**SUMMARY:**

The objective is to implement a system on a FPGA board where moles(red LEDs) appear randomly, and players must react quickly to score points by toggling the corresponding switch. The difficulty increases as the players progress requiring faster reaction times where the moles appear and disappear more quickly.

**RNG MODULE:**

Random number generator:

* Levels of difficulty:

By modifying the MAX\_VALUE and OFFSET parameters

* Range of random values

Starts with a wider range for easier levels (eg 500 - 1000)

This means leds will stay lit for longer = more reaction time

The range narrows to decrease time a mole is lot

* Triggering moles based on timer:

The RNG can set timers end value, which counts down and checks the end\_reached flag. When value is reached, the corresponding moles turns on or off

Difficuly levels:

Easy: Max\_value = 1000, OFFSET = 500

Medium: Max\_value = 700, OFFSET = 300

Hard: Max\_value = 500, OFFSET = 200

Test Bench:

1. Clock- driven random number:

Toggles the clk sgnal, which drives the rng module. Ensure module genartes a new random varlue with each clk cycle, thus modukle can synchronise with the clk

1. Range check for random values: checks to see if the output (random\_value) is in expected range. If yes: random value is > =OFFSET but <= MAX\_VALUE. If no: random\_valuw < OFFSET or > Max\_Vlaue
2. Randomness and variation: runs over multiple clk cycles, to observe random\_value varies . if yes: shows that the LSFR is working to produce random values
3. Initialization with SEED: is the module initilaised correctly
4. Continuos operation: can module run without failure

Time set to 1 microsecond, precision of 1 ps

Clock signal 50 – 25 us period