

HOMEWORK 5

Question 1: White Noise Generator

Part (a):

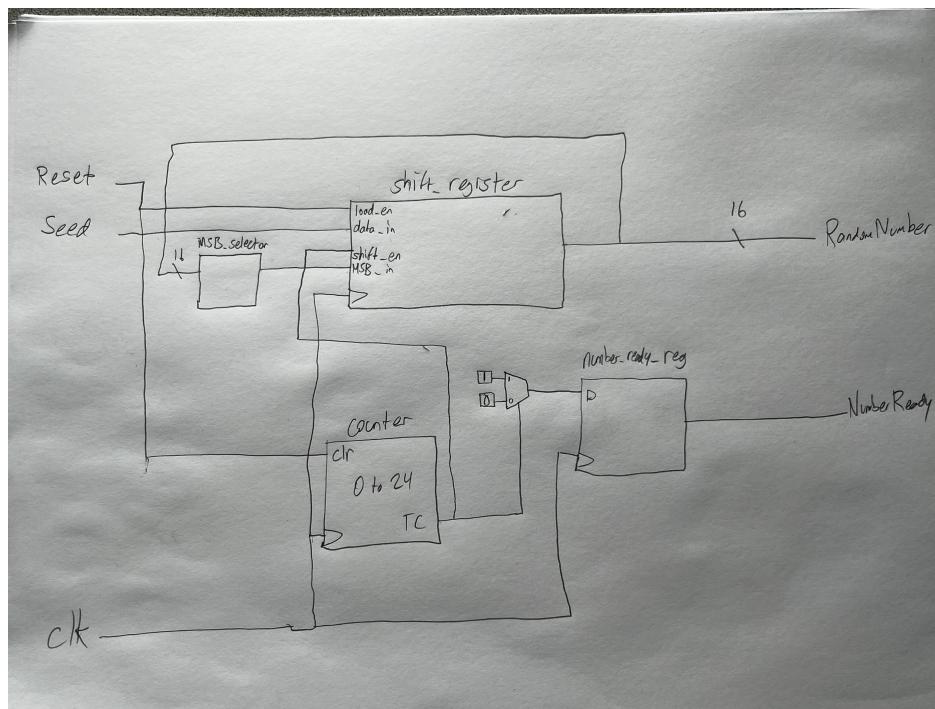


Figure 1: RTL-Level Block Diagram of the Fibonacci LFSR System

Part (b):

EDA Playgroud link: <https://www.edaplayground.com/x/Qyzx>

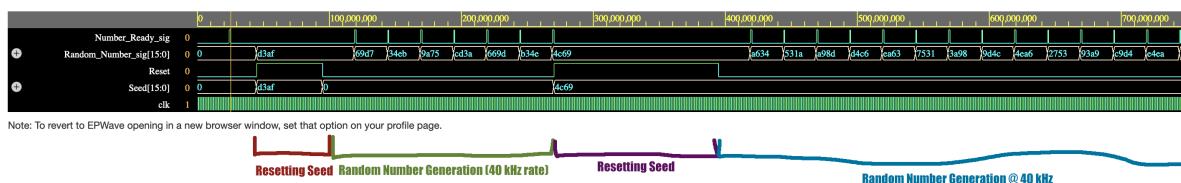


Figure 2: Waveform of Full Testbench for White Noise Generator, Annotated

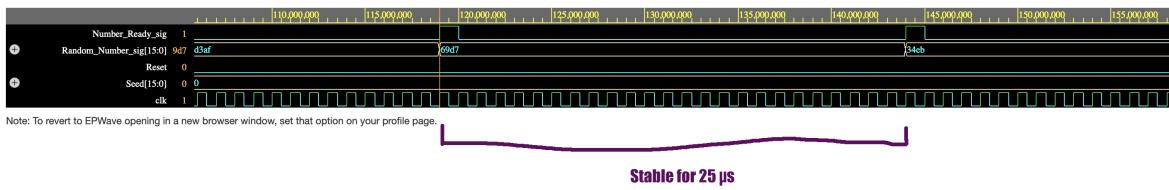


Figure 3: Zoomed-in Waveform Showing 40 kHz Refresh Rate, Annotated

Question 2: Code Guessing Game

Part (a):

This system will require 8 four-bit registers, and 2 three-bit counters.

Four registers will be used to store the four numbers needed for storing the code, and the other four registers are needed for storing each guess for comparison. The registers are chained together as with a shift register so that each entered number is first stored in the foremost register. The enable pins of the registers will be high based on control signals from the controller and from the input pins.

