Preparation of Papers for IEEE TRANSACTIONS and JOURNALS (October 2016)

Saisao Kham, *IEEE*, and Harou Xie, *IEEE*

Abstract—In the experiment we use a function generator, a dual trace oscilloscope, a digital multi meter, and a dc power supply. At the first, we measuring the frequency dependence of a signal, adjust the function generator to produce a 1 Khz sine wave with peak-to-peak amplitude of 1V. We also collect the input and output data to save screen image as .bmp from oscilloscope and binary data to USB drive. During this experiment, we will be introduced with digital circuits which are electronically be able to handle digital signals such that discrete bands of analog levels rather than by continuous ranges as used in analog electronics. All levels within a band of values represent the same information state. Because of this discretization, relatively small changes to the analog signal levels due to manufacturing tolerance, signal attenuation or noise do not leave the discrete layer, and as a result are ignored by signal state sensing circuitry. In most cases, the number of these states is two, and they are represented by two voltage bands: one near a reference value typically termed as "ground" or zero volts, and the other a value near the supply voltage. These correspond to the false and true values of the Boolean domain respectively. Digital techniques are useful because it is easier to get an electronic device to switch into one of a number of known states than to accurately reproduce a continuous range of values. Digital electronic circuits are usually made from large assemblies of logic gates, simple electronic representations of Boolean logic functions.

We show how the unique character of logic programming can be exploited for the purpose of specifying and automatically reasoning about electrical circuits. Although propositional logic has long been used for describing the truth functions of combinational circuits, the more powerful predicate calculus on which logic programming is based has seen relatively little use in design automation. We have used sequential simulation methods to solve problems in gate assignment, specialization of standard definitions, and determination of signal flow.

I. Introduction

Digital circuits are circuits dealing with signals restricted to the extreme limits of zero and some full amount. This stands in contrast to analog circuits, in which signals are free to vary continuously between the limits imposed by power supply voltage and circuit resistances. These circuits find use in “true/false” logical operations and digital computation. Integrated circuits providing a multitude of pre-engineered functions are available at very low cost, benefitting students, and professional circuit designers. Most integrated circuits provide the same functionality as “discrete” semiconductor circuits at higher levels of reliability and at a fraction of the cost.

II. Guidelines For Manuscript Preparation

Preparation by collecting necessary components for the experimental such as browsing and searching the web for “flip-flop” and “ripple counter”. Follow the truth table of respective logic gates and flip flop. Knowing the exact input and output of components i.e. one 74LS00, two 74LS74, and one 74LS86.

