FACULTY OF ENGINEERING

(SCHOOL OF COMPUTING)

SCSR1013 (SECTION 01): DIGITAL LOGIC

LAB 4

MINI PROJECT PHOTOCOPYING (XEROX) MACHINE

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DEDICATION

This report is dedicated foremost to God Almighty for his favour, mercy and grace upon our life especially during our four months Digital Logic studies at University Teknologi Malaysia and during our mini project designing.

We would also like to dedicate it to our beloved parents and siblings for their love and support and everyone else that contributed towards making this report with successful one.

ACKNOWLEDGMENT

It brings us great pleasure for an opportunity to submit our report. For this, we deeply indebted and sincerely thankful to Mr. Muhalim Bin Mohamed Amin as our lecturer of Digital Logic for his help, invaluable guidance and elating encouragement throughout the course of this report.

We are also thankful to Farah Syuhada Binti Abu Seman as senior that had done this project in her first semester as she is in 3rd year of Computer Network for her timely advice and help which was a constant source of inspiration.

We acknowledge with thanks to our classmates as well for their keen interest and a lot of cooperation during finishing and understanding on how this report need to be done.

Finally, we are deeply thankful to all people that contributed in sharing their ideas and inspired us in completing this project.

REPORT CONTENT

a. The design of the 3-bit Xerox Machine in Deeds

This project was design to make copies of paper like usually we use on photocopying machine. We decided to add a features which is it come with an LED that can light off if the required number of copies has been met.

b. Enhancement of the Xerox Machine

1. The background

3 different components were implemented on a single GAL device, those components were

- 3-bit Count Up Counter
- 3-bit Comparator
- Clock Disabler

The *WinCUPL compiler* and the *universal assistants* were needed to generate the Integrated Circuit (IC). The appendix was read and had done as the given guidance.

2. The problem

First output will be display to user that enter the amount of copies paper that they want. So then, the counter will count the number that have been entered by user at the first to photocopy. The machine will stop photocopied once the second output required number of copies produced.

Sometimes, the user did not notice either the machine was stop photocopied. So, this problem will slower the user works because there is nothing will notified them.

3. Suggested solution

This project required 3-bit. So, it will come with three core components are counter, comparator and clock disabler. The purpose of this three core components to functioning this Xerox Machine. The first core component is counter which it will determine the number copies that have been entered by user at first output while the second component is comparator will determine whether the required number of copies that has been met with first output. The last core component is the clock disabler that will disable the clock and stop counting the counter from counting. The machine will display the required number of copies and the amount that has been produced.

For the problem that user faces, we decided to add LED that can be lighten up and off. This purpose is to notify the user if the required number of copies produced when the clock disabler disabled the clock for stopping the counter. The LED will always lighten up until required number of copies and the amount that has been produced, then it will lighten off.

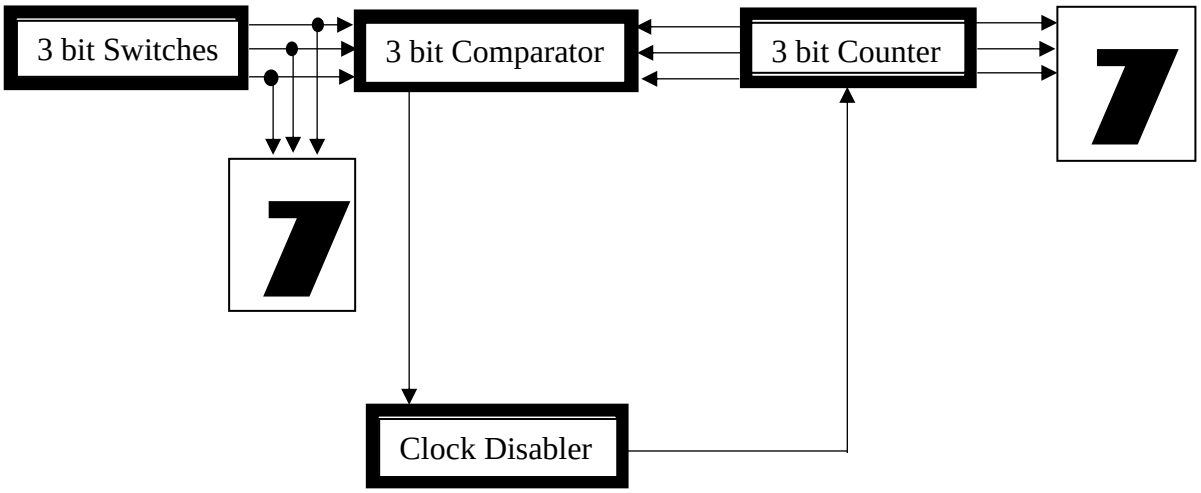

Figure 1: A block diagram

4. Requirement

a) Switches
   - To set the required number of copies.

b) Counter
   - Counter is a digital device and the output of the counter includes a predefined state based on the clock pulse applications. The output of the counter can be used to count the number of pulses. It to count the number of copies that actually has been made.

c) Comparator
   - Comparator is designed to compare the relatives magnitudes of binary number which is this project its compare the number of copies required with the number of copies produced.

d) Clock Disabler
   - It stop the counter operation.
   - When Copies produced < Required Copies, the counter will count up else the counter operation will stop counting.

