associating all of the info together and making a solitary normal information. An OR function can be created utilizing just NOR gates. It tends to be produced by basically reversing result of NOR entryway, it shows that the two information OR door utilizing NOR gates.

$$Y = (A + B)'$$

$$= A' B'$$

$$= (A'B')''$$

The above fig. shows that the NOT gate function and in NOR gate using basic gate. AND Function Illustration:

$$Y = A B$$

$$= A'' B''$$

$$= (A' + B')'$$

Converting into NAND circuit:

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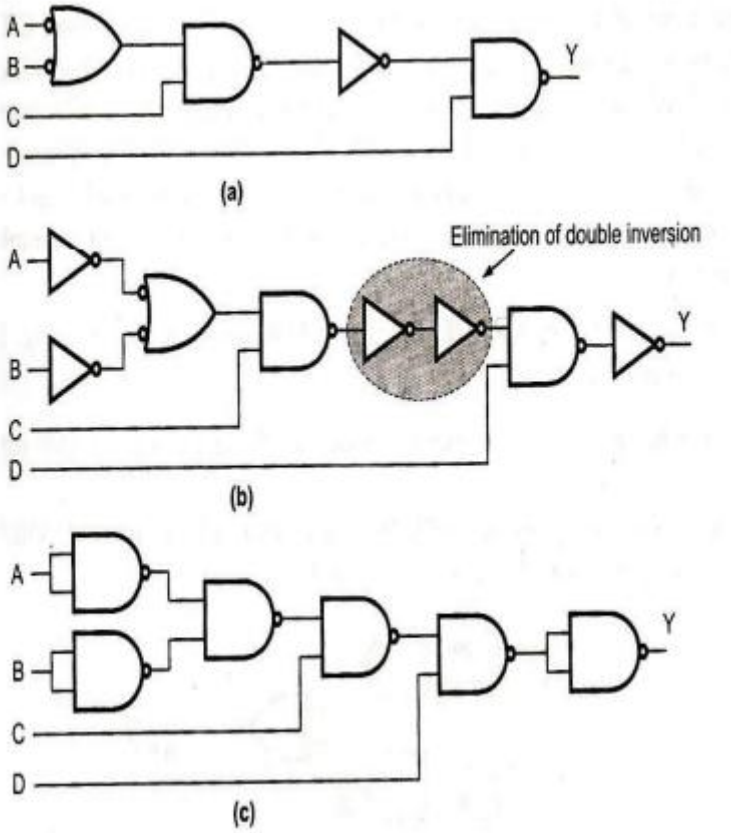

Fig. 4 NAND function using only NOR gates

CONCLUSION

Distinctive logical administrators with timing graph, inverter activities, beat activity, general gates and changes of gates are broke down. A combinational circuit which requires two 2-info AND gates and one 2-information OR entryway execution utilized in exchanging circuit pin, for example, IC 7408 and IC 7432. This utility variable can be expanded by utilizing general gates to execute logic functions.

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mathematician Diophantus of Alexandria, but the same defect was present as in the case of Akkadians."

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