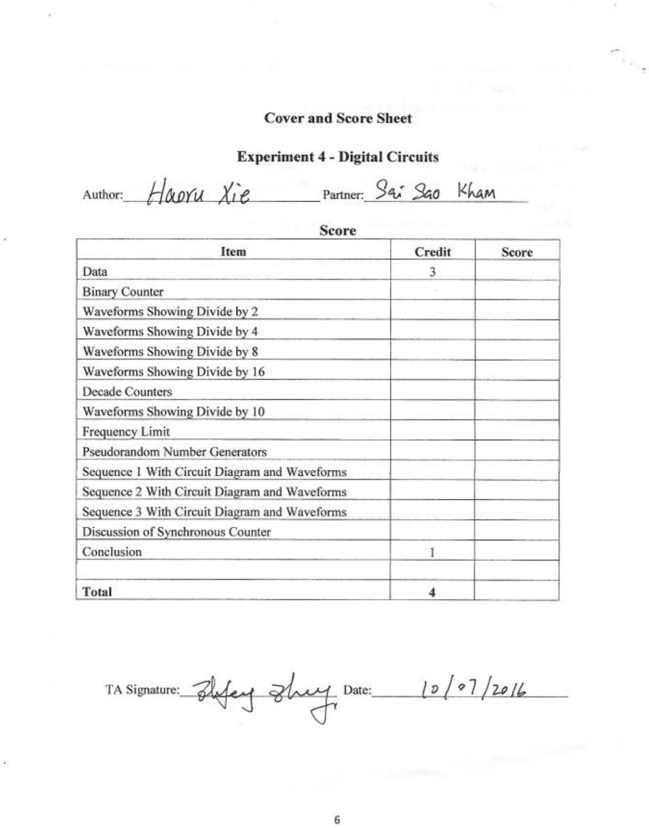
III. Math

Offset for function generator
2^0 + 2^1+2^2 + 2^3 for logic gates

IV. Units

V(voltage)
A(Ampere)
Hz(Frequency)

V. Cover and Score Sheet



Cover and Score Sheet

Experiment 4 - Digital Circuits

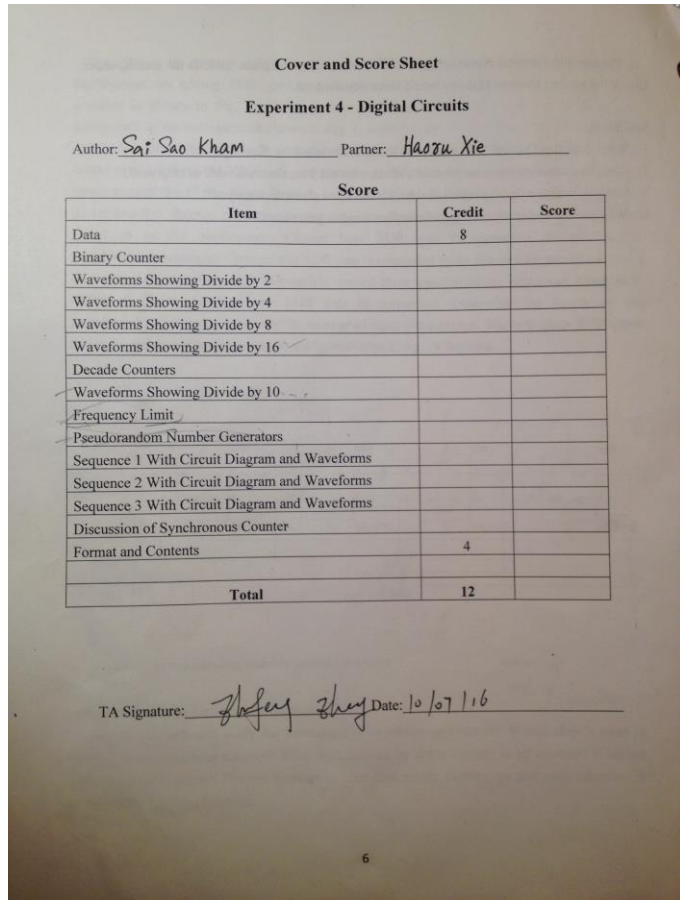
Author: Haoru Xie Partner: Sai Sao Kham

Score

Item	Credit	Score
Data	3	
Binary Counter		
Waveforms Showing Divide by 2		
Waveforms Showing Divide by 4		
Waveforms Showing Divide by 8		
Waveforms Showing Divide by 16		
Decade Counters		
Waveforms Showing Divide by 10		
Frequency Limit		
Pseudorandom Number Generators		
Sequence 1 With Circuit Diagram and Waveforms		
Sequence 2 With Circuit Diagram and Waveforms		
Sequence 3 With Circuit Diagram and Waveforms		
Discussion of Synchronous Counter		
Conclusion	1	
Total	4	

TA Signature: Date: 10/07/2016

6



Cover and Score Sheet

Experiment 4 - Digital Circuits

Author: Sai Sao Kham Partner: Haoru Xie

Score

Item	Credit	Score
Data	8	
Binary Counter		
Waveforms Showing Divide by 2		
Waveforms Showing Divide by 4		
Waveforms Showing Divide by 8		
Waveforms Showing Divide by 16		
Decade Counters		
Waveforms Showing Divide by 10		
Frequency Limit		
Pseudorandom Number Generators		
Sequence 1 With Circuit Diagram and Waveforms		
Sequence 2 With Circuit Diagram and Waveforms		
Sequence 3 With Circuit Diagram and Waveforms		
Discussion of Synchronous Counter		
Format and Contents	4	
Total	12	

