1. z-tranforms:

- Determine the unilateral z-transform of the signal $x[n] = (1/2)^{|n|}$ and specify the corresponding ROC.
- Consider a system whose input $x[n]$ and output $y[n]$ are related by,
$$y[n-1] + 2y[n] = x[n]$$
  - Using python programme, plot the output of the system for $n \geq 0$, when $x[n] = (\frac{1}{4})^n u[n]$ and $y[-1] = 2$.

2. Filtering:

Determine the output of the filter whose frequency response is
$$H(e^{j\omega}) = \begin{cases} 1, \frac{\pi}{3} \leq |\omega| \leq \frac{5\pi}{12} \\ 1, \frac{19\pi}{12} \leq |\omega| \leq \frac{5\pi}{3} \\ 0, \ otherwise \end{cases}$$
for a periodic input signal $x[n] = 1 + \sin(\frac{3\pi}{8}n + \frac{\pi}{4})$.

3. Sampling:

- Consider a sinusoid of analog frequency 75 Hz, sample it with 40 Hz, 80 Hz, 150 Hz, 300 Hz, 600 Hz. Plot the sampled signal and observe.

- For the analog signal $x(t) = \sin(150\pi t)$, write a python programme that ideally samples $x(t)$ at 80Hz and plot the signal $y(t)$ that is recovered if the sampled signal is passed through
  - An ideal LPF with cut-off $f_c = 100Hz$.
  - An ideal BPF with PB between 60Hz and 80Hz.