2018 Fall EECS205003 Linear Algebra - Quiz 10

Name: ID:

1. Compute $\mathbf{y} = F_8\mathbf{c}$ by the three FTT steps for $\mathbf{c} = (1,0,1,0,1,0,1,0)$. (Hint: First separate vector $\mathbf{c}$ into it's even and odd parts $\mathbf{c}^{'} = (1,1,1,1)$ and $\mathbf{c}^{''} = (0,0,0,0)$, then remember to use $y_j = F_4 c^{'} + w_n^j F_4 c^{''}$ to get the answer)

   Solution:

   $c^{'} = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}$ and $c^{''} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$

   Hence,

   $$\mathbf{y}^{'} = F_4 c^{'} = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & i & -1 & -i \\ 1 & -1 & 1 & -1 \\ 1 & -i & -1 & i \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix} = \begin{bmatrix} 4 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

   and $\mathbf{y}^{''} = F_4 c^{''} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$

   $$y_1 = y_1^{'} + w_8 y_1^{''} = 4 + 0 = 4$$
   $$y_2 = y_2^{'} + w_8^2 y_2^{''} = 0 + 0 = 0$$
   $$\vdots$$
   $$y_5 = y_1^{'} - w_8^5 y_1^{''} = 4 - 0 = 4$$
   $$y_6 = y_2^{'} - w_8^6 y_2^{''} = 0 - 0 = 0$$
   $$\vdots$$
   $$y_8 = y_4^{'} - w_8^8 y_4^{''} = 0 - 0 = 0$$

   $$\mathbf{y} = \begin{bmatrix} 4 \\ 0 \\ 0 \\ 0 \\ 4 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$