

Experiment 2: Investigation and Implementation of Boolean Function Using Fundamental TTL Logic Gates

Peter Dranishnikov

U0000005258

EEL3702C: Digital Logic Design

Section 04

Experiment 2: Investigation and Implementation of Boolean Function Using Fundamental TTL Logic Gates

Objectives:

1. To derive the truth table of given Boolean function of $F(x, y, z) = x'y'z + x'yz + xy'z' + xy'z$ and simplify the Boolean function using Boolean algebra.
2. To design and implement the original Boolean function and simplified Boolean function using fundamental logic gates.

Experimental Equipment:

1. 74LS04 1-input NOT TTL IC
2. 74LS08 quad 2-input AND TTL IC
3. 74LS32 quad 2-input OR TTL IC
4. DC Voltmeter
5. +5V Power supply
6. Bread Board
7. Light Emitting Diode
8. Connecting Wires

Methods/Procedure

1. Derive the truth table of the given Boolean function

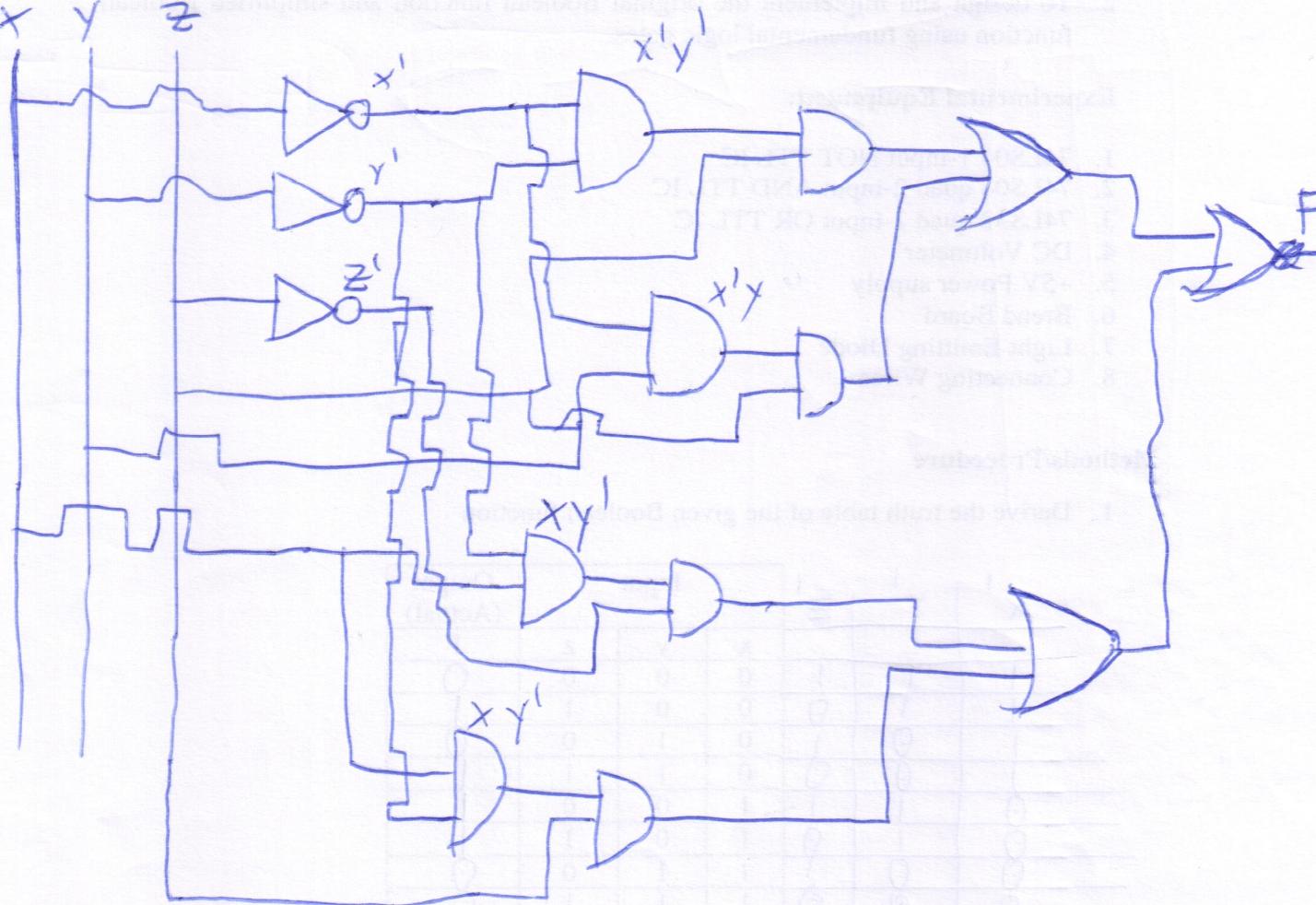
x'	y'	z'	Input			Output (Actual)
			x	y	z	
1	1	1	0	0	0	0
1	1	0	0	0	1	0
1	0	1	0	1	0	0
1	0	0	0	1	1	0
0	1	1	1	0	0	0
0	1	0	1	0	1	0
0	0	1	1	1	0	0
0	0	0	1	1	1	0

