Automatic Speech Recognition
Question Set 1

1. A finite-duration discrete-time sequence $x[n]$ is given by

$$x[n] = \begin{cases} n, & 0 \leq n \leq 7 \\ 0, & \text{otherwise} \end{cases}$$

   Compute

   (a) the DFT of $x[n]$

   (b) the IDFT of the DFT of $x[n]$

2. A discrete-time sequence is *left-sided* if it vanishes after a finite time index. It is *right-sided* if it vanishes before a finite time index. It is *finite-duration* if it is both left-sided and right-sided. It is *two-sided* if it is neither left-sided nor right-sided.

   The region of convergence of a discrete-time sequence is the region in the z-plane where its z-transform converges.

   Find the regions of convergence for the following discrete-time signals.

   (a) a left-sided signal $l[n] = a^n \; u[N_1 - n]$

   (b) a right-sided signal $r[n] = b^n \; u[n - N_2]$

   (c) a two-sided signal $t[n] = c^n$

   (d) a finite-duration signal $f[n] = d^n \; (u[n - N_3] - u[n - N_4])$

   Here $u[n]$ is the unit step sequence, defined by

$$u[n] = \begin{cases} 1 & n \geq 0, \\ 0 & \text{otherwise}, \end{cases}$$

   a, b, c, d are given real numbers and N_1, N_2, N_3, N_4 are given integers.