5. System Implementation

Switches

- Switches was provided by the ETS 5000 Digital Training Kit.

Counter

- Counter was controlled by the clock which is the counter is a count up by 3 bit.
- Counter is implemented as a WinCUPL code that will be programmed into GAL.

```
/***** Function Comparator************************/
sameCmp = !(a0$b0)&!(a1$b1)&!(a2$b2) ;
diffCmp = !sameCmp ;

/**** Function Clock Enabler *********************/
clkEn=startPrt & diffCmp ;

/*** Function Counter 3 Bit UP *******************/
field count = [q2..0];
$define s0 'b' 000
$define s1 'b' 001
$define s2 'b' 010
$define s3 'b' 011
$define s4 'b' 100
$define s5 'b' 101
$define s6 'b' 110
$define s7 'b' 111

count.ar=reset;         /*  connect reg AR to reset (Asyn Mode)  */
count.sp=preset;        /*  connect reg AR to preset (Syn Mode)  */

sequence count {
       present s0 if clkEn next s1;
              default next s0;
       present s1 if clkEn next s2;
              default next s1;
       present s2 if clkEn next s3;
              default next s2;
       present s3 if clkEn next s4;
              default next s3;
       present s4 if clkEn next s5;
              default next s4;
       present s5 if clkEn next s6;
              default next s5;
       present s6 if clkEn next s7;
              default next s6;
       present s7 if clkEn next s7;
              default next s7;

}
```

Figure 2: WinCUPL code 3 bit counter

Comparator

- Comparator is a combinational circuit which is can be designed by using XNOR gate.

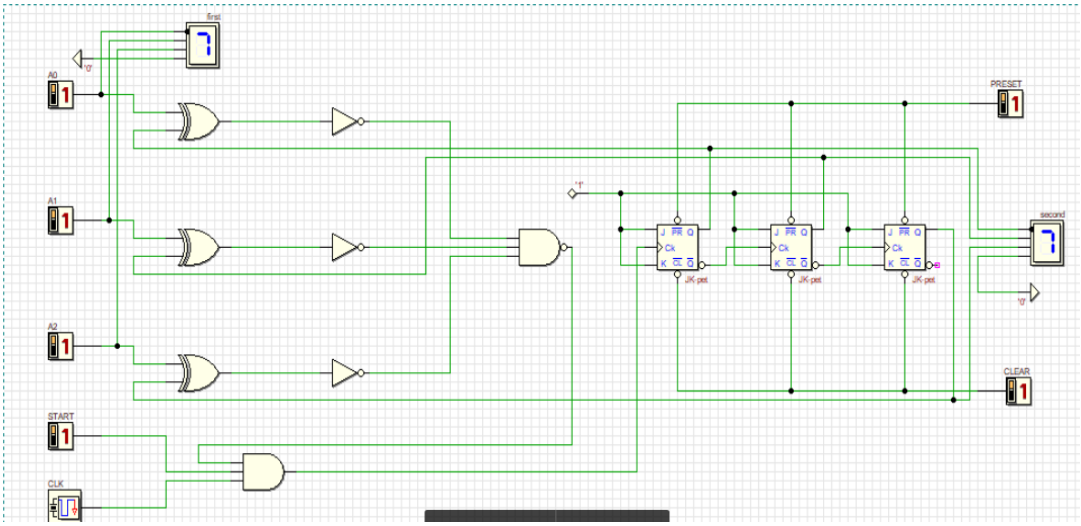

Figure 3: 3 Bits Comparator

Clock Disabler

- Circuit that disable the clock so the counter will stop counting.

6. Reflection

My reflection on this assignment project is where we need to know how to use the Deeds Simulator and WinCUPL in this project. There are some difficulties that we face when trying to implement this project in which we use WinCUPL present, there are a lot of mistakes as an example we forgot to put curly brackets, semicolon in each line, and a run time error when we were too long for the program. At first we did not understand the purpose of this project but after discussing with classmates we can imagine how this project will be done.

During drawing logic gate using Deeds Simulator we have difficulty connecting features with logic circuit. We ask for help from our friends who know how to use the feature. In addition, we also do not know how to build a logic circuit based on this assignment project. We met a senior and asked for help to solve our problem. Our senior named Farah Syuhada who is in the third year, faculty of engineering, school of computing (Networking). Thanks to her because we finally finished our logic circuit. Our project went smoothly.

REFERENCES

- Digital Logic Book (Abd.Bahrim Yusoff, Mohd Foad Rohani, Mazleena Salleh, Ismail Fauzi Isnin) – Fifth Edition.