DESIGN AND CONSTRUCTION OF FOUR INPUT LOGIC TUTOR

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APPROVALPAGE

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DEDICATION

ThisprojectisdedicatedtotheAlmightyGod,theCreatorofthewholeuniversefor Hisinfinitemercyandwisdomthroughoutmyacademicjourney.

ACKNOWLEDGEMENT

First,IwouldliketothanktheAlmightyGodforgrantingmelifeandgoodhealthas wellassupremeprotectionandguidethroughoutmystudies.

Iamthankfultomysupervisor,Mr.BuffingtonNatainforhisinformativeandusefu lguidancethroughoutthejourneyforprojectdesign.

IamverygratefultothedepartmentofComputerEngineering,myHODandlecture rsforinstillinginmetheknowledgethathasbroughtmethisfar.

Needlesstomention,thisprojectwouldnothavebeencompletedwithoutreference toandinspirationfromtheworkofotherswhosedetailsareincludedinthereference sectionofthisdocument.

ABSTRACT

In this work, we present a participatory approach to design four input logic tutor, an intelligent tutoring system that helps learners develop reasoning skills in multiple contexts (situation). Four in put logic tutor innovates through its design rationale, which leads to strong structures on which learning is based. The objective of the work is to present historiography off our input logic-switching circuit. The design mainly focuses on development and application off our input logic tutor in the field of electronics and computer applications.

TABLEOFCONTENTS

Title Page.....i

Approval Page……..……ii

Dedication.....iii

Acknowledgement.....iv

Abstract.....v

CHAPTER ONE

INTRODUCTION

1.1 Background of the study.....1

1.2 Statement of the Problem.....2

1.3 Objectives of the Study.....2

1.4 Significance of the Study.....3

1.5 Limitation of the Study……....3

CHAPTER TWO

LITERATUREREVIEW

2.1 Digital Circuit.....4

2.2 How Digital Circuits Works.....4

2.3 The fundamental concepts of Digital Circuits and Systems.....6

2.4 Digital Logic Levels…….……8

2.5 Active High and Active Low…….…..…8

2.6 Frequently Asked Questions on Basic Gates……...8

2.7 What is truth table…….……..9

2.8 Different Types of Logic Gates…….……10

2.9 Types of Basic Logic Gates……...……11

2.10 Application of Logic Gates…..……..……16

CHAPTER THREE

MATERIALSANDMETHODOLOGY

3.1 And logic gate..... 19

3.2 Transistor 19

3.3 Circuit Diagram and Components Required ……..…20

3.4 OR Logic Gates: ……...… 22

3.5 Applications of OR Gates: ……... 25

CHAPTER FOUR

4.1 Testing and Results.....36

CHAPTER FIVE

5.1 Summary and Conclusion.....37

Reference……..39

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

For a few decades now, computer has played an increasing role in education. They provide a more or less personalized environment where the learners can practice at their own, have access to tutorials, be given explanations and feedback on their performance. Intelligent tutoring system, which make use of Artificial intelligence and cognitive science, are a popular target but require a lot more effort to build.

The computation foundation of any modern machine is transistor-bases logic gates. Example, a piece of hospital equipment is to alert a nurse or doctor if a patient's heart rate or temperature increase above certain allowed limit. The alarm bell must sound (output) or the thermometer (input).

Four input logic tutor is commonly used in institution and related firm, we encounter many challenges in the building of the four input logic tutor, but despite the challenges we have been able to reach out the needs of many not just in Nigeria but across the globe. This work covers wide range in engineering field especially logic related subject.

1.2 Statement of the Problem

The project is focused on building four input logic tutor, that emphasis on the problems and difficulties hindering engineers from construction of four input logic tutor. However, if there is no logic information, it will be impossible to have an efficient working four input logic tutor.

Accuracy of record, proper authorization by relevant bodies, and practical steps hence guides engineers on how to construct a working four input logic tutor.

One of the problems founds among most organization involve getting the needed materials required for the construction of four input logic tutor due to case and installation processes.

1.3 Objectives of the Study.

The objective of this work is to introduce the concept of some basic logic gates and their dynamic characteristic. The need for students to be familiar with these characteristic because CMOS logic Students are required to understand the basic structure of the CMOS logic.

The purpose of this work is to examine critically the possibility of achieving the construction of four input logic gate, to guild students on easy means to construct four input logic tutor.

1.4 Significance of the Study

The logic will help in testing and knowing how the truth table implementation f logic gate and logic circuits, which will make the students familiar with the different types of gate and logic circuits.

1.5 Limitation of the Study

The challenges students go through when doing research on four input variable, is to analyze the reasoning that underlies valid determinations of the truths of three mathematical statements. A person needs not to have conscious knowledge of the logic principles used in the arguments, but the principles must be employed in order for the reasoning to be valid. We saw every reason to construct four input logic tutor, setting it as a guide to engineering students and teachers aiding the easy and fast determination of any inputted variable.

