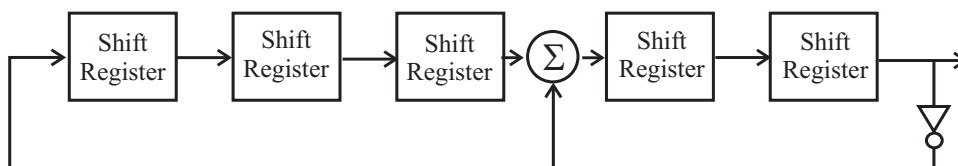


## ECE 6390 Homework 6: Digital Systems and Spread Spectrum

1. A geostationary Digital Broadcast Satellite (DBS) is sending an uncoded MPEG 2 video stream to earth using BPSK modulation with  $C/N = 7$  dB at the earth station receiver. What is the BER of the downlink? How much coding gain is available if a turbo code is used on the downlink? If a rate 1/2 turbo code was used on the downlink, what is the maximum circular orbit radius into which the satellite could be placed to maintain the BER of the uncoded geostationary orbit? (5 points)
2. **Pseudo-Noise (PN) Generator:** Below is a an example of 5 shift registers connected to form a basic  $m$ -sequence generator.



Answer the following questions based on this generator:

- a. Write a simple computer code to generate the output of this device when all shift register states are initialized to 0. Produce a sample output and calculate the code's period,  $T_{\text{code}}$ , in units of chips. (5 points)
- b. Plot the autocorrelation of this code,  $x(t)$ :

$$C_N(\Delta t) = \frac{1}{T_{\text{code}}} \int_0^{T_{\text{code}}} x(t)x(t + \Delta t) dt$$

What makes this a non-ideal code for spread spectrum modulation? (5 points)