1. Compute z-transforms and ROCs for each of the following four signals. Write each answer as a rational function (a ratio of two polynomials).

(a) \{1, 3, \frac{4}{3}\}.  
(b) \((2^n + 1)u[n]\).  
(c) \((\frac{1}{2})^n u[n] + 2^n u[-n-1]\).  
(d) \(3^n u[n] + (\frac{1}{2})^n u[-n-1]\).

2. Compute the causal inverse z-transform of each of the following functions. Do partial fractions in (d) and (e) by hand. You may check answers using `residue`.

(a) \(\frac{z+1}{2z}\).  
(b) \(\frac{z-1}{z-2}\).  
(c) \(\frac{2z+3}{z^2+3z+2}\).  
(d) \(\frac{z^2+2z}{z^2-2z+2}\).  
(e) \(\frac{z^2-z}{z^2-3z+2}\).

3. Compute the inverse z-transform of each of the following functions and ROCs:

(a) \(\frac{4z}{z-1} + \frac{5z}{z-2} + \frac{6z}{z-3}\) & \(2 < |z| < 3\).  
(b) \(\frac{(1+j)z}{z-(3+4j)} + \frac{(1-j)z}{z-(3-4j)}\) & ROC making it stable.

(c) \(\frac{(3+4j)z}{z-(1+j)} + \frac{(3-4j)z}{z-(1-j)} + \frac{(1+j)z}{z-(3+4j)} + \frac{(1-j)z}{z-(3-4j)}\) & \(\sqrt{2} < |z| < 5\). Simplify to a sum of two terms.

4. Compute the two-sided convolution \(((\frac{1}{2})^n u[n] + 2^n u[-n-1])*(\frac{1}{2})^n u[n])\) by:

(a) Multiplying their z-transforms, intersecting their ROCs, and computing \(Z^{-1}\).  
(b) Truncating each signal to \(-10 \leq n \leq 10\) and using `conv`. Compare your answers.  
How? The truncated version of the first signal to be convolved is formed in Matlab as:  
\([2.\hat{}[-10:-1] \ (1/3) \hat{}[0:10]]\) End values are small, so truncation → little effect.

5. For each of the five ROCs below, is the associated inverse z-transform:  
(i) Causal, anticausal, or two-sided; (ii) BIBO stable or unstable (2 points each).

(a) \(2 < |z| < 3\).  
(b) \(0.1 < |z| < 0.3\).  
(c) \(0.1 < |z| \leq \infty\).  
(d) \(0 \leq |z| < 2\).  
(e) \(0.5 < |z| < 3\).

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