For the two counters, one is for counting which number is being entered, and the other is for counting the number of guesses. Both counters count up to 4, so 3 bits are needed. When the counters reach their maximum count, a terminal count control signal is asserted to the controller, and the counter resets.

Other control signals:

Inputs: EnteringCodeSignal(when player is entering code), EnteringGuessSignal(when player is entering guess), and CheckSignal(when the system checks the guess against the code).

Outputs: NumberCountTC(When the player has entered the fourth code/guess number), GuessCountTC(When the player has guessed their fourth guess), and WinSignal(When the guess is equal to the code at the check state).

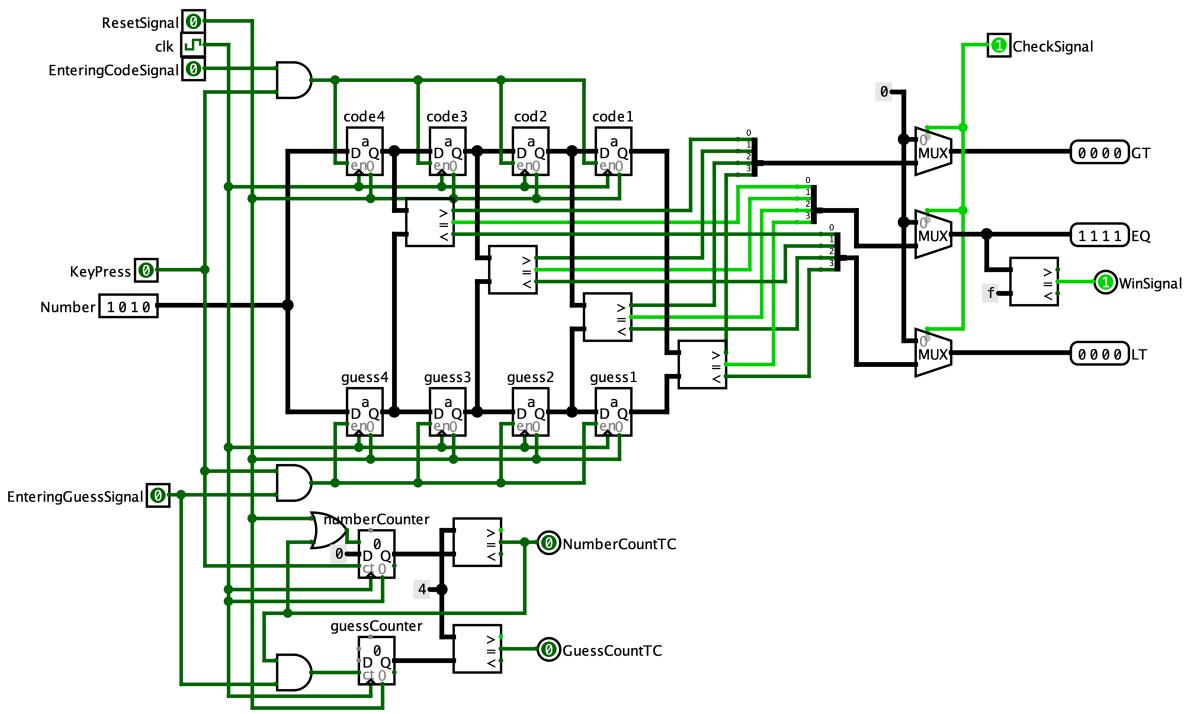
Part (b):

Figure 4: Datapath

Part (c):

