

Submission Deadline: August 29, 2024, 12:15 PM

1. Consider the multivariate normal distribution $\mathbf{X} \sim N_2(\boldsymbol{\mu}, \Sigma)$.
 - (a) Taking $\boldsymbol{\mu} = \begin{pmatrix} 5 \\ 8 \end{pmatrix}$ and $\Sigma = \begin{pmatrix} 9 & 6a \\ 6a & 4 \end{pmatrix}$ and for each of the four values of $a = -1, -0.5, 0, 0.5, 1$, generate 10,000 sample from the distribution of $\mathbf{X} = \begin{pmatrix} X_1 \\ X_2 \end{pmatrix} \sim N_2(\boldsymbol{\mu}, \Sigma)$.
 - (b) For each value of a , plot the 2-dimensional histogram (please see <https://plotly.com/python/2D-Histogram/>) based on 10,000 simulated values of \mathbf{X} .
 - (c) Also, draw the contour plots of the actual densities on the histograms.
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