2. Draw the Logic diagram using fundamental TTL logic gates for the given Boolean function.
3. Implement the logic circuit in Breadboard and verify the truth table

$$\begin{aligned}
 F(x, y, z) &= x'y'z + x'y\bar{z} + xy'z + xy\bar{z} \\
 &= x'z(y' + y) + xy'(z' + z)
 \end{aligned}$$

$$= x'z + xy'$$

$x \quad y \quad z$



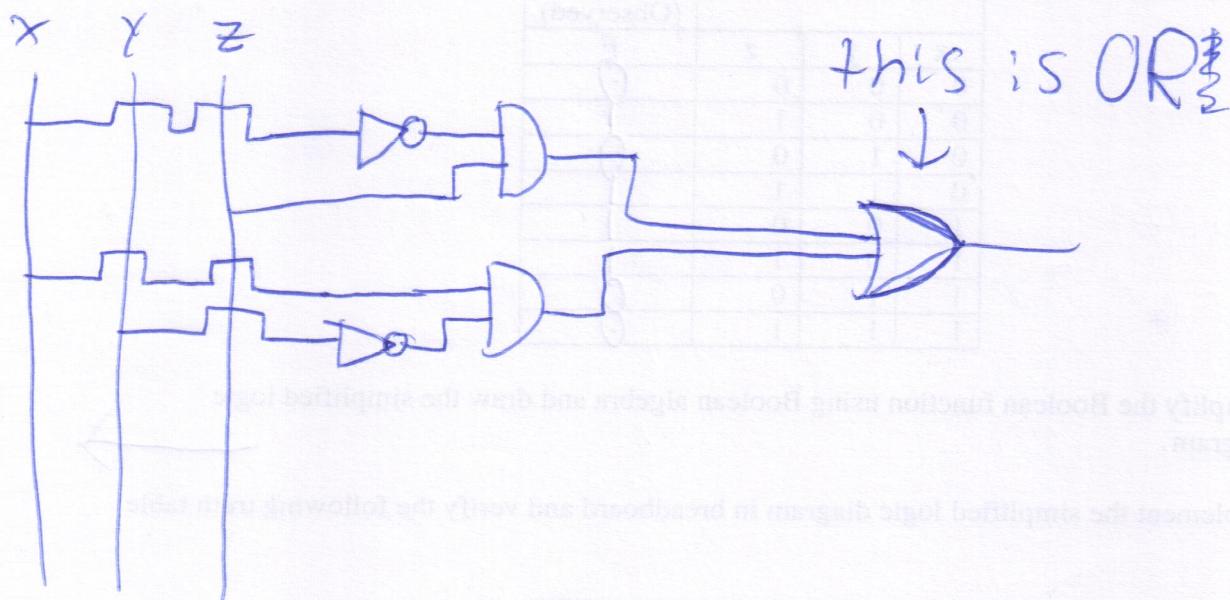
Input			Output (Observed)
x	y	z	F
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	0