TA Signature: Date: 10/07/16

6

VI, Some Common Mistakes

For digital circuit, we need understand how it is supposed to work. It is not an easy task for us to understand a very complex circuit. Simple circuits such as resistors in parallel, resistors in series, an RC circuit, etc. are easy to understand, however. In this experimental, we typically design complicated circuits by using simple circuits as "building blocks." It is important for us to understand the function of each piece, or "sub- circuit," in order to understand how the circuit works as a whole. We have learnt how each of the various electronic components (e.g. resistor, capacitor, op-amp, transistor) is supposed to behave, i.e. the current-versus-voltage (I-V) characteristics of each component. We need to be aware of such that how many terminals does the component have, what is the voltage or current of a certain terminal when we apply a certain voltage or current at another one of its terminals. Changes vary voltages and currents AC signals.

During the lab experimental, there are couple mistakes need to be aware of such that measuring the correct inputs and outputs, attach jumper cable to the correct port on breadboard, using the right components.
Need to make sure and prepare not to forget about

VII. Guidelines for Graphics Preparation and Submission

When building digital circuits using integrated circuit “chips,” and it is highly recommended to use a breadboard with power supply “rail” connections along the length. These are sets of holes in the breadboard that are electrically common along the entire length of the board. Connect one to the positive terminal of a battery, and the other to the negative terminal, and DC power will be available to any area of the breadboard via connection through short jumper wires.

VIII. Conclusion

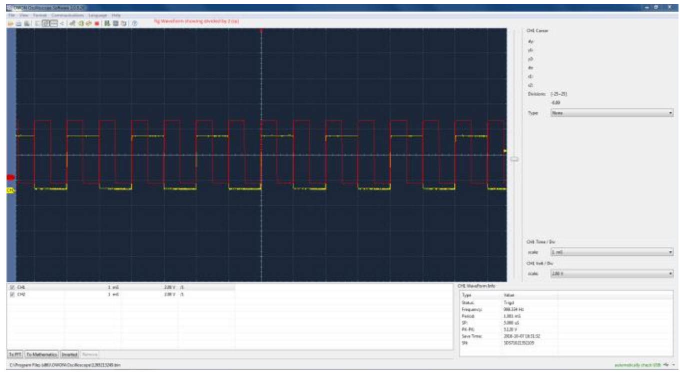
In this experiment,we performed digital tasks by using selection of circuits.As simple circuits use few ICs while complicated circuits may require a field programmable gate array or a custom VLSI to implement. A flip-flop is a bistable device .Therefore, we used D flip flop. The output responds to the input by switching between two stable states, high and low. Since it stays in the same state until new input arrives, it serves as a storage device, i.e., a single-bit memory. There are a few variations, e.g., RS, D, JK, and T flip-flops.

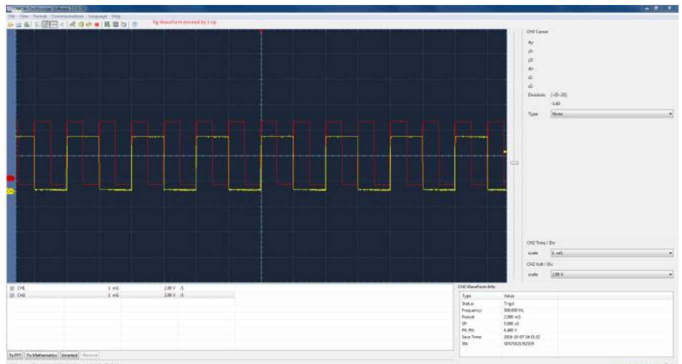
We used 74LS00, two 74LS74, one 74LS86, and respective function table for this experiment.

