This assignment will not be graded and is only for practice.

Questions 1-6 are based on common data.

Consider the data points x_1, x_2, x_3 to answer the following questions.

$$x_1 = \begin{bmatrix} 0 \\ 2 \end{bmatrix},$$
$$x_2 = \begin{bmatrix} 1 \\ 1 \end{bmatrix},$$
$$x_3 = \begin{bmatrix} 2 \\ 0 \end{bmatrix}$$

The mean vector of the data points x_1, x_2, x_3 is

1 point

- ○ $\begin{bmatrix} 0 \\ 0 \end{bmatrix}$
- ○ $\begin{bmatrix} 1 \\ 1 \end{bmatrix}$
- ○ $\begin{bmatrix} 0 \\ 1 \end{bmatrix}$
- ○ $\begin{bmatrix} 0.5 \\ 0.5 \end{bmatrix}$

The covariance matrix $C = \frac{1}{n}\Sigma_{i=1}^{n}(x_i - \bar{x})(x_i - \bar{x})^T$ for the data points x_1, x_2, x_3 is

1 point

- ○ $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$
- ○ $\begin{bmatrix} 0.5 & 0.5 \\ 0.5 & 0.5 \end{bmatrix}$
- ○

$\begin{bmatrix} 0.67 & -0.67 \\ -0.67 & 0.67 \end{bmatrix}$

- $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

The eigenvalues of the covariance matrix $C = \frac{1}{n}\Sigma_{i=1}^{n}(x_i - \bar{x})(x_i - \bar{x})^T$ are

1 point

(Note: The eigenvalues should be arranged in the descending order from left to right.)

- 0.5, 0.5
- 1, 1
- $\frac{4}{3}$, 0
- 0, 0

The eigenvectors of the covariance matrix $C = \frac{1}{n}\Sigma_{i=1}^{n}(x_i - \bar{x})(x_i - \bar{x})^T$ are

1 point

(Note: The eigenvectors should be arranged in the descending order of eigenvalues from left to right in the matrix.)

- $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$
- $\begin{bmatrix} 0.5 & 0.5 \\ 1 & 1 \end{bmatrix}$
- $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$
- $\begin{bmatrix} -0.7 & 0.7 \\ 0.7 & 0.7 \end{bmatrix}$

The data points x_1, x_2, x_3 are projected onto the one dimensional space using PCA as points z_1, z_2, z_3 respectively.

1 point

- $z_1 = \begin{bmatrix} 1 \\ 1 \end{bmatrix}, z_2 = \begin{bmatrix} 1 \\ 1 \end{bmatrix}, z_3 = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$
- $z_1 = \begin{bmatrix} 0.5 \\ 0.5 \end{bmatrix}, z_2 = \begin{bmatrix} 0 \\ 0 \end{bmatrix}, z_3 = \begin{bmatrix} -0.5 \\ -0.5 \end{bmatrix}$
- $z_1 = \begin{bmatrix} 0 \\ 2 \end{bmatrix}, z_2 = \begin{bmatrix} 1 \\ 1 \end{bmatrix}, z_3 = \begin{bmatrix} 2 \\ 0 \end{bmatrix}$
- $z_1 = \begin{bmatrix} -1 \\ 1 \end{bmatrix}, z_2 = \begin{bmatrix} 0 \\ 0 \end{bmatrix}, z_3 = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$

The approximation error J is given by $\Sigma_{i=1}^{n} ||x_i - z_i||^2$. What could be the possible value of the reconstruction error? ***1 point***

- 1
- 2
- 10
- 20