Problem 8.2

(a) Given,

$$X_a[k] = \begin{cases} 1 & k = 0 \\ 0 & k = 1, 2..., 9 \end{cases} \tag{1}$$

The 10-point IDFT is given as, using the IDFT formula, where $N = 10$ and $n = 0, 1, ..9$

$x_a[n] = \frac{1}{10} \sum_{n=0}^{9} \delta(k) e^{(\frac{2\pi}{10})kn}$.

(b) $X_b[k] = 1$ for $k = 0, 1, 2, ..., 9$

The 10-point IDFT is given as,

$x_b[n] = \delta[n]$

(c) Given,

$$X_c[k] = \begin{cases} 1 & k = 3, 7 \\ 0 & k = 0, 1, 2, 4, 5, 6, 8, 9 \end{cases} \tag{2}$$

The 10-point IDFT is given as, using the IDFT formula, where $N = 10$ and $n = 0, 1, ..9$

$x_a[n] = \frac{1}{10} \sum_{n=0}^{9} \delta(k) e^{(\frac{2\pi}{10})kn} = \frac{1}{10}[e^{(\frac{2\pi}{10})3n} + e^{(\frac{2\pi}{10})7n}]$

(d) Given $X_d[k] = cos(\frac{2\pi k}{5})$ for $k = 0, 1, 2, .., 9$

$X_d[k] = cos(\frac{2\pi k}{5}) X_b[k] = \frac{1}{2} e^{j(\frac{2\pi}{10})2k} X_b[k] + \frac{1}{2} e^{-j(\frac{2\pi}{10})2k} X_b[k]$

Using the delay property, $x_d[n] = \frac{1}{2}(\delta[n-2] + \delta[n-8])$.