ENEL 384 Final Project - Simple Number Guessing Game
FPGA & VHDL
Aaron Borja: 200482770

Introduction

This project is a simple number-guessing game designed with VHDL on VIVADO, and loaded onto the BASYS 3 FPGA board. The goal of this game is simple. The program will have a random number in mind, from 0 to 9. The user will then have to guess this number using the switches on the FPGA board. Because it can be any number from 0 to 9 including 0 and 9, the switches the user can guess with will be SW0 to SW9.

Basic Components

This game implements a simple clock signal which is currently running at the default 100 MHz clock signal to allow all of the operations to synchronize and avoid any unwanted increments to variables or displays.

The first main source of input for the user in this game is the switches. As previously mentioned, the way a user can guess is by using the switches on the BASYS 3 board. If they want to guess the number '5', they would need to find switch #5 and switch it on.

The game also implements a reset button which allows the user to reset the game. The program will randomly pick a new number between that range, and allow the user to guess again.

For the output components of the game, the 7 Segment Display is utilized. If the user guesses the correct number, the number is displayed on the 7 Segment Display. Alongside this feature, the first LED (LD0) also lights up, which indicates a correct guess. Otherwise, the display and the LED will remain blank if the user either guesses wrong or does not guess at all.

Random Number Generator

As this is a number guessing game, a random number generator has been implemented, by using the clock and implementing a counter that increments upon each reset. This way, it provides a more "randomized" number than if we were to declare the fixed random number from the signals which generate a fixed sequence. This can be shown in the lines below.

```
random_number <= (random_number + 3) mod 10;
```

```
signal random_number : INTEGER range 0 to 9 := 3;
```

This will calculate a random sequence of numbers and repeat.

Future Plans

- Implement a random number generator based off of seeding?
- Implement a difficulty stage. For example, when I turn sw15 on, it will increase the difficulty by only allowing the user 3 guesses.
- Add a score counter