Discrete Assignment
EE1205 Signals and Systems

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Question 11.9.1.2: Write the first five terms of the sequence whose terms are represented by $x_n = \frac{n}{n+1}$

Solution: Given the terms of the sequence are $x(n) = \frac{n}{n+1}$ where $n = 0, 1, 2, 3, 4...$
In terms of $u(n)$, x_n is

$$x(n) = u(n) - \frac{u(n)}{n+1} \tag{1}$$

$$x(n) = \begin{cases} 0 & \text{if } x = 0 \\ u(n) - \frac{u(n)}{n+1} & \text{if } x > 0 \\ \text{not defined} & \text{if } x < 0 \end{cases}$$

Z-transform is defined as,

$$x(n) \overset{Z}{\leftrightarrow} X(Z)$$

$$X(Z) = \sum_{i=-\infty}^{\infty} x(n).Z^{-n} \tag{2}$$

Here, Z-transform

$$X(Z) = \sum_{i=1}^{\infty} x(n).Z^{-n} \tag{3}$$

$$= \sum_{i=1}^{\infty} \frac{n}{n+1}.Z^{-n} \tag{4}$$

On solving,

$$X(Z) = \frac{Z}{Z-1} + Z\log\left(1 - Z^{-1}\right) \tag{5}$$