# FMN011 Exercises Chapter 10 and 11

The problems are based on the designated problem from Sauer's book, but may not be identical.

**10.1 E1/3** Find the DFT of [0, 1, 0, -1] and the inverse DFT of [1, 0, 0, 0].

**10.2 E1** Find the trigonometric polynomial that interpolates (0, 0), (0.25, 1), (0.5, 0), (0.75, -1):

**10.3 E1** Find the best order 2 least squares approximation to the data in the Exercise above, using the basis functions $1$ and $\cos 2\pi t$.

**11.1 E3** Find the DCT of $x = [1, 0, 1, 0]$, and find the corresponding interpolating function $P_n(t)$ for the data points $(i, x_i)$, $i = 0, \ldots, n-1$.

**11.1 C1** Plot the data from the Exercise above, along with the DCT interpolant and the DCT least squares approximation with 2 terms.

**11.2 E1** Find the 2D-DCT of

$$X = \begin{pmatrix} -1 & 1 & -1 & 1 \\ -2 & 2 & -2 & 2 \\ -3 & 3 & -3 & 3 \\ -4 & 4 & -4 & 4 \end{pmatrix}$$

**11.2 E2** Find the least squares low-pass filtered approximation to X by setting all transform values $Y_{kl} = 0$ for $k + l \geq 4$.

**11.2** Repeat the previous Exercise, but instead, quantize linearly with $q = 1$.

**11.3 E3** Draw a Huffman tree and convert the message

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including spaces, to a bit stream by using Huffman coding. Compare the Shannon information with the average number of bits needed per symbol.