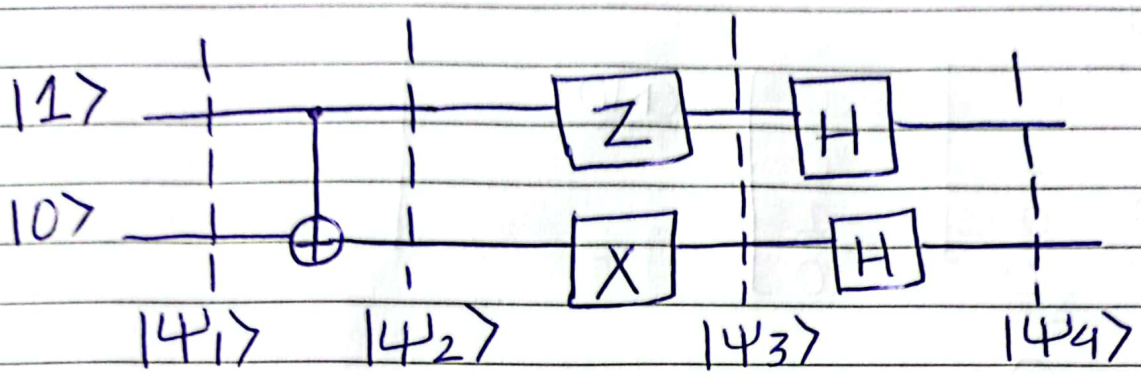
(1)

$|10\rangle$

WEDNESDAY 03
محرم 5



$|\psi_1\rangle = |10\rangle$

$|\psi_2\rangle = |11\rangle$

$|\psi_3'\rangle = -|11\rangle$

$|\psi_3\rangle = -|10\rangle$

THURSDAY 04
محرم 6

$$|\psi_4\rangle = -H^{\otimes 2}|10\rangle$$

$$= -\{H|1\rangle H|0\rangle\}^2$$

$$= -\left(\frac{|0\rangle - |1\rangle}{\sqrt{2}}\right)\left(\frac{|0\rangle + |1\rangle}{\sqrt{2}}\right)$$

$$|\psi_4\rangle = -\frac{1}{2}\left(|00\rangle + |01\rangle - |10\rangle - |11\rangle\right).$$

05 FRIDAY
7 محرم

unitary matrix :-

$$S_1 = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix} = \text{CNOT}$$

$$S_2 = Z \otimes X$$

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

$$= \begin{bmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & -1 \\ 0 & 0 & -1 & 0 \end{bmatrix}$$

06 SATURDAY
8 محرم

07 SUNDAY
9 محرم

$$S_3 = H \otimes H$$

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

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

$$S_3 \times (S_2 \times S_1)$$

(3)

$$S_2 \times S_1 = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & -1 \\ 0 & 0 & -1 & 0 \end{bmatrix} \times \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$

$$= \begin{bmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & -1 \end{bmatrix} = (S_2 \times S_1)$$

$$S_3 \times (S_2 \times S_1)$$

$$= \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & -1 & 1 & -1 \\ 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \end{bmatrix} \frac{1}{2} \times (S_2 \times S_1)$$

$$= \frac{1}{2} \begin{bmatrix} 1 & 1 & -1 & -1 \\ -1 & 1 & -1 & 1 \\ 1 & 1 & 1 & 1 \\ -1 & 1 & 1 & -1 \end{bmatrix} = S_3 \times (S_2 \times S_1)$$

19 FRIDAY 21 محرم

$H^{\otimes 3}(|111\rangle + |101\rangle + |100\rangle)$

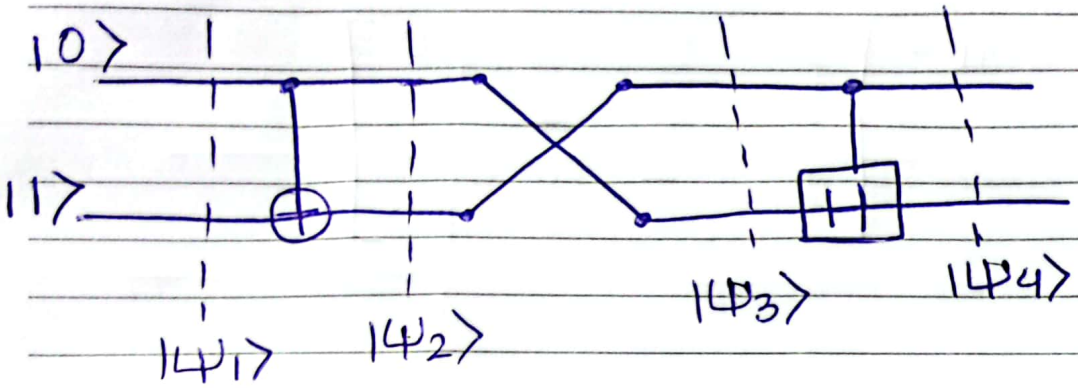
	111	101	100
000	+	+	+
001	−	≠	≠
010	≠	≠	+
011	≠	≠	+
100	−	−	−
101	+	≠	≠
110	≠	≠	−
111	−	≠	≠

