Quiz 10 EE3900

1 Definitions

1. The *Kronecker delta* function is defined as

$$\delta(n) = \begin{cases} 1 & n = 0 \\ 0 & n \neq 0 \end{cases} \tag{1.1}$$

2. The unit step function is

$$u(n) = \begin{cases} 1 & n \geq 0 \\ 0 & n < 0 \end{cases} \tag{1.2}$$

3. The *one sided* Z-transform of $x(n)$ is defined as

$$X^+(z) = \sum_{n=0}^{\infty} x(n) z^{-n}, \quad z \in \mathbb{C} \tag{1.3}$$

4. The *Pingala* series is generated using the difference equation

$$x(n+2) = x(n+1) + x(n), \quad x(0) = x(1) = 1, n \geq 0 \tag{1.4}$$

5. α, β are the roots of the equation

$$z^2 - z - 1 = 0 \tag{1.5}$$

6.

$$y(n) = x(n-1) + x(n+1), \quad n \geq 0 \tag{1.6}$$

2 Problems

1. Show that

$$X^+(z) = \frac{1}{1 - z^{-1} - z^{-2}} \quad |z| > \alpha \tag{2.1}$$

2. Show that

$$x(n) = \frac{\alpha^{n+1} - \beta^{n+1}}{\alpha - \beta} u(n) \tag{2.2}$$

3. Show that

$$Y^{+}(z) = \frac{1 + 2z^{-1}}{1 - z^{-1} - z^{-2}} \quad |z| > \alpha \tag{2.3}$$

4. Find the Z transform of

$$x(n) * u(n-1) \tag{2.4}$$

5. Is the system defined by (1.6)
   a) Linear
   b) Time-invariant
   c) Causal
   d) Stable?