CHAPTER TWO

LITERATURE REVIEW

2.1 Digital Circuit

Digital circuits are the backbone of computers. They are used for multiple purpose ranging from simple logic gates to complex microprocessors, which are responsible for executing instructions in a computer.

Digital logic circuits are the basis of digital systems. These logic circuits are set of logic gates that show logical equivalence between two different groups of binary numbers.

These digital logic circuits use '1' (one) and '0' (zero) for on/off conditions, where 1 represents ON, and 0 represents off conditions.

Digital Logic Circuits are digital devices that use logic gates, ALU's microprocessors, RAM, ROM to control other circuits. It is a specific form of logic circuit that processes the numerical values 0 and 1.

2.2 How Digital Circuits Works

A digital circuit converts a series of numbers into another series of numbers. It is designed to give only one output for any given input, and the output will be either OV or 5V. A circuit uses discrete values of voltage to represent data.

The most common digital circuits are based on the binary number system, although some systems use non-binary values. The digital circuit contains

switches, which are either ON or off. It processes information as a sequence of“1’s and “0’s.”

A digital circuit is an electronic circuit that uses discrete quantities of information, such as logic levels (i.e. not a continuous range as an analog signal does), to process information and perform functions. We use a digital circuit because it can change the voltage level from OV to 5V, which is very convenient for use with a microcontroller.

It uses binary code that only has two digits: zero and one. Digital circuits are used in calculators, computers, TVs, and many other devices.

Digital circuits are also called logical circuits because they perform logical operations on digital signals. Digital circuits use logic gates like AND, OR, NOT, NAND, and NOR to perform the required digital operations.

A digital circuit is a circuit containing digital logic. Digital circuits are the most common physical implementation of Boolean algebra and binary arithmetic and are the basis of all modern computers.

It is because digital circuits are mainly used to process data that has only two values, such as true or false.

In other words, it can be said that a digital circuit's primary function is to process the information that manages the binary system. Digital circuits are called logical circuits because they perform logical operations and produce results that can be interpreted as True or False.

2.3 The Fundamental Concepts of Digital Circuits and Systems.

Digital circuit, also known as digital electronics, is a branch of electronics that performs various tasks to fulfill multiple requirements with the help of digital signals. Mainly this circuit is used to overcome the disadvantages of analog systems.

Analog systems are slower, and the data, which is obtained, may have an error in it. The circuit is designed by neither using binary logic gates like NOR,

XOR, NOT, NAND, OR, AND. These logic gates are known for performing logical operations.

This design helps the circuit to move from one state to another. The input signal used for this circuit is in digital form, which is 1'sand 0's binary language format.

2.4 Digital Logic Levels.

A Logic level is defined as a specific state or voltage of a signal. As mentioned earlier, 1 and O are the two states of Logic gates.

The logic state 1 and 0 represents as HIGH and LOW respectively. In digital electronics, these binary logic levels play a crucial role in Data storage, Data transfer.

Generally, these logic levels can be understood as ON and OFF states, as stated earlier the logic levels are introduced to the logic gate by the supply Voltage.

2.5 Active High and Active Low

The Active low pin must be connected to LOW logic level or ground, in the same way the active high pin must be connected to HIGH logic level or to 5 volts or 3.3 volts. Active high input and active low Input pins are seen in ICs and micro controllers. They just describe low the pin is being activated.

To understand this in a simple way, when we see the enable pin CE in a shift register IC, without any (bar) on it, we connect it to low input i.e. to ground 0 volts. Otherwise, if we see the enable pin with a line on it as (CE), we connect it to the high input i.e.to 3.3 or 5 volts supply, in order to enable the pin.

2.6 Frequently Asked Questions on Basic Gates.

- What is the use of basic logic gates?

Fundamental logical functions are performed using basic logic gates. These are the fundamental components of integrated circuits.

- What are the types of basic logic gates?

  AND gate, OR gate, XOR gate, NAND gate, NOR gate, XNOR gate, and NOT gate are the seven types of basic logic gates.

- What are universal gates?

  A universal gate is a logic gate that can implement any Boolean function without using another logic gate.

  The universal gates are the NOR and NAND gates.

2.7 What is truth table?

Truth table is a tabular representation of all the possible input and output combinations of each logic gate type. Truth tables provide a quick summary of all potential outputs any distinct gate type can provide**.**

Four Input Truth Table for an OR gate

Inputs				Output
A	B	C	D	X
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1

0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

2.8 Different Types of Logic Gates

1. NOT GATE

2. AND GATE

3. OR GATE

4. NAND GATE

5. NOR GATE

6. XOR GATE

7. XNOR GATE

These are the seven basic logic gates.

2.9 Types of Basic Logic Gates

There are basic logic gates used in performing operations in digital systems.

The common ones are:

OR Gate

AND Gate

NOT Gate

Additionally, these gates can be found in a combination of one or two.

Therefore, we get other gates such as NAND Gate, NOR Gate, EXOR Gate, and EXNOR Gate.