20 SATURDAY 22 محرم

21 SUNDAY 23 محرم

$$= \left(3|000\rangle - |001\rangle + |010\rangle + |011\rangle - 3|100\rangle + |101\rangle - |110\rangle - |111\rangle\right)\frac{1}{2\sqrt{2}}.$$

$|01\rangle$



$\Rightarrow |\Psi_1\rangle = |01\rangle$

$|\Psi_2\rangle = |01\rangle$

$|\Psi_3\rangle = |10\rangle$

$|\Psi_4\rangle = |1\rangle H|0\rangle$

$= |1\rangle \left(\frac{|0\rangle + |1\rangle}{\sqrt{2}}\right)$

$|\Psi_4\rangle = |10\rangle + |11\rangle \left(\frac{1}{\sqrt{2}}\right)$

$S_3 \times (S_2 \times S_1)$

$S_1 = CNOT = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix}$

07 WEDNESDAY
11 صفر

$$S_2 = SWAP = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$S_3 = CH = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1/\sqrt{2} & 1/\sqrt{2} \\ 0 & 0 & 1/\sqrt{2} & \frac{-1}{\sqrt{2}} \end{bmatrix}$$

08 THURSDAY
12 صفر

$$(S_2 \times S_1) = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$

$$S_3(S_2 \times S_1) = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1/\sqrt{2} & 1/\sqrt{2} \\ 0 & 0 & \frac{1}{\sqrt{2}} & \frac{-1}{\sqrt{2}} \end{bmatrix} \times (S_2 \times S_1)$$

$$= \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 1/\sqrt{2} & 1/\sqrt{2} & 0 \\ 0 & 1/\sqrt{2} & -1/\sqrt{2} & 0 \end{bmatrix} = S_3(S_2 \times S_1)$$

12 MONDAY 16 صفر

$H^{\otimes 3}(|111\rangle + |100\rangle + |110\rangle)$

	111	100	110
000	+	+	+
001	−	−	+
010	−	−	−
011	+	−	−
100	−	−	−

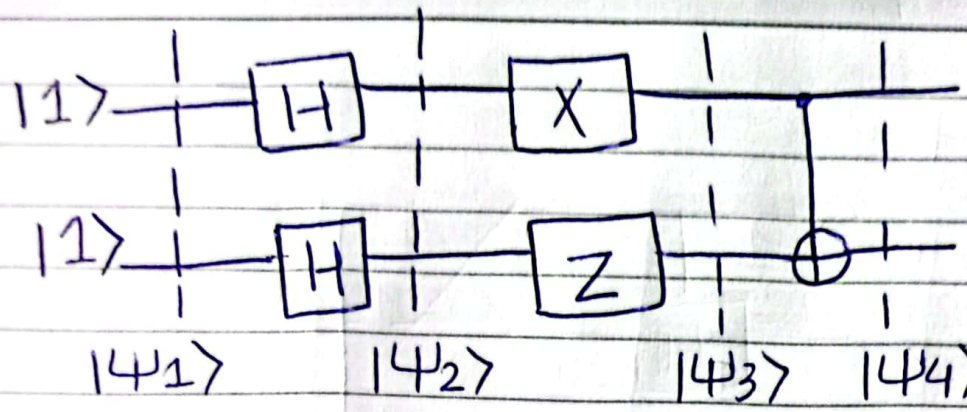
13 TUESDAY 17 صفر

101	−	−	−
110	+	−	−
111	−	−	−

$$= \{ 3|000\rangle + |001\rangle - |010\rangle + |011\rangle - 3|100\rangle - |101\rangle + |110\rangle - |111\rangle \} \frac{1}{2\sqrt{2}}.$$

August 2022
1444 محرم

|11⟩ FRIDAY 12 محرم 14



$|\psi_1\rangle = |11\rangle$

$|\psi_2\rangle = H^{\otimes 2}|11\rangle$

$= H|1\rangle H|1\rangle$

$= \left(\frac{|0\rangle - |1\rangle}{\sqrt{2}}\right)\left(\frac{|0\rangle - |1\rangle}{\sqrt{2}}\right)$

$|\psi_2\rangle = \frac{1}{2}\left(|00\rangle - |01\rangle - |10\rangle + |11\rangle\right)$

SUNDAY 14 محرم 16 SATURDAY 13 محرم 15

$|\psi_3\rangle = \frac{1}{2}\left(|10\rangle - |11\rangle - |00\rangle + |01\rangle\right).$

$|\psi_3\rangle = \frac{1}{2}\left(|10\rangle + |11\rangle - |00\rangle - |01\rangle\right).$

$|\psi_4\rangle = \frac{1}{2}\left(|11\rangle + |10\rangle - |00\rangle - |01\rangle\right)$

