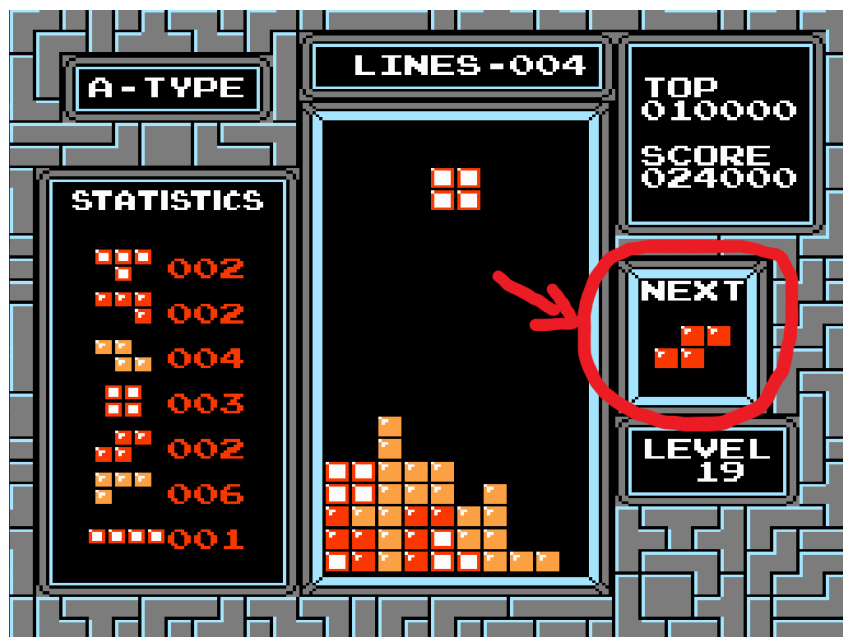
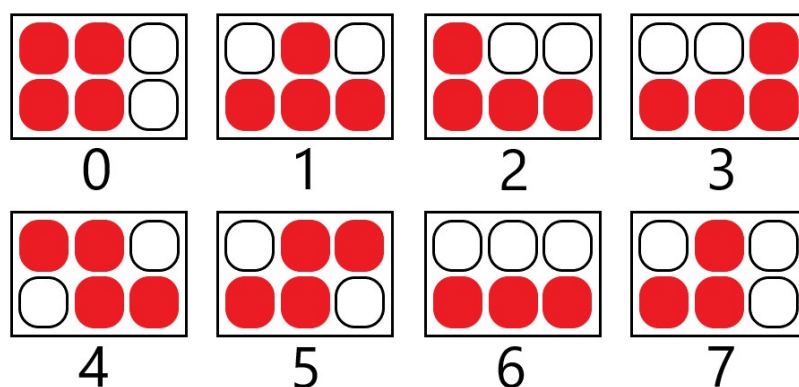


Project : NES Tetris Random Shape Generator



Tetrimino shown in a Tetris game

The project for this year focuses on a classic problem in game design: pseudo-random generation. In the original NES version of Tetris in the image above, the game uses a specific mathematical function to decide which shape (Tetrimino) will appear next. For this project, we have simplified this mechanism into a hardware circuit that generates and displays 8 different simplified shapes on a 2x3 LED matrix. The list of shapes is shown below.

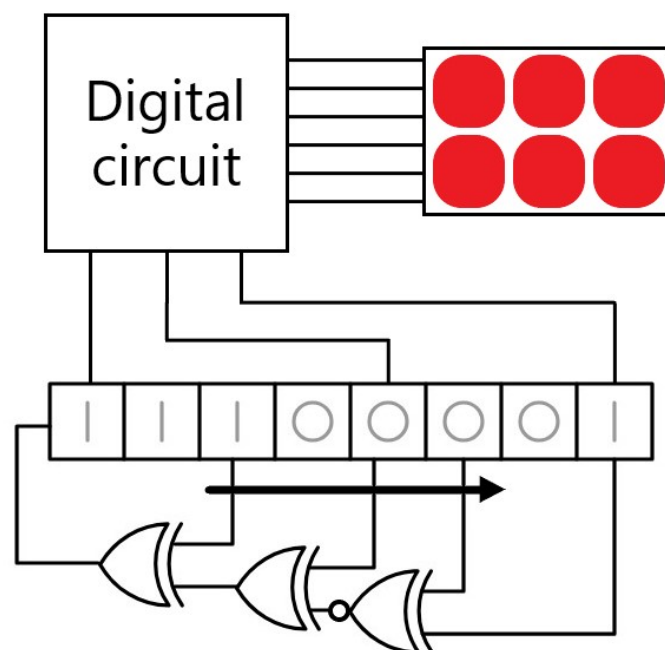


8 Tetrimino shapes used in Tetris

Circuit description

Like described in the image below, the system consists of three main stages:

- **The Random Engine:** An 8-bit shift register that uses XOR/XNOR feedback logic to cycle through values.
- **The Logic Decoder:** A combinational circuit (the "Digital Circuit" box in the diagram) that takes the output of the LFSR and translates it into specific signals for the display.
- **The Shape Display:** A 2x3 grid consisting of 6 LEDs. Depending on the current random value (0 to 7), a specific pattern of LEDs will light up to represent a "piece."



Tetris random shape circuit diagram

The heart of this circuit is a Linear-Feedback Shift Register (LFSR). While computers seem to generate "random" numbers, they actually follow a deterministic sequence that is so long it appears random to the human eye. By using a shifter and XOR gates in a feedback loop, we can create a sequence of bits that cycles through various states.

Technical Requirements

To successfully implement this design, you will need to master several components discussed in class:

- **Sequential Logic:** You will need two 4-bit shift register ICs (or 8 D-type flip-flops) to build the LFSR.

- **Feedback Loop:** Implement the XOR/XNOR gates as shown in the schematic to ensure the register does not get stuck in a "null" state and provides a proper pseudo-random distribution.
- **Combinational Mapping:** You must design the logic that maps a 3-bit input (from the register) to the 6 LED outputs. You should use the 5 steps method learned in class.
- **Clocking:** A 555 timer is required to pulse the circuit. A low frequency (1-2 Hz) is recommended so the user can see the shapes changing, you will some intern tutorial to learn how to use the 555 clock/timer.

Clauses and conditions

- The project is intended to be achieved physically using breadboards, the lecture [videos](#) contain a brief introduction to breadboards. The project probably needs more than one breadboard.
- You have a [list](#) of the must known and available 7400 ICs to use, on www.el-kalam.com website. But in the case it was impossible to find one component, you are allowed to implement it using elementary gates or flipflops.
- To be accepted, the circuit should follows the specifications detailed above.
- This project should be done individually, in monomial number of students.
- The project is limited for a total number of 10 students accepted, which means, only the first 10 valid submissions will be accepted.
- For submission, a student should send a clair small video of the proper working of the circuit (not images). Plus the related schematics, and a brief explanation.
- The submission email address is kara.abdelaziz@el-kalam.com.
- The deadline for submission is dated to the 10/05/2026 at 23:59 p.m.
- For the accepted submissions, an appointment will be programmed with the student to inspect the physical working circuit.
- The student accomplishing this project will be rewarded 10 bonus points in TD mark.

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