Below is detailed explanation of each of the basic gates with their truth table.

OR Gate

In an OR gate, the output of an OR gate attains state 1 if one or more inputs attain state 1. But if both inputs attain state 0, the it will result to an output of state 0.

The Boolean expression of the OR gate read as Y = A + B (Y equals A 'OR' B).

The truth table of a two-input OR gate is given as;

A	B	Y
0	O	O
0	1	1
1	0	1
1	1	1

AND Gate

In the AND gate, the output of an AND gate attains state 1 if and only if all the inputs are in state 1.

The Boolean expression of AND gate is Y = A.B

The truth table of a two-input basic AND gate is given as;

A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

NOT Gate

In a NOT gate, the output of a NOT gate attains state 1 if and only if the input does not attain state 1.

The Boolean expression is;

$A = \overline{A}$

It is read, as Y equals NOT A.

The truth table of NOT gate is as follows;

A	**$\overline{A}$**
0	**1**
1	**0**

When connected in various combinations, the three gates (OR, AND and NOT) give us basic logic gates such as NAND, and NOR gates, which are the universal building blocks of digital circuits.

NAND Gate

This basic logic gate is the combination of AND and NOT gates.

The expression of the NAND gate $C = \overline{A.B}$

The truth table of a NAND gate is given as;

INPUT		**OUTPUT**
A	**B**	**Y**
0	**0**	**1**
0	**1**	**1**
1	**0**	**1**
1	**1**	**0**

NOR Gate

This gate is the combination of an OR and NOT gate.

The Boolean expression of NOR gate is;

$Y = \overline{A + B}$

The truth table of a NOR gate is as followings,

INPUT		OUTPUT
A	**B**	**X**
0	**0**	**1**
0	**1**	**0**
1	**0**	**0**
1	**1**	**0**

Exclusive-OR gate (XOR Gate)

The Boolean expression of the XOR gate is;

$X = A\overline{B} + \overline{A}B$

The truth table of an XOR gate is;

INPUT A	INPUT B	OUTPUT X
0	**0**	**0**
0	**1**	**1**
1	**0**	**1**
1	**1**	**0**

Exclusive-NOR Gate (XNOR Gate)

In the XNOR gate, the output is in state 1 when both inputs are the same, that is, both 0 and both 1.

The Boolean expression of the XNOR gate

$Y = AB + \overline{A}\overline{B}$

The truth table of an XNOR gate is given below

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	1

2.10 Application of Logic Gates

Logic gates have a lot of applications, but they are mainly based upon their mode of operations or their truth table. Basic logic gates are often found in circuits such as safety thermostat, push buttons locks, automatic watering systems, light activated burglar alarms and many other electronic devices.

One of the primary benefits is that basic logic gates can be used in a single device. However, it can be restricted due to the given physical space in the

device, digital integrated circuits (ICS). WE find an array of the logic gate area unit.

- **Digital Computers:** logic gates form the basis of digital computers. Combination of logic gates are used to perform arithmetic and logical operations, enabling the execution of computers.
- **Arithmetic operations:** logic gates are used to perform basic arithmetic operations such as addition, subtraction, multiplication and division in digital circuits.
- **Memory units:** flip-flops and other memory elements, which are essential components of digital memory units, are constructed using logic gates.
- **Data storage:** logic gates are used in various data storage devices, including registers, RAM (Random access memory) and ROM (Read only memory).
- **Microprocessors and Microcontrollers:** logic gates are integral components of microprocessors an microcontrollers, which are the brain of digital systems.
- **Digital Signal Processing:** Digital processors use logic gates to perform signal processing tasks, such as filtering, modulation and demodulation.
- **Communication Systems:** logic gates play a role in the design of communication systems, including encoding and decoding of data in communications protocols.

- **Control Systems:** logic gates are used in control systems to implement logical decision making processes and control signals.
- **Automation and aerobatics:** Logic gates are used to control the actions of various components and devices.
- **Security Systems:** logic gates are employed in the design of security systems, including access control systems an alarm, systems.
- **Digital Displays:** seven segments displays, used in digital clocks and other devices, utilize logic gates to control the display of numbers and characters.
- **Logic Circuits:** Various types of logic circuits such as adders, multiplexers and demultiplexers are constructed using combination of logic gates for specific purpose.
- **Industrial Control Systems:** Logic gates are used to regulate and control various processes in manufacturing and production.
- **Consumer Electronics:** Logic gates are found in a wide range of consumer electronics, including TVs, audio systems and household appliances.
- **Automotive Electronics:** logic gates a play a crucial role in the electronics of modern vehicles, controlling various functions such as engine management, navigation and entertainment systems

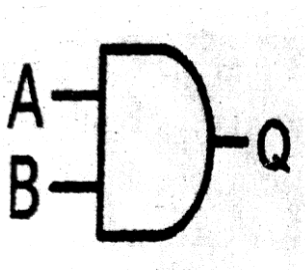
  These are just few examples, and the application of logic gates are extensive across numerous fields

