Due Friday, 7 Oct 2022, by 11:59pm to Gradescope.
50 points total.

1. (10 points) Consider the following sequences:

$$x[n] = \{2, \quad 0, \quad -1, \quad 6, \quad -3, \quad 2, \quad 0\}, -3 \le n \le 3,$$
$$y[n] = \{8, \quad 2, \quad -7, \quad -3, \quad 0, \quad 1, \quad 1\}, -5 \le n \le 1,$$
$$w[n] = \{3, \quad 6, \quad -1, \quad 2, \quad 6, \quad 6, \quad 1\}, -2 \le n \le 4.$$

The sample values of each of the above sequences outside the ranges specified are all zeros. Generate the following sequences:

(a) $c[n] = x[n+3]$,

(b) $d[n] = y[n-2]$,

(c) $e[n] = x[-n]$

(d) $u[n] = x[n-3] + y[n+3]$

(e) $v[n] = y[n-3] \cdot w[n+2]$,

(f) $s[n] = y[n+4] - w[n-3]$, and

(g) $r[n] = 3.9w[n]$

2. (10 points) Determine the fundamental period of the sinusoidal sequence $\tilde{x}[n] = A \sin(\omega_0 n)$ for the following values the angular frequency ω_0:

(a) 0.3π,

(b) 0.48π,

(c) 0.45π,

(d) 0.525π,

(e) 0.7π,

(f) 0.75π.

3. (10 points) Determine the fundamental period of the following periodic sequences:

(a) $\tilde{x}_a[n] = e^{j0.25\pi n}$,

(b) $\tilde{x}_b[n] = \cos(0.6\pi n + 0.3\pi)$

(c) $\tilde{x}_c[n] = \text{Re}\left(e^{j\pi n/8}\right) + \text{Im}\left(e^{j\pi n/5}\right)$,

(d) $\tilde{x}_d[n] = 6\sin(0.15\pi n) - \cos(0.12\pi n + 0.1\pi)$

(e) $\tilde{x}_e[n] = \sin(0.1\pi n + 0.75\pi) - 3\cos(0.8\pi n + 0.2\pi) + \cos(1.3\pi n)$

4. (10 points) Assume $x(n)$ has period N. Are the following sequences periodic? Please provide your reasoning:

   (i) $x(1 - 2n)$

   (ii) $x(n) + (-1)^n x(0)$

5. (10 points) Write a **MATLAB** program to plot a continuous-time signal $x(t) = \cos(2\pi f_0 t)$ and its sampled version with the following frequency f_0 and sampling frequency f_s:

   (i) $f_0 = 3$ Hz, $f_s = 10$ Hz

   (ii) $f_0 = 7$ Hz, $f_s = 10$ Hz

   (iii) $f_0 = 13$ Hz, $f_s = 10$ Hz

   Is it possible to perfectly reconstruct the original continuous-time function from the samples? Why? Please provide your code, plots, and answers in your report.

   Hint: you need to use the *hold* function to keep both plots for each figure.