

Homework 0

Handed Out: August 28

Due: 7:59 pm September 4

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1 Declaration

- **Person(s) discussed with:** *None*
- **Affiliation to the course: student, TA, prof etc.** *None*
- **Which question(s) in coding / written HW did you discuss?** *None*
- **Briefly explain what was discussed.** *None*

2 Multiple Choice & Written Questions

1. (a) C
(b) A
2. (a) D
(b) A
3. (a) A
(b) A
4. (a) B
(b) We are given that

$$Var(x) = E[(X - E[X])^2] \tag{1}$$

$$= E[(x^2 - 2xE[x] + E[x]^2)] \tag{2}$$

$$= E[x^2] - E(2xE[x]) + E[E[x]^2] \tag{3}$$

$$= E[x^2] - 2 \cdot E[x] \cdot E[x] + E[x]^2 \tag{4}$$

$$= E[x^2] - 2E[x]^2 + E[x]^2 \tag{5}$$

$$= E[x^2] - E[x]^2 \tag{6}$$

We know that $E[2xE[x]] = 2E[x]E[x] = 2E[x]^2$ because $E[x]$ is a constant. Furthermore we know that $E[E[x]^2] = E[x]^2$ because $E[x]$ is a constant. Thus, our equation for variance $Var(x) = E[(X - E[X])^2]$ reduces down to $E[x^2] - E[x]^2$.

5. (a) **C**
 (b) **D**
 (c) **A**
6. (a) We are given a 2x2 matrix. We can find the eigenvalues of a 2x2 matrix by solving the following equation: $\det(A - \lambda \cdot I) = 0$. Since A is 2x2 we know then $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$. And also, because A is a 2x2 matrix, then the determinant of any 2x2 matrix given elements $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ $\det(M) = ad - bc$. Thus, we can solve for the eigenvalues of A by solving the equation:

$$\begin{aligned}
 \det(A - \lambda \cdot I) &= 0 \\
 &= \det\left(\begin{bmatrix} 4 - \lambda & 2 \\ 1 & 5 - \lambda \end{bmatrix}\right) = 0 \\
 &= (4 - \lambda)(5 - \lambda) - 2 = 0 \\
 &= 20 - 9\lambda + \lambda^2 - 2 = 0 \\
 &= \lambda^2 - 9\lambda + 18 = 0 \\
 &= (\lambda - 6)(\lambda - 3) = 0 \\
 &\lambda = 6, 3
 \end{aligned}$$

Thus, the two eigenvalues for the matrix A are 6 and 3.

- (b) **C**

3 Python Programming Questions

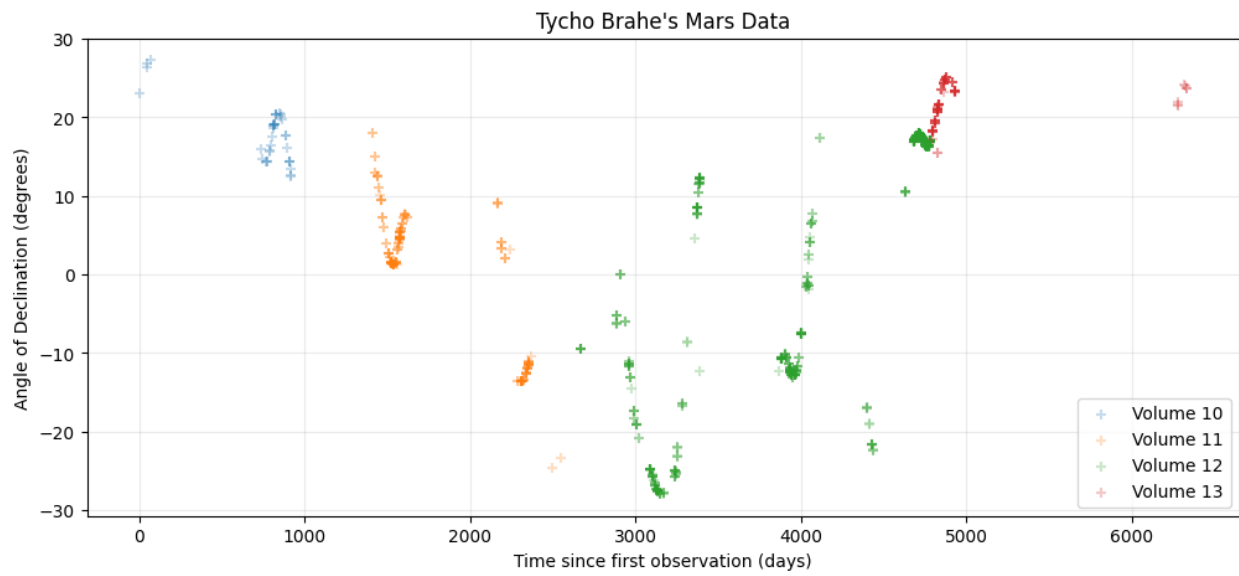


Figure 1: Figure 1