CHAPTER THREE

DESIGN METHODOLOGY

3.1 AND Logic Gate

AND logic gate is *a* D-shaped logic gate with two inputs and one single output, where the D shape in between the input and output is the logic circuit. The relation between input and output values can be explained using the AND Gate



'A' (Input 1)	'B' (Input 2)	'Q' (Output)
0	0	0
0	1	0
1	0	0
1	1	1

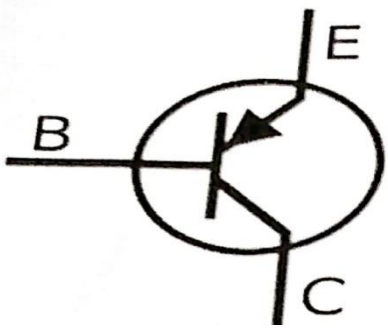
Truth Table shown below.

The equations output can be easily explained using the and gate Boolean Equation, which is q=axb or q=AB. Hence, for an AND gate the output is high only when both the inputs are high.

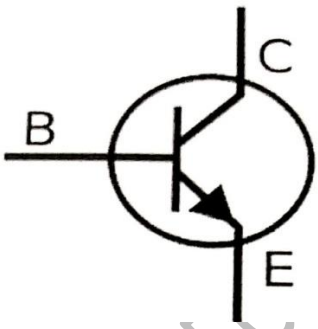
3.2 Transistor

A transistor is a semiconductor device with three terminals that can be CONNECTED to an external circuit. The device can be used as a switch and also as an amplifier to change the values or control the passing of an electrical signal.

For building an AND logic gate using a transistor we would be using BJT transistors which can be further classified into two types: PNP and NPN—Bi-polarJunction Transistors.The circuit symbol for each of them can be seen below.



PNP BJT



NPN BJT

This article will explain to you, how to build AND Gate circuit using transistor. The logic of an AND gate is explained above already and to build an AND gate using a transistor we will follow the same truth table shown above.

3.3 Circuit Diagram and Components Required

The list of components required to build an AND gate using an NPN transistor are listed as follows:

1. Two NPN transistors. (You can also use PNP transistor if available)

2. Two 10KΩ resistors & one 4-5KΩ resistor.

3. One LED (Light Emitting Diode) to check the output.

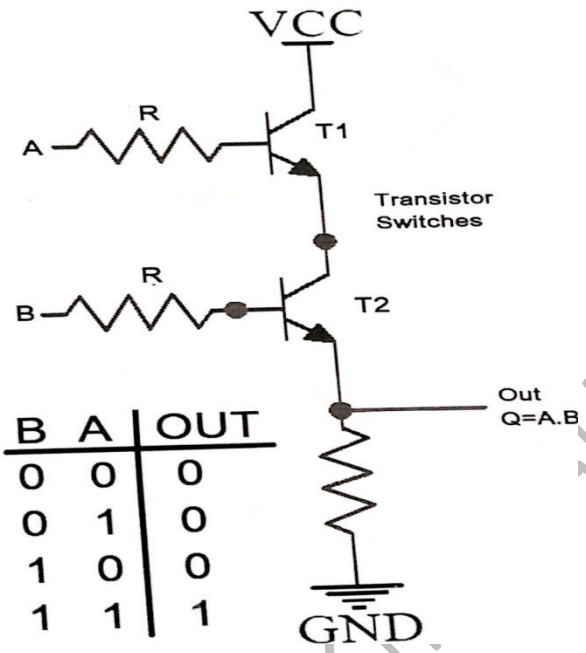
4. A Breadboard.

5. A +5V Power supply.

6. Two PUSH buttons.

7. Connecting Wires.

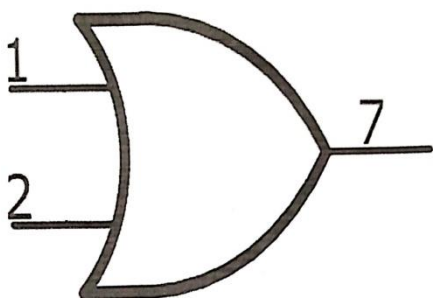
The circuit represents both the inputs A & B for the AND gate and Output, Q which also has a +5V supply to the collector of the first transistor which is connected in series to the second transistor and an LED is connected to the emitter
terminal of the second transistor. The inputs A & B are connected to the base terminal of Transistor 1 and Transistor 2, respectively and the output Q goes to the positive terminal LED. The below diagram represents the above-explained circuit to build an AND gate using NPN Transistor.



The Transistors used in this tutorial AR

3.4 OR Logic Gates

OR gates implement Boolean 'disjunction', that is it helps in finding the maximum of the given binary inputs.



OR gates have the circuit symbol show in figure 1, the curved end is the input and the pointy end is the output. The logic they follow is simple, the output is true if any one input is true or if either input A or input B is true. The OR Gate Truth Table is shown below.

