Linear Data Chapter 3

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1. Consider the following vectors

$$\vec{x} = \begin{pmatrix} 0.1 \\ 3.2 \\ 5.4 \\ 6.0 \end{pmatrix}, \quad \vec{y} = \begin{pmatrix} 0 \\ 0 \\ -1 \\ 0 \end{pmatrix}, \quad \vec{z} = \begin{pmatrix} 3 \\ 3 \\ 0.1 \end{pmatrix}$$

   For each of exercises a–e, either compute the desired quantity by hand with work shown or explain why the desired quantity is not defined.

   (a) $10\vec{x}$

   (b) $10\vec{x} - 2\vec{y}$

   (c) $\vec{y} + \vec{z}$

   (d) $\langle \vec{x}, \vec{y} \rangle$

   (e) $\langle \vec{x}, \vec{z} \rangle$

2. Give an example of a linear combination which is not feasible for a particular data problem.

3. Apply the IVORY Heuristic to a grade book (grid of numbers with rows corresponding to students and columns corresponding to graded assignments).

4. Consider the following figure[1]

[1]Source: Big Bend's Aerosol and Extinction Budgets during BRAVO, `https://vista.cira.colostate.edu/Improve/wp-content/uploads/2016/05/3_BigBendBxtBudge1.pdf`, Accessed: 02/03/2024

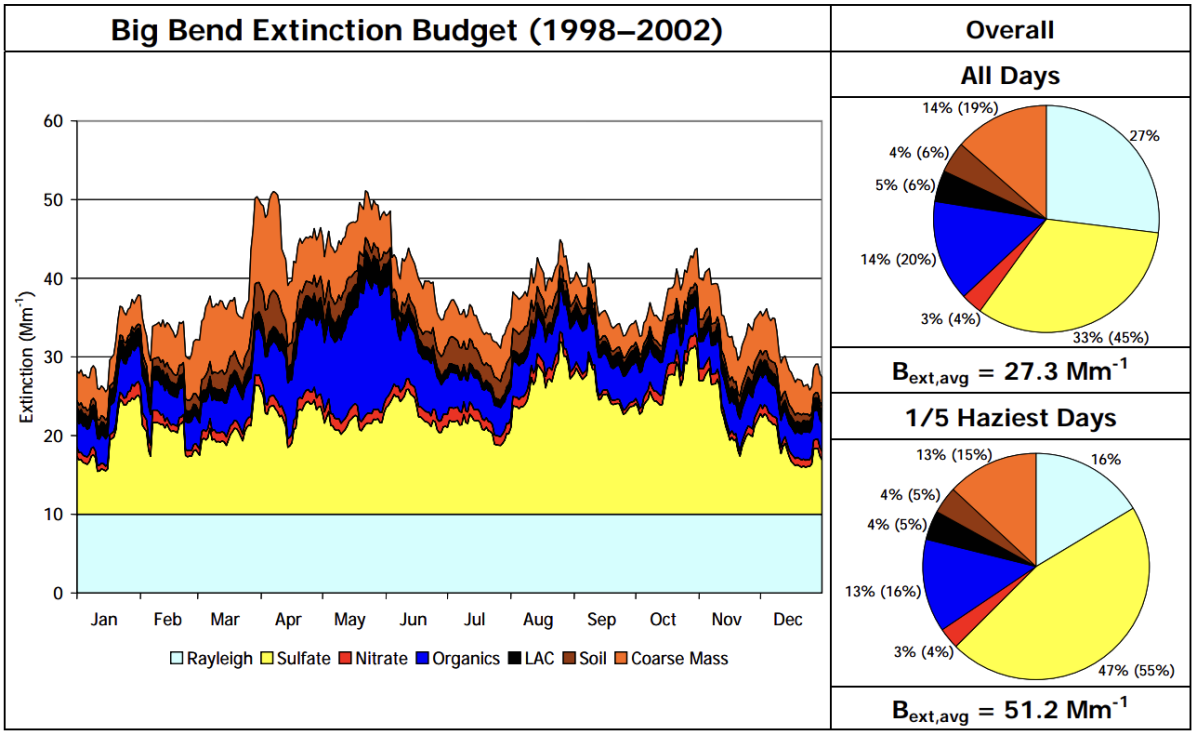

Figure 3-12. Big Bend National Park five-year light extinction budget. All days that fall on the same day of the year were averaged together, then the data were smoothed using a 15-day moving average.

from a report by Colorado State University's Cooperative Institute for Research in the Atmosphere (CIRA) on research to understand aerosols in the atmosphere at Big Bend National Park.

(a) Explain which of the the following linear algebra operations (scalar multiplication, vector addition, linear combination, inner product) was definitely used to generate the figure. You do not need any further information than what is shown in the figure.

(b) Explain what benefit there is to using that linear algebra operation the way the researchers did.