数字逻辑设计 2019/2020：Final Project

王跃明老师

Game Design: Finger Dancer

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1. Abstract

The following report presents the final project for the course “Digital Logic Design”, taken in the fall and winter semester of 2019-2020. We chose to create a finger dancing game, where the player needs to recreate the pattern generated by the circuit in a given time frame. The game is implemented on the SWORD board, and only requires the four component seven-segment display, switches, and the LED lights below the display. To reflect on what we have learned from the course, we have used a variety of different modules such as registers, counters, and frequency dividers. Proper memory and register access have also been applied here. Modules from previous labs such as the multiplexers, and full adder have been recycled into this project. We have also constructed our own input, display and compare modules from scratch. This report will summarize the game behavior, the design process, simulations and debugging process.

1. Introduction
2. Background

“Finger Dancer” is a simple game where the player is given a pattern of lights and must match it using the corresponding switches before the time runs out. If the player successfully completes the round, “PASS” will be displayed on the seven-segment display and the score increases. In the case that the player does match the pattern, “FAIL” will be displayed and automatically ends the game. As the player progresses, the time for each round will decrease.

1. Purpose

The purpose of this final assignment is to make use of all the various skills and tools learned throughout this course and apply it to construct this game. This allows our team to practice working on the FPGA SWORD board and get a sense of what it is like to design practical circuits.

1. Instruments and Materials
2. PC with Xilinx ISE 14.7
3. SWORD/FPGA Board
4. User Manual: How to Play Finger Dancer

The basic idea of “Finger Dancer” is to match the pattern indicated on the LEDs below the seven-segment display, using the switches. Each time the player successfully does so, “PASS” is indicated on the seven-segment display, and their score is increased. The game continues with the duration of each round progressively decreasing. If the player fails to match the switches with the LEDs, the game ends and “FAIL” is displayed. The score is reset, and the player may start the game again.

1. Implementation and Design
2. Circuit Design
3. Taking in User Input – Input

The input module takes in the logical on/off values from the switches and outputs it to the compare module for further processing. It polls for input at every clock cycle.

1. Comparing Input – Compare

The compare module takes in two 1-bit binary numbers as inputs; one from the input module and one from the state module. To check if these numbers are equal, they are compared by using a NOT XOR gate. If the two inputs are equal, a 1 is outputted. Otherwise, a 0 is returned.

1. Updating the Score – ScoreUp

The ScoreUp module changes the score, according to the input

1. Changing State – UpdateState
2. Changing the Duration – UpdateTime
3. Initializing the Modules – Timing
4. Display

The display module consists of the scoreboard module (from a previous lab experiment), a binary-to-BCD decoder and a module that specifically displays “PASS” or “FAIL”.

1. Frequency Divider – FreqDiv
2. Flowchart
3. Simulations
4. Debugging
5. Final Comments
6. Source Code
7. Work Distribution

Anna Tang (Group Leader): 30%

Chen Yi Hui: 20%

Joshua Malmberg: 30%

Justin Choi: 20%

10- References