A	B	OUTPUT
0	0	0
0	1	1
1	0	1
1	1	1

This principle can be extended to as many inputs as is needed, the output is true if any one (or at least one) of the inputs is true.

In this article we will be building an OR Logic gate using transistor, if you want to know more on OR gate and how they work you can check this basics of OR gate article.

Parts Required

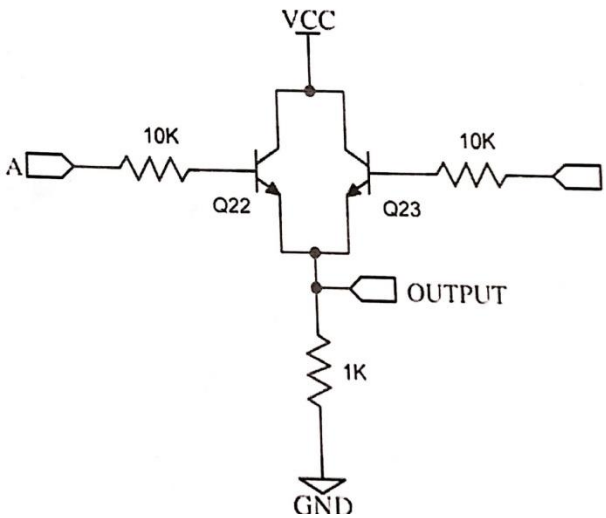
· NPN small signal transistors (2N2222, BC547, etc.)

· 1K resistors

· 10K resistors

OR Gate using Transistor- Circuit Diagram

The first version of the OR gate is the simplest one - it consists of two paralleled emitter followers sharing a common emitter resistor.



The above circuit diagram shows the simplest way to build an OR gate using NPN transistors. When input A is held High, a small current passes through the base of transistor Q22. This turns Q22 on, and (relatively) large current flows from the collector to the emitter. The current is dropped across the emitter resistor. The voltage across the emitter resistor is Vcc - 0.7V, so the output 'follows the input with a gain of a little less than unity. The same thing happens when input B is held High . When both the inputs are held high, both transistors are Active , but the same voltage is dropped across the emitter resistor, and the out-put is still High. This circuit shows perfect OR behavior. Connecting switches and LEDs to the input shows the behavior of the circuit better as you can see in the below images.

3.5 Applications of OR Gates

Along with the AND gate, the OR gate forms an integral part of all logic circuits. For example, if there are ten inputs that a microcontroller needs to monitor, a 10 input OR gate will tell the controller if any one of the inputs is High without needing ten input pins.

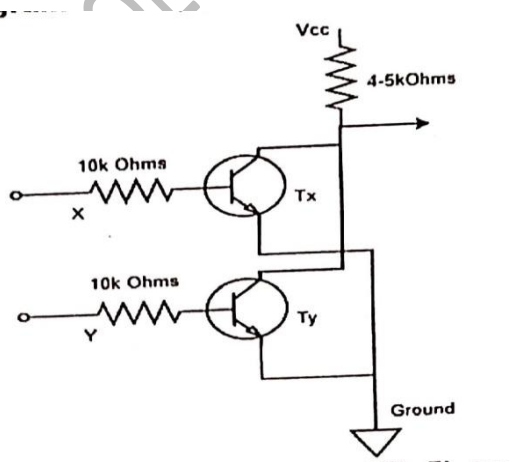
Another interesting applications of logical OR is in your car. The seatbelt warning light turns off only when all the doors are closed, in other words, if any one (or at least one) of the doors are open, the alarm lights up.

Transistor Implementation of Negated OR

To design a NOR-gate using transistor, mostly two bipolar junction transistors are needed. Here, NOR logic gate is constructed using two NPN transistors, 10k Ohms resistors 2, 4-5k Ohm resistor 1, push buttons - 2, wires to establish connections between the components, LED display, and power supply. Below is the NOR gate circuit diagram that explains the functionality.

NOR Using Transistor

As per the above diagram, the two NPN transistors Tx and try are in parallel connection and the output pin has a connection with the collector ends of both the transistors. Both the inputs X and Y are connected to the base terminals of both the transistors correspondingly.



Now, based on the value and combination of inputs applied at the base terminals, the output changes respectively which is as per the NOT OR gate truth table.

To know the exact functionality of the NOR logic gate using a transistor , we need to analyze all four combinations of inputs.

Case 1: When X = 0

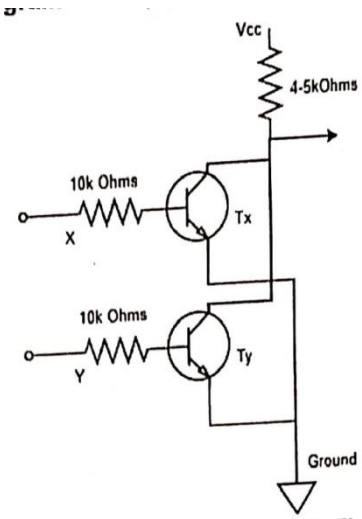
When both the X and Y inputs are at a logic LOW state, then there exists no connection between the emitter and collector end of Tx and Ty. Because of this, the power supply reaches the collector ends of Tx and Ty. As the collector terminals of Tx and Ty are connected with LED display, the power supply reaches to output that corresponds to logic HIGH resulting in LED light glowing.

