

1) a)

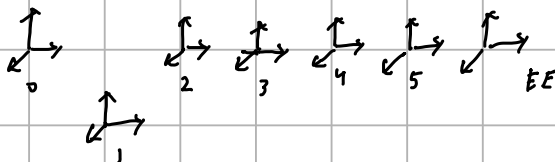
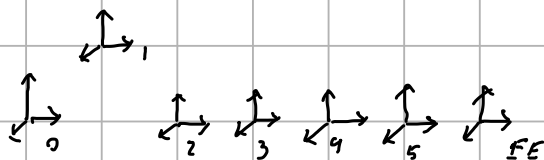
$$\begin{bmatrix} \cos(\frac{\pi}{4}) & -\sin(\frac{\pi}{4}) & 0 & 0 \\ \sin(\frac{\pi}{4}) & \cos(\frac{\pi}{4}) & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} \frac{\sqrt{2}}{2} & -\frac{\sqrt{2}}{2} & 0 & 0 \\ \frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2} & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} = T_{SB}$$

b) origin of B in S is  $\langle 0, -9, 7 \rangle$

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos \frac{\pi}{2} & -\sin \frac{\pi}{2} & -9 \\ 0 & \sin \frac{\pi}{2} & \cos \frac{\pi}{2} & 7 \\ 0 & 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & -1 & -9 \\ 0 & 1 & 0 & 7 \\ 0 & 0 & 0 & 1 \end{bmatrix} = T_{SB}$$

c) No. For example two solutions could look like this.

The full translation is the same as it defines the same robot, but the intermediary ones are defined by engineers.



d) It would mean the end effector frame is in the exact same position as the frame 0.

