ECE 310 Spring 2025
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Homework 8

SOLUTIONS

Show all work for full credit.

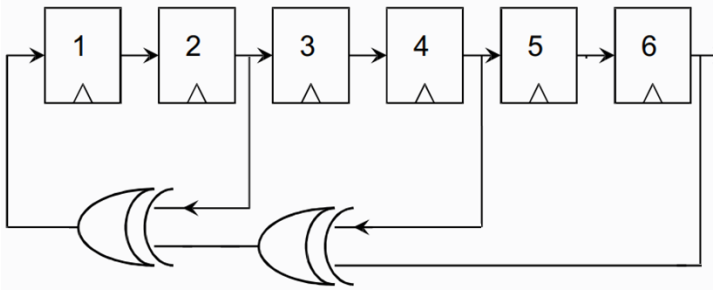
1. Give an example application of random number generators not described in class or slides. Make sure to explain in detail how random numbers play an important role in your example. **(20 pts)**

   Lottery, video/board games for various reasons, juror selection, etc.

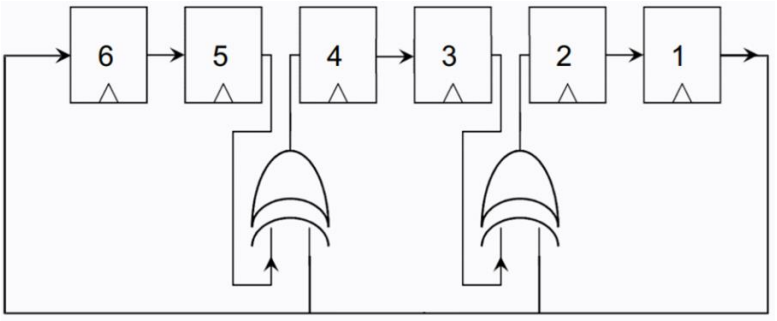
2. In a LFSR of any length, why isn't state S0 (encoded as all zeros) be used? Justify your answer with a Fibonacci LFSR of length 4 with any number of taps. **(20 pts)**

   There is no way to advance in the states if starting from S0 no matter what the generator polynomial is as XOR with 0 is itself, therefore if all inputs are 0, there is no way to advance to a non-zero state.

3. Draw the Fibonacci LFSR for the polynomial $P(x) = x^6 + x^4 + x^2 + 1$ that uses 2-input XOR gates. **(20 pts)**



4. Draw the Galois LFSR for the polynomial $P(x) = x^6 + x^4 + x^2 + 1$ that uses 2-input XOR gates. **(20 pts)**



5. Given the polynomials in Questions 3 and 4 above, which implementation is better from the perspective of clock speed? That is, which LFSR implementation can be clocked faster? Justify your answer. **(20 pts)**

   Galois, since the 2-input XOR gate has a smaller delay than a sequence of XOR gates and the outputs of the XOR gates are computed in parallel.