Homework 6

6.5.a. Let $H = \frac{1}{\sqrt{2}} \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$. Write the matrix of the operator H[2] acting on the space $B^{\otimes 3}$

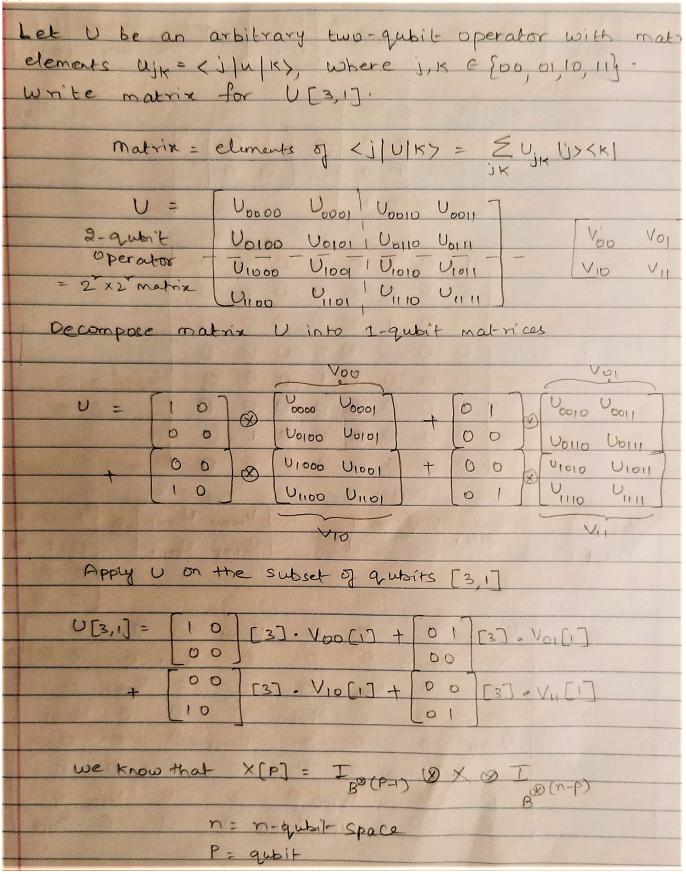
1. We have qubit space of 3 and Hardman operator on subset of 2 qubits, given by below formula,

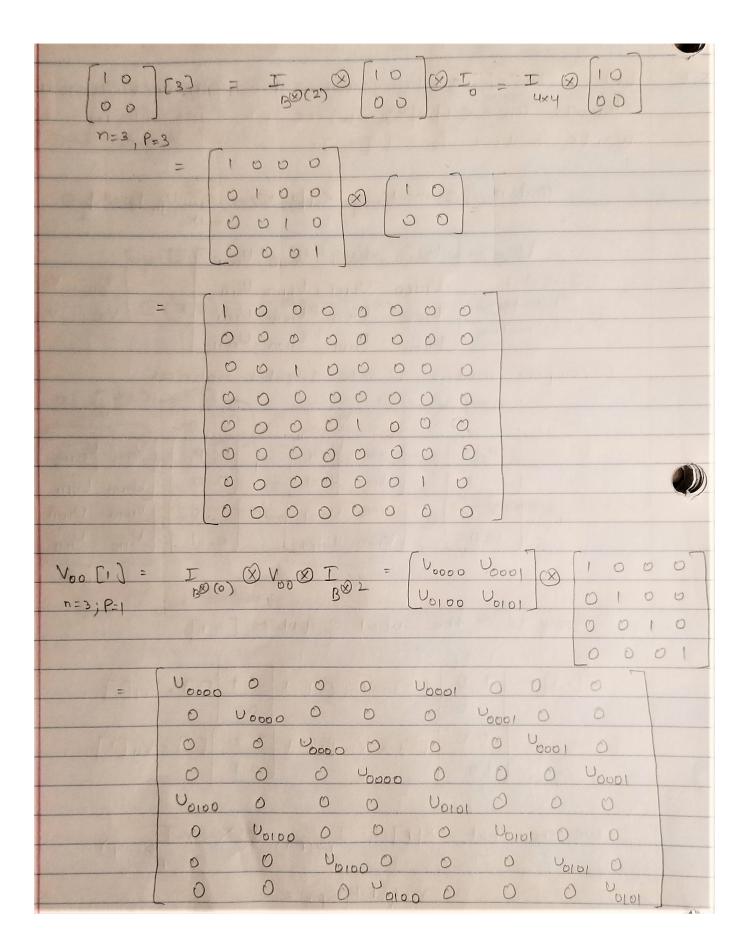
$$X[p] = I_{B^{\otimes (p-1)}} \otimes I_{B^{\otimes (n-p)}}$$