IX. Data Binary Counter

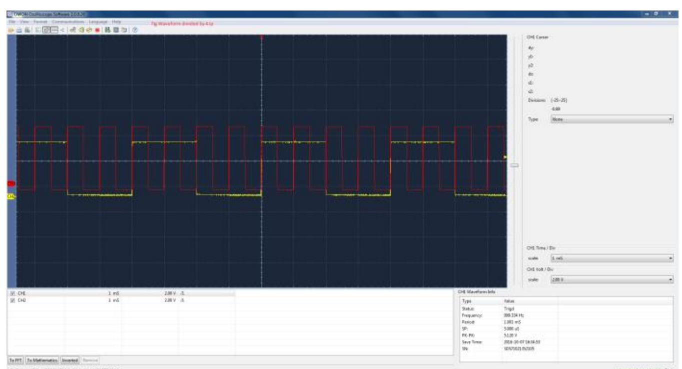
A synchronous binary counter counts from 0 to (2^N)-1, where N is the number of bits/flip-flops in the counter. Each flip-flop is used to represent one bit. The flip-flop in the lowest-order position is complemented/toggled with every clock pulse and a flip-flop in any other position is complemented on the next clock pulse provided all the bits in the lower-order positions are equal to 1

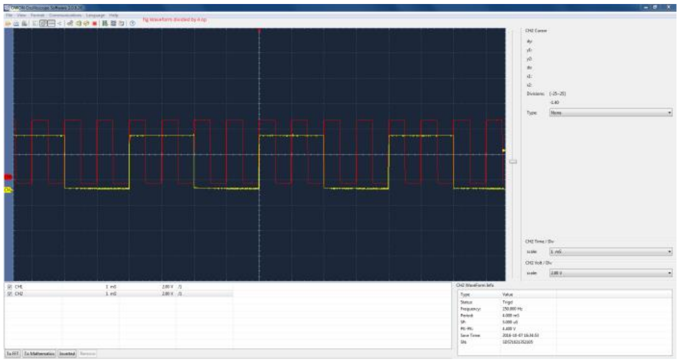
Waveforms Showing Divide by 2



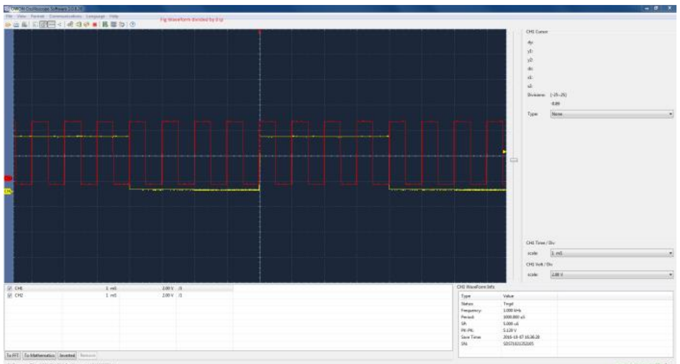


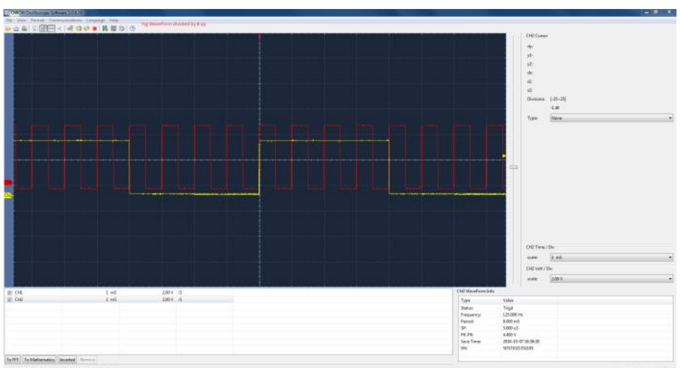
Waveforms Showing Divide by 4



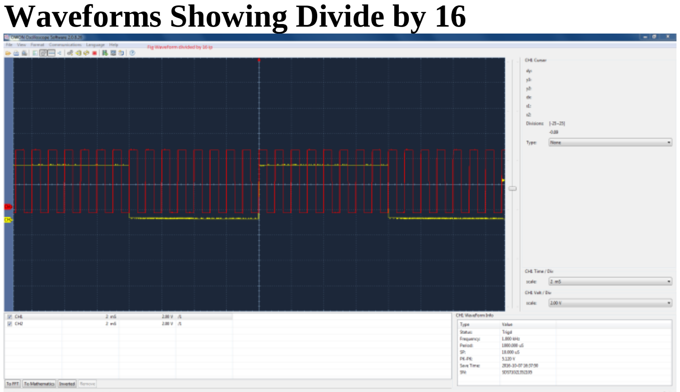


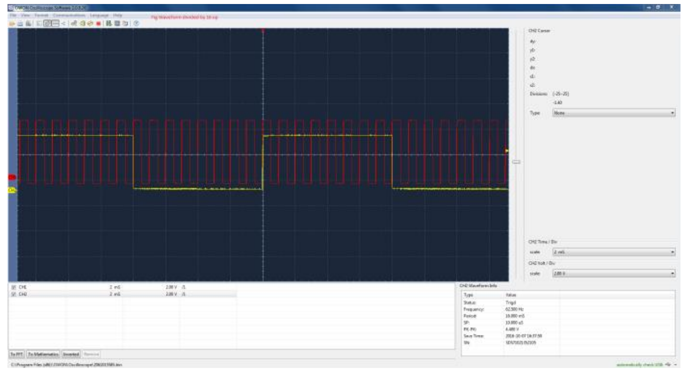
