Jimenez Nicanor J
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DSP prelim problem set

Part 1

$$H = \frac{1}{\sqrt{2}} \begin{vmatrix} 1 & 1 \\ 1 & -1 \end{vmatrix}$$

$$Y = \begin{vmatrix} 0 & -1i \\ 1 & 0 \end{vmatrix}$$ #changed i to 1

$$O = \begin{vmatrix} 1 & 0 \\ 1 & 1 \end{vmatrix}$$

$$1a = H * Y = \frac{1}{\sqrt{2}} \begin{vmatrix} 1 & 1 \\ 1 & -1 \end{vmatrix} * \begin{vmatrix} 0 & -i \\ i & 0 \end{vmatrix} = \frac{1}{\sqrt{2}} \begin{vmatrix} 1 & -i \\ 1 & i \end{vmatrix}$$

$$1b = Y * H = \begin{vmatrix} 0 & -i \\ i & 0 \end{vmatrix} * \frac{1}{\sqrt{2}} \begin{vmatrix} 1 & 1 \\ 1 & -1 \end{vmatrix} = \frac{1}{\sqrt{2}} \begin{vmatrix} -i & -i \\ i & -i \end{vmatrix}$$

$$1c = H * H = \frac{1}{\sqrt{2}} \begin{vmatrix} 1 & 1 \\ 1 & -1 \end{vmatrix} * \frac{1}{\sqrt{2}} \begin{vmatrix} 1 & 1 \\ 1 & -1 \end{vmatrix} = \frac{1}{2} \begin{vmatrix} 2 & 0 \\ 0 & 2 \end{vmatrix}$$

$$1d = Y * H * O = \begin{vmatrix} 0 & -i \\ i & 0 \end{vmatrix} * \frac{1}{\sqrt{2}} \begin{vmatrix} 1 & 1 \\ 1 & -1 \end{vmatrix} * \begin{vmatrix} 1 & 0 \\ 1 & 1 \end{vmatrix} = \frac{1}{\sqrt{2}} \begin{vmatrix} -i & 0 \\ 0 & 0 \end{vmatrix}$$

$$1e = H * Y * H * O = \frac{1}{\sqrt{2}} \begin{vmatrix} 1 & 1 \\ 1 & -1 \end{vmatrix} * \begin{vmatrix} 0 & -i \\ i & 0 \end{vmatrix} * \begin{vmatrix} 1 & 0 \\ 1 & 1 \end{vmatrix} = \frac{1}{\sqrt{2}} \begin{vmatrix} 1 & -1 \\ 1 & 1 \end{vmatrix}$$

ANS

1a=[[0.+0.31830989j 0.-0.31830989j] [0.-0.31830989j 0.-0.31830989j]]
1b=[[0.-0.31830989j 0.+0.31830989j] [0.+0.31830989j 0.+0.31830989j]]
1c=[[2.02642367e-01 5.31624302e-18] [5.31624302e-18 2.02642367e-01]]
1d=[[0.+0.j 0.-0.31830989j] [0.-0.63661977j 0.-0.31830989j]]
1e=[[0.+2.02642367e-01j 0.+2.02642367e-01j] [0.-2.02642367e-01j 0.-5.31624302e-18j]]

Part 2

| a b |
| c d |

Determinant = ad - bc

H = (1/√2) * | 1 1 |
             | 1 -1 |

Determinant_H = (1/√2) * (1 * (-1) - 1 * 1) = (1/√2) * (-2) = -√2

Y = | 0 -i |
    | i 0 |

Determinant_Y = 0 * 0 - (-i * i) = i^2 = -1

Determinant_H = -√2
Determinant_Y = -1

Part 3

1.
A = [(5, 0, 0), (0, 5, 0), (0, 0, 5)]

B = [(1, 0, 5), (2, 7, 6), (6, 4, 7)]

2.
a = [(1, 2, 6), (3, 15, 4), (2, 10, 3)]

b = [(5, 2, 4), (6, 2, 4), (0, 1, 1)]

ans(A) = 5 * (5*7*7 - 0*6*4) - 0 * (...) - 0 * (...)
       = 5 * (245 - 0) - 0 - 0
       = 5 * 245
       A= 1225

ans(B) = 1 * (15*1*4 + 4*2*6 + 10*3*2)
       - 2 * (3*1*4 + 4*2*2 + 10*3*0)
       + 6 * (3*2*2 + 15*2*0 + 4*1*3)
= (60 + 48 + 60) - (12 + 16 + 0) + (12 + 0 + 12)
= 168 - 28 + 24
           B = 164