4. Simplify the Boolean function using Boolean algebra and draw the simplified logic diagram
5. Implement the simplified logic diagram in breadboard and verify the following truth table

Input			Output (Actual)
x	y	z	F
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	0

6. Analyze the original Boolean function and simplified Boolean function and write a discussion in your report what you learn from this experiment

$$= x'z + xy' \text{ (work on previous page)}$$



Input 0 (Binary)	Input 1 (Binary)	Output (Binary)
0	0	0
0	1	0
1	0	0
1	1	1

Appendix

Integrated Circuits (ICs) pin diagram

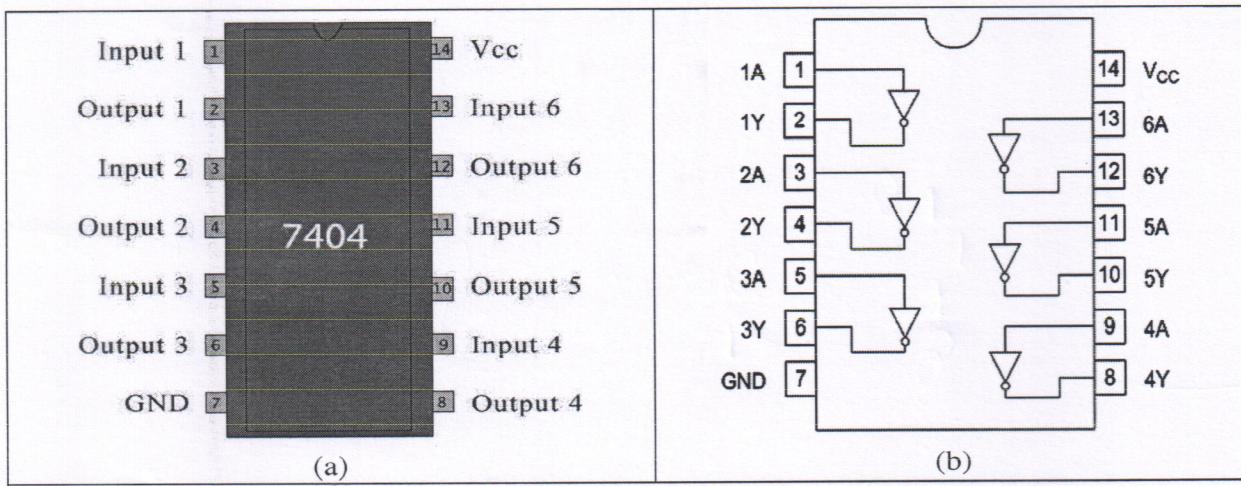


Figure 1. 74LS04 Integrated Circuits (a) Top view and (b) Pin diagram

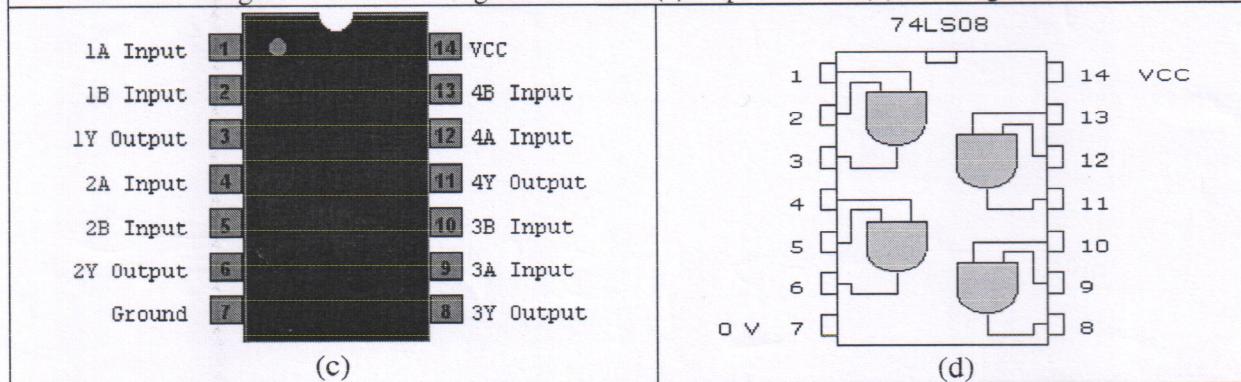


Figure 2. 74LS08 Integrated Circuits (c) Top view and (d) Pin diagram

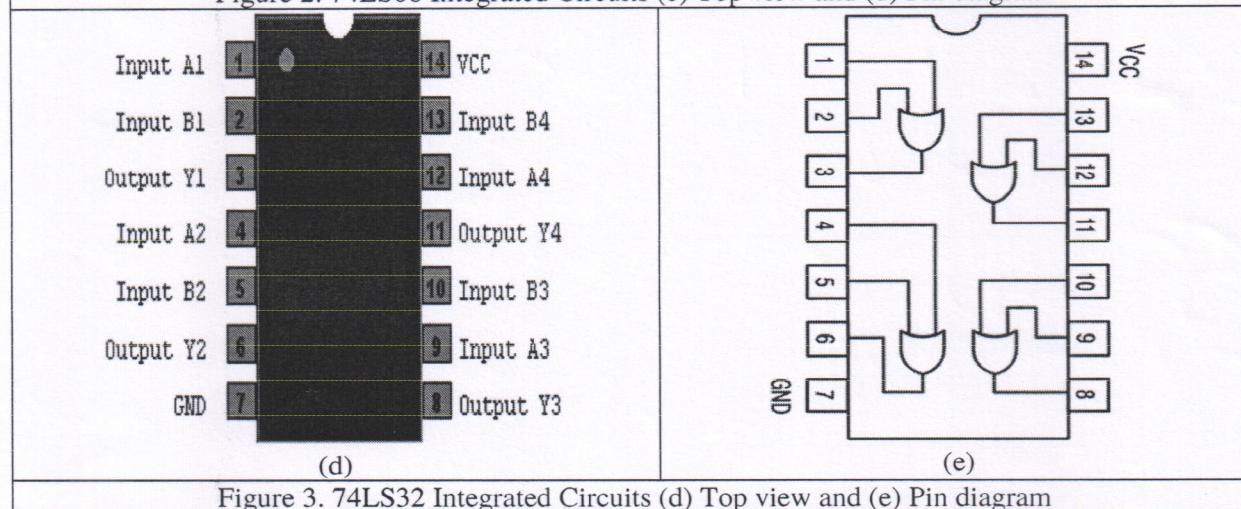


Figure 3. 74LS32 Integrated Circuits (d) Top view and (e) Pin diagram

EEL3702C
Lab Check off Sheet

Please bring a print out of this sheet before demonstrating your working circuit. Attach this check off sheet with the Lab report.

Note: Lab check off sheet should be signed by the Instructor or TA. Lab reports without the check off sheet will not receive credit.

Name: Rofter Dronishnikov
Section: 04
Experiment: Experiment 2

Lab Demonstration Comments:

Unscripted M/02/02
All work Bl/02/05

Signature of Instructor/TA:

Date:

Results and Discussion:

The unsimplified circuit matched the truth table of the original unsimplified function exactly, although the circuit construction was very time-consuming. Two 74LS08 chips were required for the unsimplified circuit. The simplified circuit functioned correctly and exactly as the unsimplified function in the final demonstration (signed later than the laboratory session, see checkoff sheet for more information). The simplified circuit initially had connection problems, but were corrected before the final demonstration.

Conclusion:

Using the methods of boolean algebra, an initially large function may be simplified. The simplified function is usually easier to construct and simpler to debug than the unsimplified expression, saving significant development time and costs while achieving the same result of the initial function.