Waveforms Showing Divide by 8





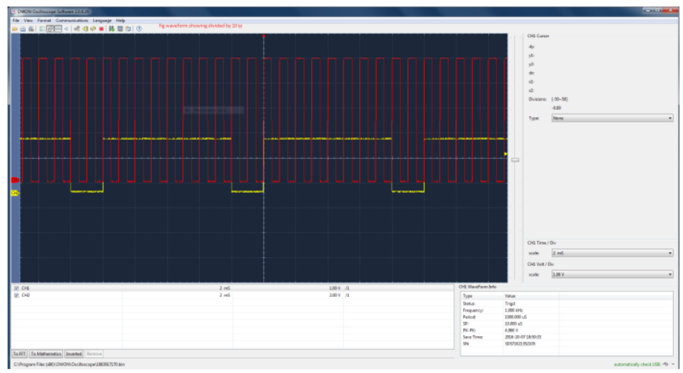
Waveforms Showing Divide by 16

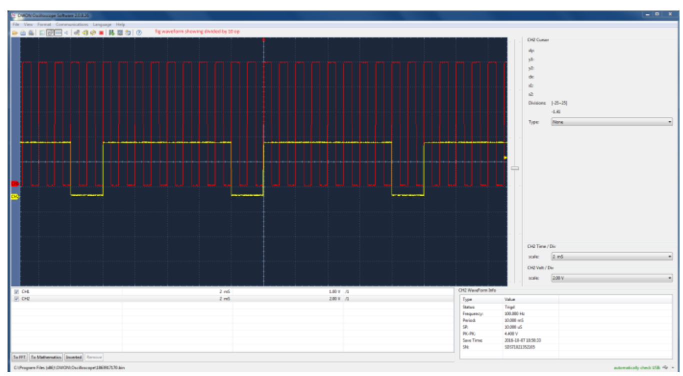




X. DECADE COUNTERS

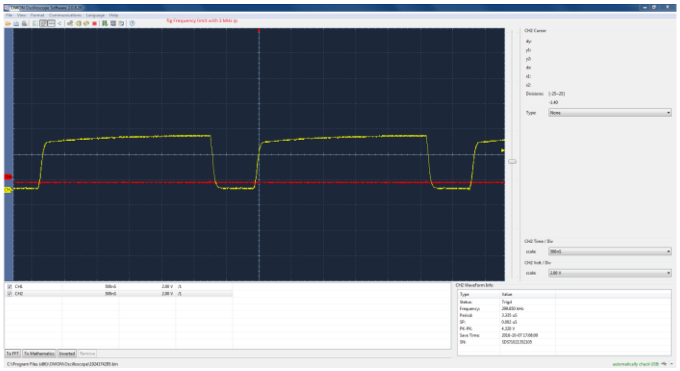
Waveforms Showing Divide by 10

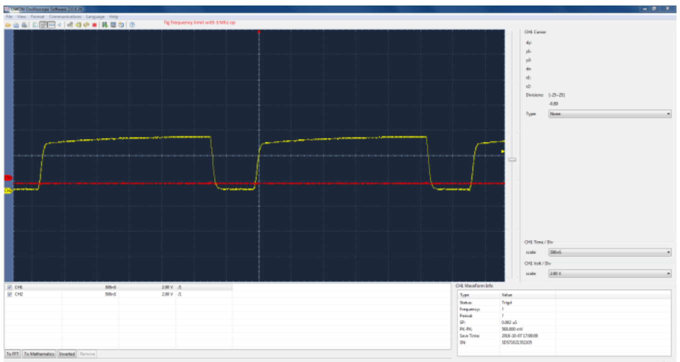




XI. Frequency Limit

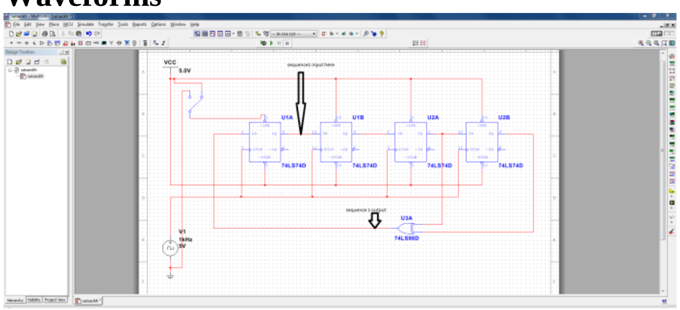
Increase the frequency to 3M Hz.

