

20% 1. Determine a set of basis for the null space of the following matrix

$$\begin{bmatrix} 1 & 2 & 1 & 2 \\ 3 & 6 & 4 & -1 \\ 4 & 8 & 5 & 1 \\ -2 & -4 & -3 & 3 \end{bmatrix}$$

20% 2. Find the eigenvalues and corresponding normalized eigenvectors for the matrix D, where

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

20% 3. Find a least squares, best-fitting straight line for the points (1, 3), (-2, 2), (0, 4), (3, 4), and (2, 7).

20% 4. A factory produces light bulbs and packs every 12 bulbs in a box. The quality of the bulbs is checked by randomly selecting 4 bulbs from each box for testing. If two or more than two bulbs do not pass the quality test, the whole box is discarded. What is the probability for a box with 5 bad bulbs to pass the test?

20% 5. Three dice, each with 1 to 6 on its surfaces, are thrown once together. What is the probability that at least one 4 is shown and the sum of adding the number shown on each dice is an even number?