LAB3. SWITCHES, LIGHTS, AND MULTIPLEXERS

Lab. Hour: 7:00~10:00pm. 21th and 23th Mar. 2017
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1. INTRODUCTION

In this lab, we will study how to connect simple input and output devices to an FPGA chip and implement a circuit with DE2 board. We will use the switches as input signal to the circuit and red LED, green LED, and 7-segment displays as output devices on the DE2 board. So, you will learn

- How to use 18 switches (sw 17-0) as input signal
- How to use 18 red LEDs (ledr 17-0), 9 green LEDs (ledg 8-0), and 8 7-segments as output devices
- Make 8x1 multiplexer

2. PROBLEM SPECIFICATION

We use inputs and outputs as follow:

- Input

Input	Meaning
sw 7-0	8-bit input signals
sw 17-15	3-bit multiplexer controller

- Output

Output	Meaning
ledr 7-0	checking the input signal
ledr 17-15	checking multiplexer controller
ledg 7-0	output signal
hex 3-0	displaying your birthday
hex 5-4	displaying hexadecimal number
hex 6	displaying input signal's bit number go by multiplexer
hex 7	signal value

- Examples

case 1: input signal – 11111111 / multiplexer controller – 001 / birthday – 21 Mar.

#	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
sw	0	0	1	x	x	x	x	x	x	x	1	1	1	1	1	1	1	1
ledr	0	0	1	x	x	x	x	x	x	x	1	1	1	1	1	1	1	1
ledg										x	0	0	0	0	0	0	1	0
hex											1	1	F	F	0	3	2	1

case 2: input signal – 01011101 / multiplexer controller – 111 / birthday – 12 Feb.

#	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
sw	1	1	1	x	x	x	x	x	x	x	0	1	0	1	1	1	0	1

ledr	1	1	1	x	x	x	x	x	x	x	0	1	0	1	1	1	0	1
ledg										x	1	0	0	0	0	0	0	0
hex											0	7	9	D	0	2	1	2

3. REPORTS EVALUATION CRITERIA

Each item listed below will be checked when we evaluate your report and we take off some points if they do not exist or are improper.

PRELIMINARY REPORT

Please study about,

- About DE2 board (6)
  - What is PIN assignment and how to setup it up (2)
  - Search basic working principles of switch, LED and 7-segment on DE2 board (2)
  - Describe how to use "function" statement in VHDL (2)
- About Lab2 (4)
  - What is multiplexer? (2)
  - Make pseudo-code about 7-segment using VHDL function, and multiplexer (2)

You can get information from DE2 User Manual and VHDL Programming in the course web site.

FINAL REPORT

Please express your results into,

- Result Analysis (6)
  - Source code you implement. You should choose key features to be explained. If your explanation is line-by-line comment, you might get minus. (3)
  - Timing and function simulation result. Compare the difference between timing simulation and function simulation (3)
- Discussion (4)
  - What is purpose of multiplexer? And where is it used? (2)
  - What was the most difficult part and what you have learned from it. (2)

4. NOTE

TAs are very strict on copying and plagiarizing. You can refer to books, papers and internet pages. However, you cannot borrow them 'as is' if you do not explicitly indicate the source that you have cited. Also, it is strongly recommended that to write down what you've understood in your words.

Your report does not need to include a cover page and you can format it freely. (Because TA do not evaluate how beautifully you format it.) However, the content of the report should be precise.

We receive the report using the *moodle website*. However, you can submit your report (or a part of it) in hardcopy if you want to.

When you upload your compressed project file, you must follow the format described below.

Lab#_studuentid_name.zip / ex) Lab3_20115148_JunghoSong.zip