Problem 1 (10 Points) Derive the Z-transform of the following signals:

1. $x[n] = a^n u[n]$, $a$ real.
2. discrete impulse function $\delta[n]$
3. unit step function $u[n]$

Problem 2 (10 Points) Find the Z transform of the following:

1. $x(t) = u[n - n_0]$
2. $x(t) = a^{n+1} u[n + 1]$

Problem 3 (10 Points) Find the inverse Z transform of:

$$X(z) = z^2(1 - \frac{1}{2} z^{-1})(1 - z^{-1})(1 + 2z^{-1}) \text{ given } 0 < |z| < \infty$$

Problem 4 (10 Points) Using partial fractions calculate inverse Z transform of:

$$X(z) = \frac{z}{2(z - 1)(z - \frac{1}{2})} \text{ given } |z| < \frac{1}{2}$$