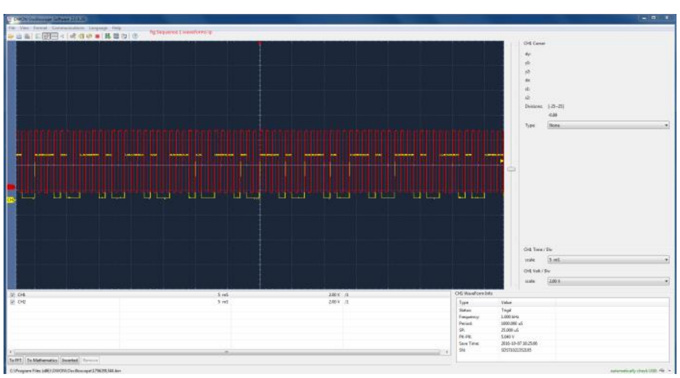


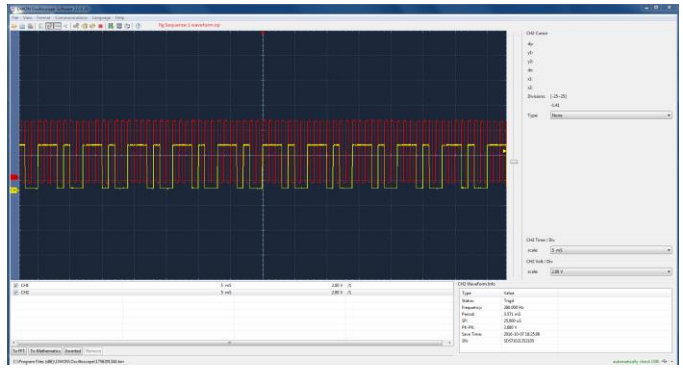


XII. **Pseudorandom Number Generators**

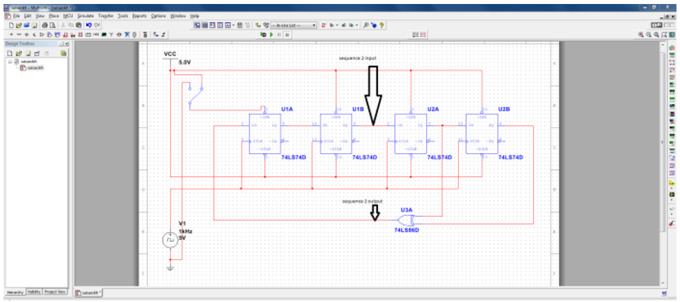
Sequence 1 with Circuit Diagram and Waveforms

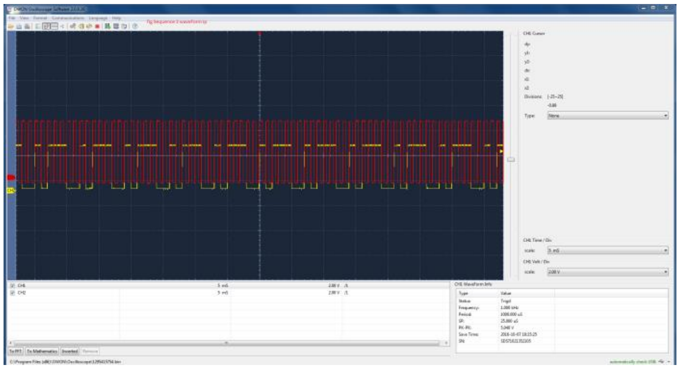


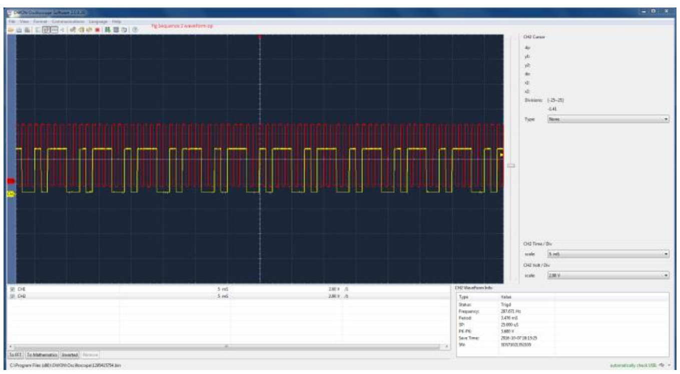




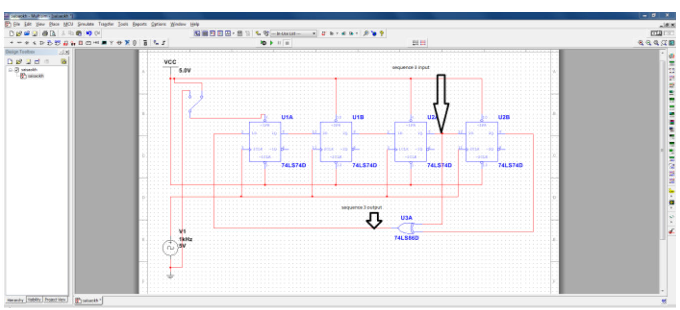
Sequence 2 with Circuit Diagram and Waveforms