Case 2:

In this condition, the input for the Tx transistor is 0 and the input for the Ty transistor is 1. When there is the power supply to the circuit, it passes to the collector ends of both Tx and Ty, then the current will pass only to the Ty that has Y input. As the input for X is '0', there will be no connection in between the collector and emitter ends for the transistor Tx whereas there will be a direct connection between emitter and collector ends for Ty. From here, the current reaches the entire circuit, but the emitter end has a connection with the ground which makes a 'O' potential difference between the ground and output terminal. Due to this, LED moves into OFF condition thus making the output as logic LOW.

Use Transistors to Build a NAND Gate

A two-input NAND gate produces a LOW output if both of its inputs are HIGH, and a HIGH output otherwise. It's easy enough to create a NAND gate by using just two transistors. Consider the circuit diagram below.



This is easily implemented on a solder less breadboard. We can use open pushbuttons for the two inputs, BB. We can have a nice visual representation of the output by placing a light-emitting diode (LED) at the point marked AB

If both of the inputs are HIGH, both of the transistors will conduct through their collector-emitter paths (i.e., the north-to-south path in the diagram), which creates a short circuit to ground. This causes the current to bypass the output altogether, which in turn causes the out-put to go LOW.

If either transistor turns off, however, the supply current can't flow through the transistors to ground, so it flows through the output circuit instead. Thus, the output is HIGH if either one of the inputs is LOW. If both inputs are HIGH, the output is LOW.

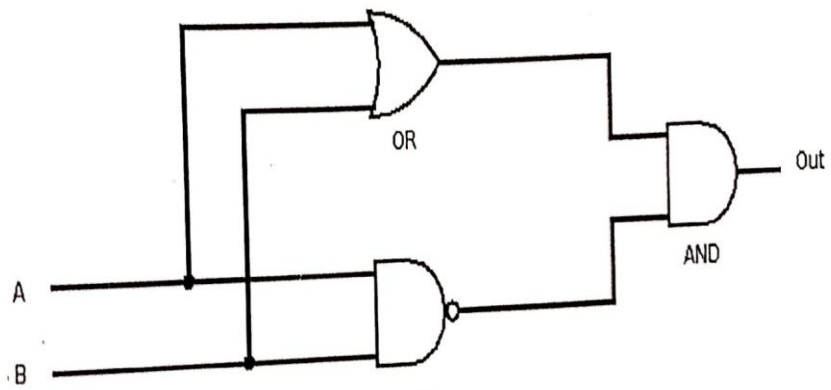
Consequently, the LED will be on until you press both of the push buttons. This action causes both inputs to go HIGH, which causes the output to go LOW and the LED to go dark.

Concept of Operation

An electronic XOR (Exclusive OR) gate performs the digital logic XOR function. This function is generally similar to the standard OR function with one critical difference. For both OR and XOR, the output is high when either of the two inputs are high, and when both inputs are low the output is low. However when both inputs are high, the standard OR circuit will be high but the XOR circuit will be low. A quick look at an Implementation of an OR gate reveals that this difference adds a good deal of complexity to the circuit. As can be seen in the logic diagram below, the XOR gate is built by combining three more simple gates, the OR gate, the NAND gate and the AND gate to produce the desired result.