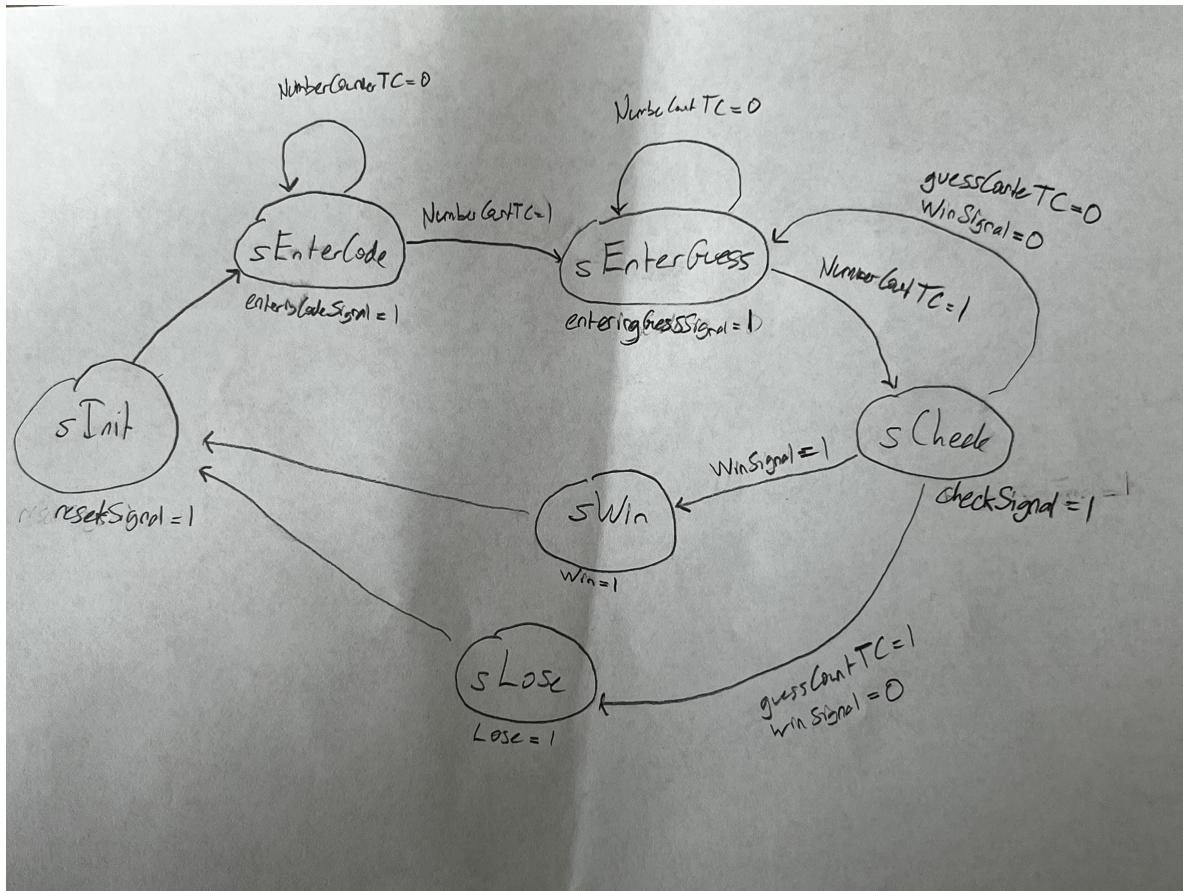


Figure 5: Finite State Machine

Part (d):

EDA Playground link: <https://www.edaplayground.com/x/Qz5g>

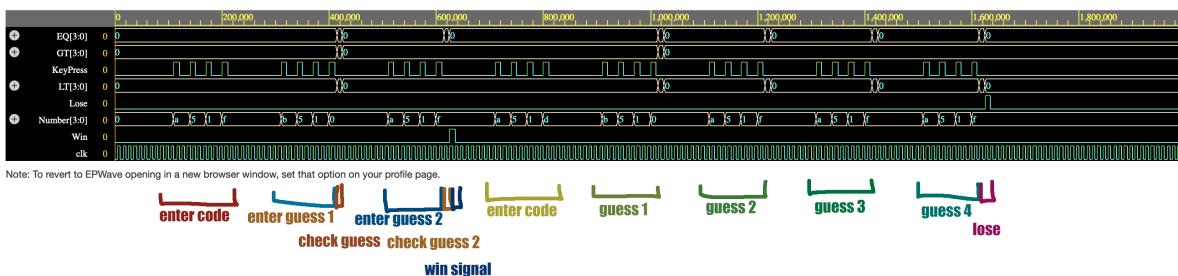
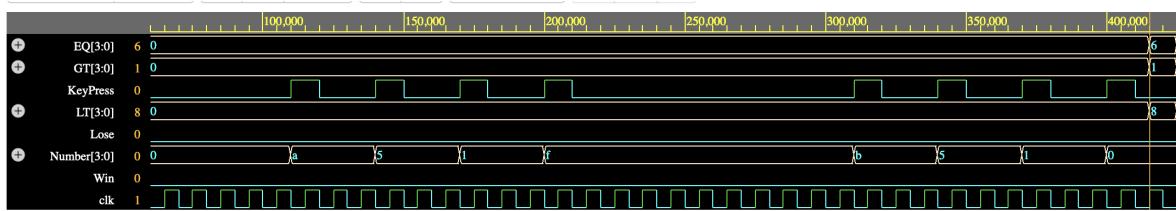


Figure 6: Full Game Operation, Annotated



Code: a51f

Guess: b510

GT: 0001 0x1

EQ: 0110 0x6

LT: 1000 0x8

Figure 7: Zoomed-In Look at a Specific Guess, Annotated