Consider the multivariate normal distribution $X \sim \mathcal{N}(\mu, \Sigma)$.

1. Taking $\mu = \begin{pmatrix} 5 \\ 8 \end{pmatrix}$ and $\Sigma = \begin{pmatrix} 1 & 2a \\ 2a & 4 \end{pmatrix}$ and for each of the three values of $a = -0.5, 0, 0.5$, generate $X = \begin{pmatrix} X_1 \\ X_2 \end{pmatrix} \sim \mathcal{N}(\mu, \Sigma)$.
2. For the cases $a = -0.5, 0, 0.5$ (and also for the case $a = 1$), plot the values generated in a three dimensional graph (similar to the univariate case), where $x$ and $y$-axes would correspond to $X_1$ and $X_2$ values and the $z$-axis would correspond to the count/frequency of the generated value. Do this simulation for $1000$ values of $X$.
3. Also, plot the actual and simulated density for the above cases, both for the two-dimensional and the marginal one-dimensional cases.