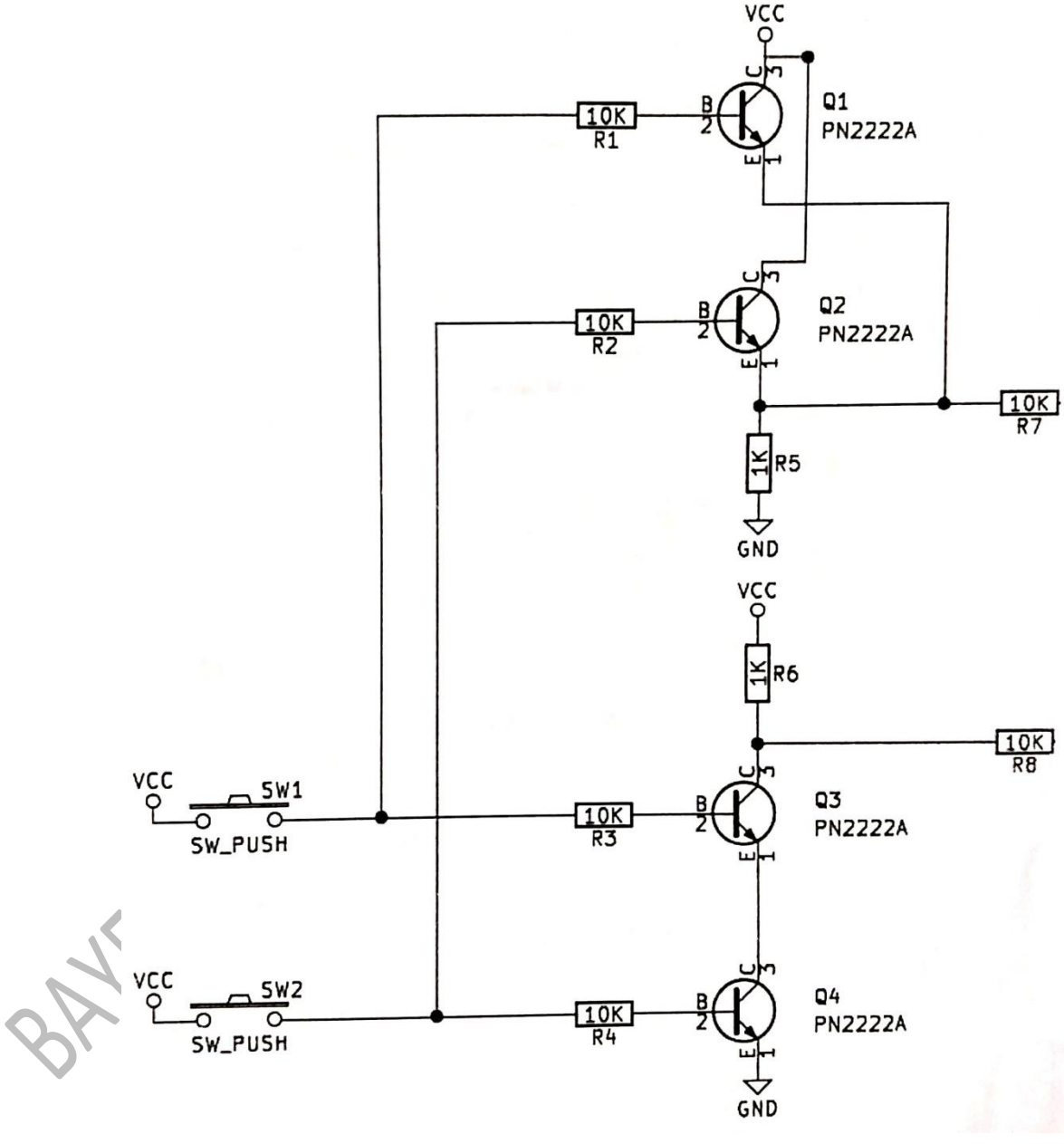
The example transistor XOR gate circuit is implemented here using PN2222A NPN transistors (a variant of the 2N2222A)but many common NPN bipolar junction transistors could be substituted.

Logic Diagram



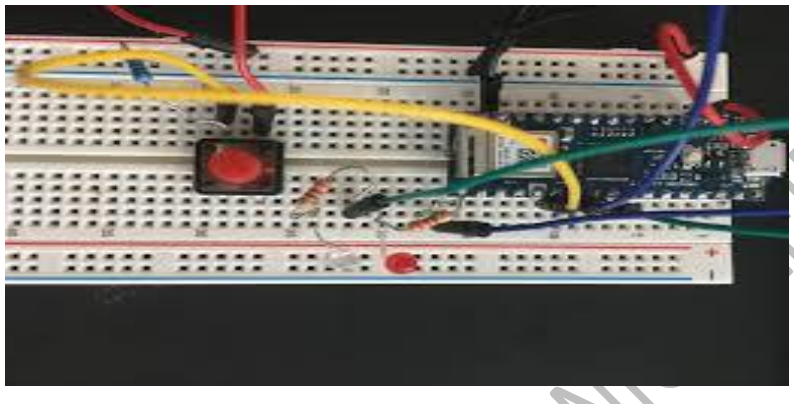
NAND

Schematic Diagram



Breadboard Diagram

Parts



- PN2222A - NPN General Purpose Transistor (x6)
- 10K Resistor (x6)
- 1K Resistor (x3)
- Green 5v LED (x1)
- Tactile Pushbutton Switch (x2)

Truth Table

In		out
0	0	0
0	1	1

1	0	1
1	1	0

PN2222A Pin out

Notes on Implementation

- The LEDs used in the project have a built in current limiting resistor eliminating the need for an external resistor to protect the device. This resistor is shown in the schematic as a resistor with the value "Lim" for completeness.
- The circuit was built and tested at 4.8 volts DC (4 AA NIMH re-chargeable batteries).

- XNOR-gate-using-pass-transistor-logic| Pass-Transistor-
- 'XNOR' gate using pass transistor logic. The truth table of 'XNOR' gate is as shown in Table below. In this gate if the B input is low then right NMOS transistor is ON and the inverted logic value of A is copied to the output F.

