PROGRAMMING IN C

Wed 14 Nov 2018

PROBLEM Write a prog. that (lang. C)

1) Defines matrices (2x2) (Hint: Define it as an array of 4 #'s)
2) Implements multiplication of 2 such matrices
3) Implements addition of 2 such matrices

What are those things called matrices (sing. matrix)?

First nothing to do with the film series 😊

Definition A matrix is an arrangement of number in a rectangular form

Ex: A 2x2 matrix has 2 row & 2 columns

$$\begin{pmatrix} 3 & 1 \\ 2 & 1.5 \end{pmatrix}$$

Ex: →

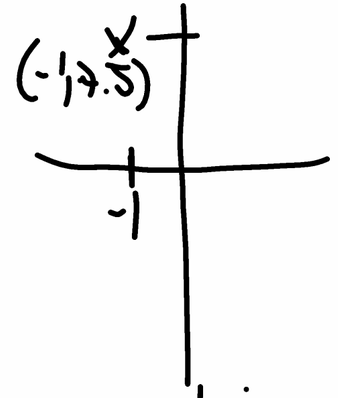
Ex: A 3x2 matrix has 3 rows & 2 columns

$$\begin{pmatrix} 1 & \frac{1}{2} \\ \frac{3}{4} & 5 \\ 7.3 & -1 \end{pmatrix}$$

Ex: A 2x3 matrix has 2 rows & 3 columns

$$\begin{pmatrix} 5 & -1 & 2 \\ \frac{7}{3} & -4 & 0 \end{pmatrix}$$

Arrangements of #'s are not rare. We have already seen in math that a point on the plane is given by 2 #'s arranged as an ordered pair (x, y). Ex: $(-1, 2.5)$



Example: A gates in Quantum Computation are square matrices

And X, Y, Z, H These are 2x2 matrices

But CNOT is 4x4 matrix

Multiplication of 2x2 matrices:

Ex: $A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ $B = \begin{pmatrix} 5 & 6 \\ 7 & 8 \end{pmatrix}$

$$A \cdot B = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} \begin{pmatrix} 5 & 6 \\ 7 & 8 \end{pmatrix} = \begin{pmatrix} 1\cdot 5 + 2\cdot 7 & 1\cdot 6 + 2\cdot 8 \\ 3\cdot 5 + 4\cdot 7 & 3\cdot 6 + 4\cdot 8 \end{pmatrix} =$$

$$= \begin{pmatrix} 19 & 22 \\ 43 & 50 \end{pmatrix}$$

Exercise: What's $B \cdot A$?

$$A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} \qquad B = \begin{pmatrix} 5 & 6 \\ 7 & 8 \end{pmatrix}$$

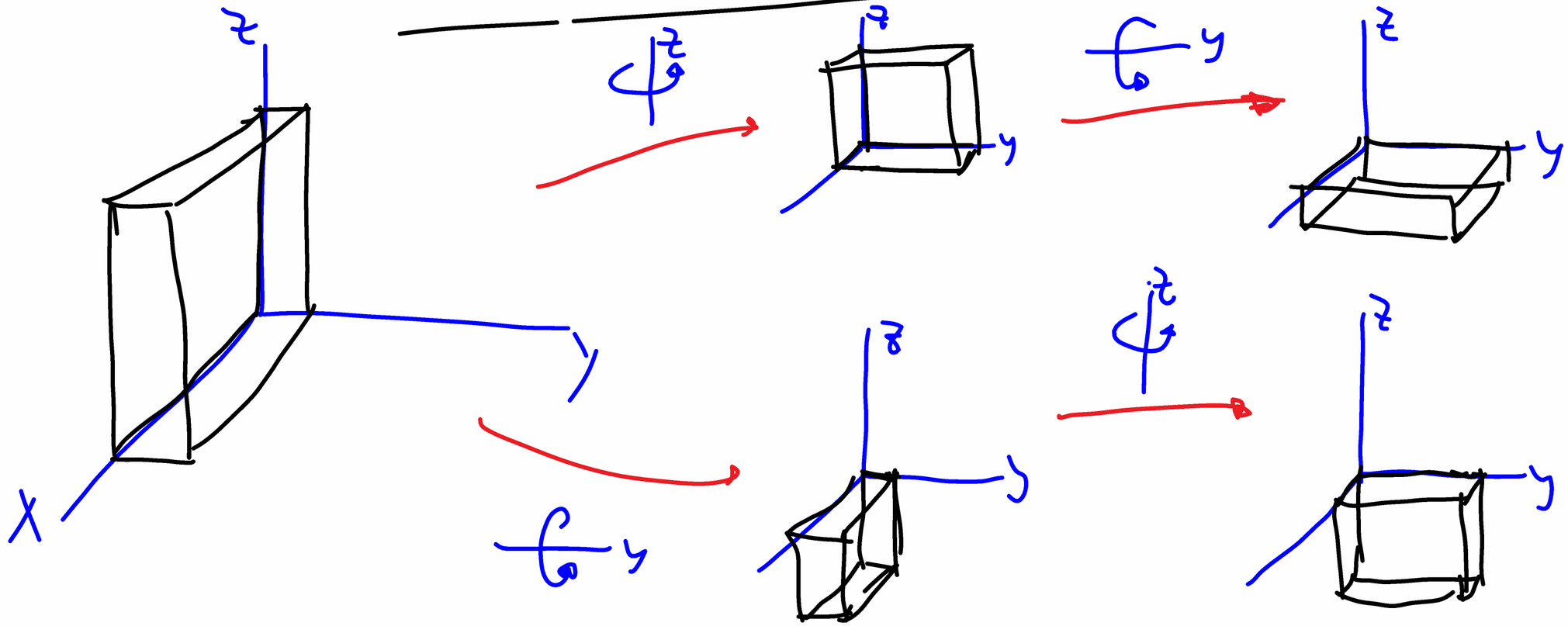
$$B \cdot A = \begin{pmatrix} 5 & 6 \\ 7 & 8 \end{pmatrix} \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} = \begin{pmatrix} 5 \cdot 1 + 6 \cdot 3 & 5 \cdot 2 + 6 \cdot 4 \\ 7 \cdot 1 + 8 \cdot 3 & 7 \cdot 2 + 8 \cdot 4 \end{pmatrix} =$$

$$= \begin{pmatrix} 23 & 34 \\ 31 & 46 \end{pmatrix}$$

NOTICE

$A \cdot B \neq B \cdot A$!!

MATRIX MULTIPLICATION HAS TO DO WITH ROTATIONS



MATRIX ADDITION

$$A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} \quad B = \begin{pmatrix} 5 & 6 \\ 7 & 8 \end{pmatrix}$$

$$A + B = \begin{pmatrix} 1+5 & 2+6 \\ 3+7 & 4+8 \end{pmatrix} = \begin{pmatrix} 6 & 8 \\ 10 & 12 \end{pmatrix}$$