V. Prodanov
EE470, Spring 2018

The second project asks of you to develop a program that demonstrates fundamental yet non-intuitive concepts; those related to sequence generation, auto-correlation, power spectral density, and signal envelopes. I am looking for programs that take simple inputs and produce an easy-to-understand output. The options are briefly discussed in the following. I hope all four projects receive some coverage.

1) **A program that emulates 1st (or 2nd) order discrete-time $\Delta\sum$ modulator.** The user should be able to specify a simple input (DC, sin wave, other?). The program will map the input into a single-bit sequence, calculate its FFT and display the magnitude (in log units). The goal is to show the noise shaping properties of the loop. Additional features could include calculating noise RMS over a specified BW or averaging-and-decimation.

2) **A program that demonstrates the creation of a CRC (as accomplished by a shift-register and XORs).** Ideally the user should be able to choose among few 'for real' polynomials, type a short text (say name or initials) which is converted to a binary string and pushed into the CRC register. The program will display the states of the shift register at a slow pace (change in .5sec increments) and stop when the CRC code is complete.

3) **A program that allows a user to create periodic sequences (of 1 and -1) using shift registers and study their auto-correlation properties.** The user should be able to specify the coefficients of the generating polynomial (0s and 1s) and the seed value held in the shift register. The program will then calculate the resulting sequence, map the '0' and '1' into "1" and '-1', calculate and display the ACF.

4) **A program that demonstrates the magnitude variation of a 'digital' RF signal.** Ideally, the user should be able to specify: a text input, bits-per-symbol, and filtering. The program will convert the text into a bit sequence (using ASCII), de-multiplex it into two rectangular-wave sequences, filter them, calculate magnitude & phase and plot those in a polar form.

Requirements:

- The programs run on platforms readily available (for free) to CP students.
- The inputs are intuitive and the graphics are of good size and quality.
- The programs demo in 10 min (or less)
- Two people per team
- With instructor permission, two teams could partner when individual projects complement each other
- You may include a message "*courtesy of …*" in the plots your programs generate.