1) Consider the discrete-time signal \( x(n) = (2)^n \{ u(n) u(-n + 4) \} \)
   a) Sketch the signal \( x(n) \). Is it of finite or infinite duration?
   b) Find the \( x(-2), x(0), x(0.5), \) and \( x(3) \)
   c) Is \( x(n) \) an energy signal or not? Explain.

2) Suppose that a LTI has difference equation given by
   \[ y(n) = \alpha y(n-1) - x(n) + x(n-1), \text{where } \alpha \text{ is a constant.} \]
   a) Write the transfer function \( H(z) \).
   b) What is the restriction on \( \alpha \) for stability?
   c) If the system is an FIR, what is the value of \( \alpha \)?

3) A signal \( x(n) \) has the z-transform given by: \( X(z) = 1 - 0.4 z^{-1} + 0.8 z^{-2} \)
   a) Find \( x(n) \) and sketch it. Is it of finite duration or infinite duration?
   b) Given the ROC of \( X(z) \)
   c) Determine the FT of \( x(n), X(e^{j\omega}) \). What are the values of \( X(e^{j\omega}) \) and \( X(e^{j\pi}) \)?
   d) Is \( X(e^{j\omega}) \) periodic or not? Explain.

4) If a continuous-time signal is given by: \( x_a(t) = 2 \cos(\Omega_1 t) \cdot \cos(\Omega_2 t), \)
where $\Omega_1 = 20 \pi \text{ rad./s}$ and $\Omega_2 = 40 \pi \text{ rad./sec}$ is to be sampled:

a) What is the minimum sampling frequency to avoid aliasing?

b) Find $x(n)$ after sampling the signal. What are the corresponding digital frequencies?

c) What arrangement is needed to avoid aliasing?