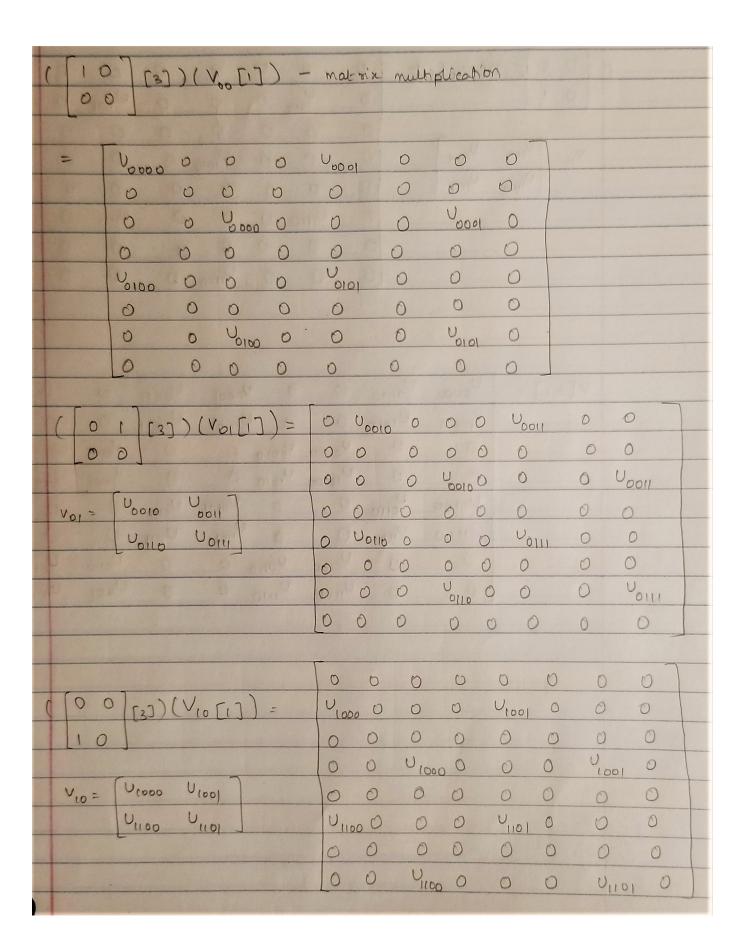
2. In our case n=3, p=2, we get, $H[2]=I_{B^{\otimes (1)}}\otimes H\otimes I_{B^{\otimes (1)}}$

$$H[2] = \frac{1}{\sqrt{2}} \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix} \otimes \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$=\frac{1}{\sqrt{2}}\begin{bmatrix}1 & 1 & 0 & 0\\ 1 & -1 & 0 & 0\\ 0 & 0 & 1 & 1\\ 0 & 0 & 1 & -1\end{bmatrix}\otimes\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}=\frac{1}{\sqrt{2}}\begin{bmatrix}1 & 0 & 1 & 0 & 0 & 0 & 0 & 0\\ 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0\\ 1 & 0 & -1 & 0 & 0 & 0 & 0 & 0\\ 0 & 1 & 0 & -1 & 0 & 0 & 0 & 0\\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0\\ 0 & 0 & 0 & 0 & 1 & 0 & -1 & 0\\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & -1\end{bmatrix}$$







[00 R371	(VI [1])	= 0	0,0	0	0	0	0	0	0
01		0	U 10	10 0	0	0	U ₁₀₁₁	0	0
		0	0	0	0	0	0	0	0
V1) = 1010	Violi	0	0	0	U1010	0	0	0	U1011
Ullio	VIIII	0	0	0	0	0	0	0	0
	16.2	0	U ₁₁₁	00	0	0	UIII	0	0
		0	0	0	0	0	0	0	0
		0	0	0	UIIIO	0	0	0	Unil
1989									
U[3,1] =	U ₀₀₀₀	U ₀₀₁₀	0	0	U ₀₀₀₁	U0011	0	C)]
U[3,1] =	U ₀₀₀₀	U ₀₀₁₀			U ₀₀₀₁			0	
U[3,1] =	U ₀₀₀₀	U ₀₀₁₀ U ₁₀₁₀		0	U ₀₀₀₁	0	0	0	011
U[3,1] =	01000	U1010	0	0	0	0	0	0	011
U[3,1] =	0	0	0	0	0	0	0	0	011
U[3,1] =	0	V1010 0 0 V0110	0 V ₀₀₀₀	O V ₀ 010 V ₁ 010	U,001 O O U0101	0	U0001	0 0 0	
	0 0 0 0 0 0 0	V1010 0 V0110 V1110	0 V ₀₀₀₀ V ₁₀₀₀	0 000	U 1001 O U 0101 U 1101	0	0001 V1001	0 0 0	
	0 0 0 0 0 0 0	V1010 0 0 V0110	0 V ₀₀₀₀ V ₁₀₀₀	0 V ₀ 010 O	U,001 O U0101 U101	0 0 0 0	0 0001 0 0	0 0 0 0	011

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