15 MONDAY
محرم 17

$$S_1 = H \otimes H$$

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

$$S_2 = X \otimes Z$$

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

16 TUESDAY
محرم 18

$$= \begin{bmatrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & -1 \\ 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \end{bmatrix}.$$

$$S_3 = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix} = CNOT$$

$$S_3 \times (S_2 \times S_1)$$

$$(S_2 \times S_1) = \begin{bmatrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & -1 \\ 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \end{bmatrix} \times \frac{1}{2} \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & -1 & 1 & -1 \\ 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \end{bmatrix}$$

$$(S_2 \times S_1) = \frac{1}{2} \begin{bmatrix} 1 & 1 & -1 & -1 \\ -1 & 1 & 1 & -1 \\ 1 & 1 & 1 & 1 \\ -1 & 1 & -1 & 1 \end{bmatrix}$$

$S_3 * (S_2 \times S_1)$

$$= \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix} \times (S_2 \times S_1)$$

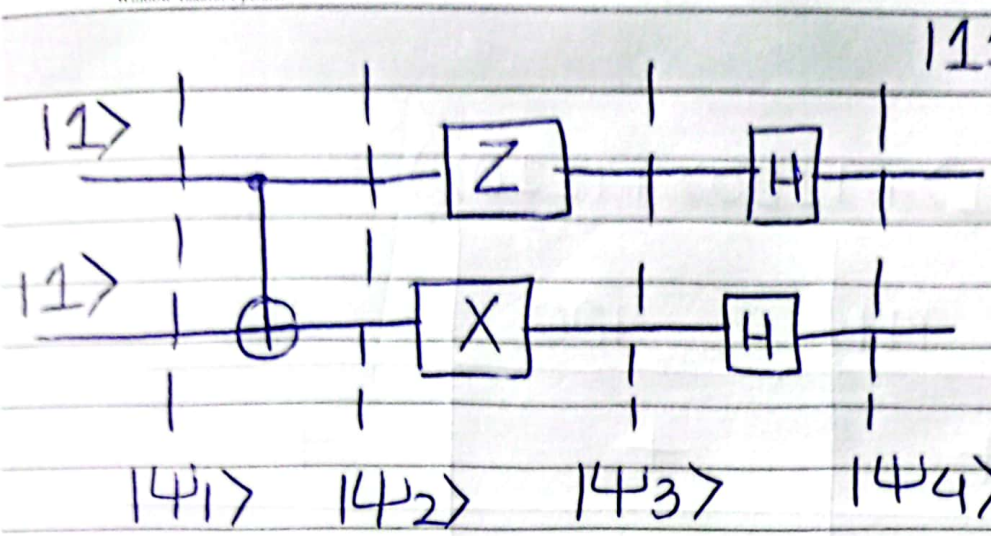
TUESDAY 23
25 محرم

$$= \frac{1}{2} \begin{bmatrix} 1 & 1 & -1 & -1 \\ -1 & 1 & 1 & -1 \\ -1 & 1 & -1 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix} = S_3 \times (S_2 \times S_1)$$

$H^{\otimes 3}(|000\rangle + |101\rangle + |110\rangle)$

	000	101	110
000	+	+	+
001	−	−	+
010	+	−	−
011	−	−	−
100	−	−	−
101	+	−	−
110	−	−	+
111	+	+	+

$= \{3|000\rangle + |001\rangle + |010\rangle - |011\rangle - |100\rangle + |101\rangle + |110\rangle + 3|111\rangle\} \frac{1}{2\sqrt{2}}$.



$$|\Psi_1\rangle = |11\rangle$$

$$|\Psi_2\rangle = |10\rangle$$

$$|\Psi_3'\rangle = -|10\rangle$$

$$|\Psi_3\rangle = -|11\rangle$$

$$|\Psi_4\rangle = H^{\otimes 2} \Rightarrow -|11\rangle$$

$$= -H|1\rangle H|1\rangle$$

$$= -\left(\frac{|0\rangle - |1\rangle}{\sqrt{2}}\right)\left(\frac{|0\rangle - |1\rangle}{\sqrt{2}}\right)$$

$$|\Psi_4\rangle = -\frac{1}{2}(|00\rangle - |01\rangle - |10\rangle + |11\rangle .$$

unitary matrix is same as on pg #2, 3.

16 FRIDAY
20 صفر

$H^{\otimes 3}(+|111\rangle + |100\rangle + |110\rangle)$

	111	100	110
000	+	+	+
001	≠	≠	+
010	−	≠	≠
011	+	≠	≠
100	−	−	−

17 SATURDAY
21 صفر

18 SUNDAY
22 صفر

101	≠	≠	−
110	+	≠	≠
111	−	≠	≠

$$= \{ 3|000\rangle + |001\rangle - |010\rangle + |011\rangle - 3|100\rangle - |101\rangle + |110\rangle - |111\rangle \} \frac{1}{2\sqrt{2}}.$$