When B input is high left NMOS transistor is ON and the logic value of A is copied to the output F, which satisfies the truth table of the XNOR gate. Simplest logic operations of counters, shift registers and numeric displays. For ease of interconnection and understanding, all. necessary inputs and logics indicator are built-in and all logic elements are shown in mimic diagram form on a panel. Unlike many other logic tutors, there are no confusing cross references to integrated circuit data sheets. The integrated circuits are permanently fitted, which avoids the potential student damage and contact problems normally associated with the breadboard type of tutor employing loose ICs and sockets. The logic tutor is robust and fully protected electrically and mechanically against the most common forms of maltreatment.

The work board in this electronics range uses an open printed circuit board construction

and can be conveniently housed in the dedicated systems storage Rack SSR1000.

Breakdown of Expenses

S/N	DESCRIPTION	QT	UNIT	AMOUNT(N)
1	NPN Transistor	6	500	3000
2	10K Resistor	6	500	3000
3	1K Resistor	4	500	2000

4	Green 5v LED	1	1000	1000
5	Breadboard	1	2000	2000
6	Tactile Pushbutton switch	2	1000	2000
7	Connecting wires	20	100	2000
8	Misceleneos			5000
TOTAL				**20,000**

CHAPTER FOUR

4.1 TESTING AND RESULTS.

On power - up from a 5V supply all the bulbs lit fully .this was a good sign as they're possibly the component most likely to have been broke.

Using jumper wires I then proved that all the switches worked correctly and I then tested each of the 4logi gates Individual .The TTL chips were unlikely to have been faulty but then we didn't know what life this logic Tutor has had.

All worked perfectly so on further repairs were needed.

We then built few combinational logic circuits and found the tutor fun to use

CHAPTER FIVE

5.1 SUMMARY AND CONCLUSION

The four input logic tutor is a tool to support students in their leaning of formal logic, and more specifically formal proofs.

It cannot yet be classified as an intelligent tutor, it has intelligent characteristics. It possesses an expert module that enables it to apply rules of inferences and laws of equivalence of propositional logic.

Expert modules constitute the foundation of any intelligent tutor (Anderson 1998). Moreover it's feedback takes into account the input of the users and in many cases, the explanations provided are as enlightening as the ones provided by a good human tutor.

Immediate future work indicates modifying the present tool according to the results of the preliminary evaluations to increase user's comfort.

*. The logic tutor, as described in this paper, with a paper leaner model, i.e. with insight in the knowledge level and difficult of the students. This leaner model uses most, a skill acquisition model (Yacef 1999) and maintains the present ' suitability 's it can help the learner to learn better (Greer & McCalla 1994, kay 1997).

*. The teacher’s module of the logic tutor, whose role is to upstream the information gathered from the students ' interactions with the logic tutor to the

students ' interactions with the logic tutor to the teaching team.

The lecturer for example can visualize the results of the class and adapt his/her teaching accordingly'

This will improve even more the educational value of the tools, both for the students and for the lecturer.

Finally, our aim is to increase the multimedia aspect of this course to encourage flexible and independent leaning. Our logic course has been redesigned through this tool at teaching, training and assessment levels. It in clues more media , like a set of commented solutions afternoon watching mistakes made and difficult encountered by students while solving exercises. Comments include traps to avoid and hints to find solutions.

REFERENCES

Adi Ben -Isreal and Yuri Levin The Geometry of linear separability in Data sets Lins .Alge and Appl.

Anderson, J.R .(1988).The expect module. In foundations of intelligent tutoring systems, M.C.Polson & J.J Richardson,eds Hillsdale: NJ Lawrence Eribaum Associates,,PP .21-53.

Cambridge international General Certificate of secondary Education computer study Guide 2014.

Du Boulay ,B .(2000) .Can we learn from ITSs? Invited talk at the 5th International Conference on intelligent Tutoring systems, Montreal 2000.

Dugdale, S.(1992). The design of computer -based mathematics education. In computer -Assisted Instruction and Intelligent

Greer J. & McCalla, G.(1993), Non - diagnostic intelligent tutoring systems, proceedings of the 15th under sevice / industry training systems and education conference. orlando, Florida,PP .450-459.

Haifa conference on matrix Theory, January 3 -5 ,2005 .

Kay,J.(1997). Leaner know thyself students models to leaner control and responsibility. Keynote address at ICCE'97, Kuching.

Larkinard R.W Chabay ,eds to. Lawrence Eribaum, PP 11-45.

Merceron ,A. (2001) . Languages and Logic. Pearson Education Australia.

S.N Sivanandam, S.N Deepa, (2006) introduction to Neural Networks using Matlab 6.0,Tata - Hill Education,.

Tutoring systems: shared goals and complementary approaches. J.H

Warren S. McCulloch And Walter Pitts, A Logical calculus of the ideas immanent in nervous activity, Bulletin of Mathematical Biophysics Volume 5,1943 pg: 115-133

Yacef, K. (2000) . providing an intelligent tutoring aid to assist undergraduate teaching. SESQUI Internal proposal report, university of Sydney, Australia

Yacef,k (1999) towards an intelligent instructor - assistant system for training operator's of complex and dynamic skills. ph .D Dissertation. university of Paris 5and INRIA.