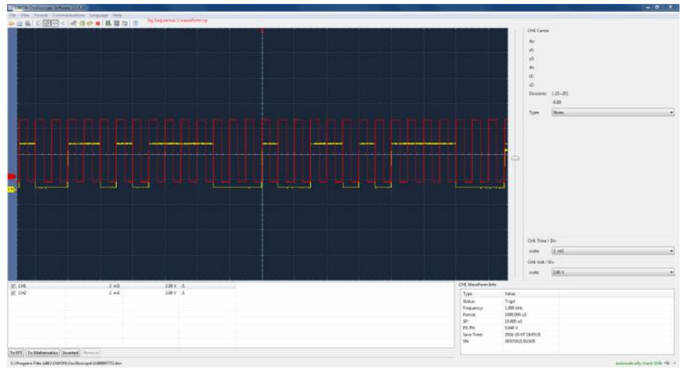


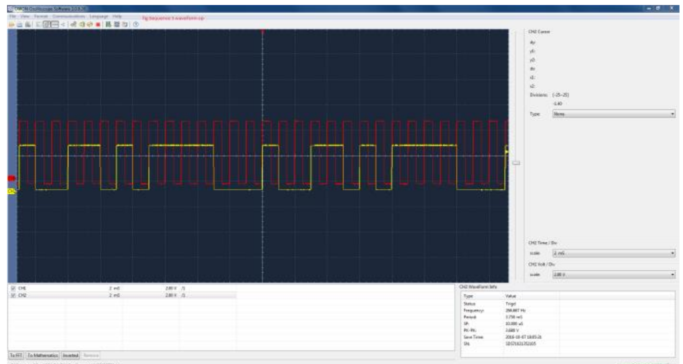




SEQUENCE 3 WITH CIRCUIT DIAGRAM AND WAVEFORMS







XIII. Discussion of Synchronous Counter

A synchronous binary counter counts from 0 to 2^N-1, where N is the number of bits/flip-flops in the counter. Each flip-flop is used to represent one bit. The flip-flop in the lowest-order position is complemented/toggled with every clock pulse and a flip-flop in any other position is complemented on the next clock pulse provided all the bits in the lower-order positions are equal to 1. For example A_4 A_3 A_2 A_1 = 0011. On the next count, A_4 A_3 A_2 A_1 = 0100. A_1, the lowest-order bit, is always complemented. A_2 is complemented because all the lower-order positions (A_1 only in this case) are 1's. A_3 is also complemented because all the lower-order positions, A_2 and A_1 are 1's. But A_4 is not complemented the lower-order positions, A_3 A_2 A_1 = 011, do not give an all 1 condition. To implement a synchronous counter, we need a flip-flop for every bit and an AND gate for every bit except the first and the last bit.

From the schematic provide in lab description, we can see that although the counter is synchronous and is supposed to change simultaneously, we have a propagation delay through the AND gates which add up to give an overall propagation delay which is proportional to the number of bits of the counter. To overcome this problem, we can feed the outputs from the flip-flops directly to a many-input AND gate as follows :

The BCD counter is just a special case of the MOD-N counter (N = 10). BCD counters are very commonly used because most human beings count in decimal. To make a digital clock which can tell the hour, minute and second for example, we need 3 BCD counters (for the second digit of the hour,minute and second), two MOD-6 counters (for the first digit of the minute and second), and one MOD-2 counter (for the first digit of the hour).

References

Basic format for books:

[1] SEDRA. SMITH, “Microelectronic Circuit,” in *Title of His Published Book, 7*th ed. New York.

[2] https://en.wikipedia.org/wiki/Digital_electronics

[3] http://www.circuitstoday.com/logic-gates

First A. Author (M’76–SM’81–F’87) Author became a member Tau Sigma in 2015, a senior standing student in computer engineering department at University at Buffalo in 2016, earned bachelor of science degree in mechanical engineering Yangon, Burma, 2005, Associate Degree in computer science, and liberal science of arts in mathematic from Erie Community College, Buffalo, NY, 2016. Author, S Kham worked as a volunteer for 3 years UNHCR in Kuala Lumpur, Malaysia, 2012.

Author became a member Tau Sigma in 2015. This author was born in Henan province, China, in 1994. He is junior international student in the New York state university at buffalo. His major is electronic engineering.