

Monte Carlo Simulation Assignment - 6

Ques 1:

- To generate a sample of the Bivariate Normal Random Variable X , Cholesky Factorization method for the 2×2 case was used.
- The following steps were followed:
 - Using the Box-Muller method, a 1000 values for $Z1 \sim N(0, 1)$ and $Z2 \sim N(0, 1)$ were generated.
 - Using the Cholesky Factorization, $X1 \sim N(5, 1)$ and $X2 \sim N(8, 2)$ were obtained
 - $X \sim N(\mu, \Sigma)$ was obtained by clubbing $X1$ and $X2$ into a 2×1 vector

Ques 2-3:

For the obtained random sample of X , simulated graphs were plotted.

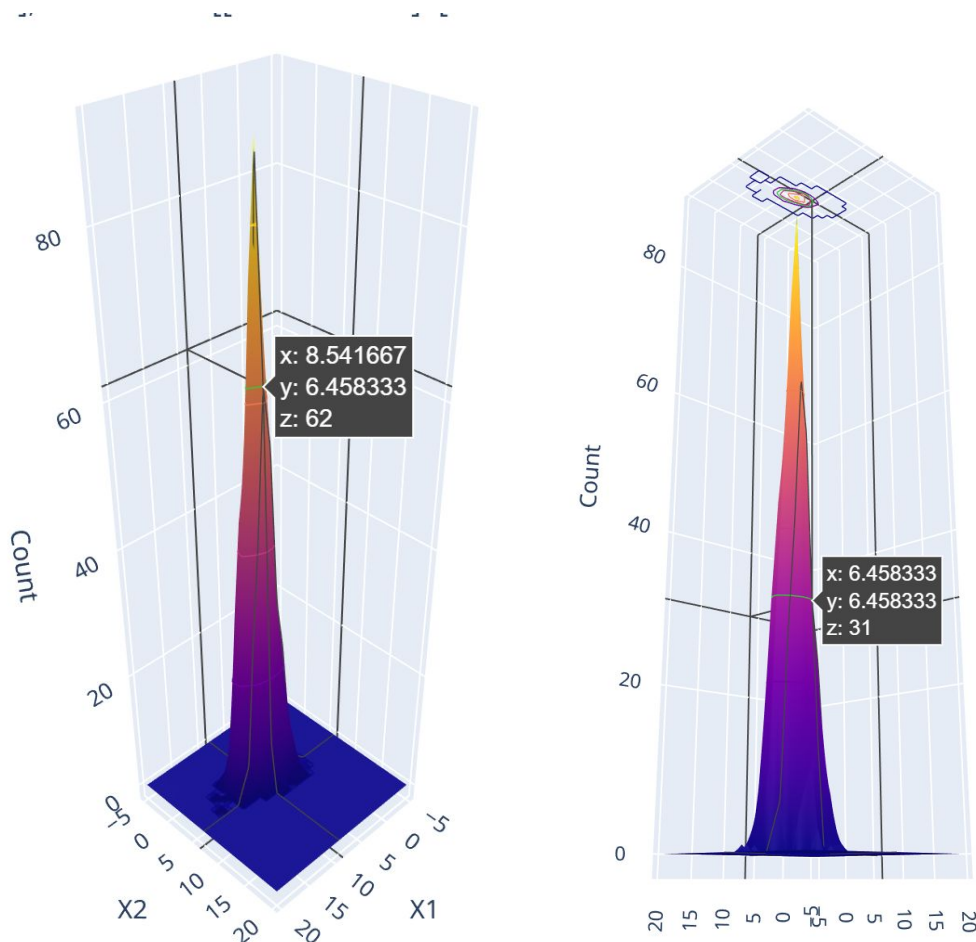
(The Mean and the Variance of the sample is mentioned within the graphs)

- $a = -0.5$

$a = -0.5$

SIMULATED Multivariate Distribution Curve

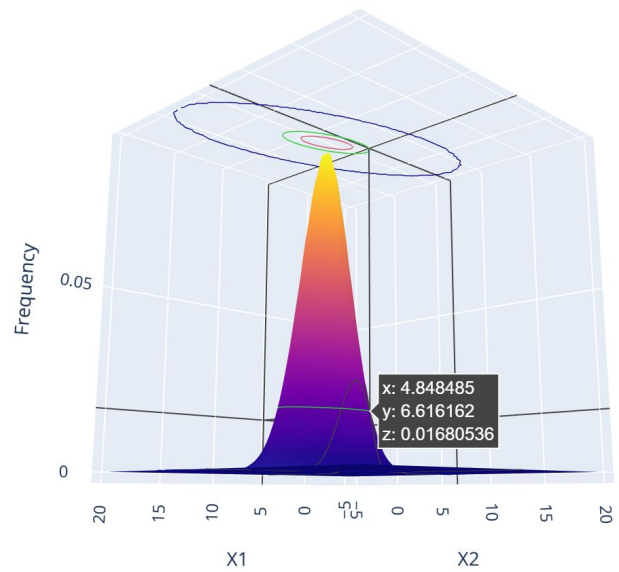
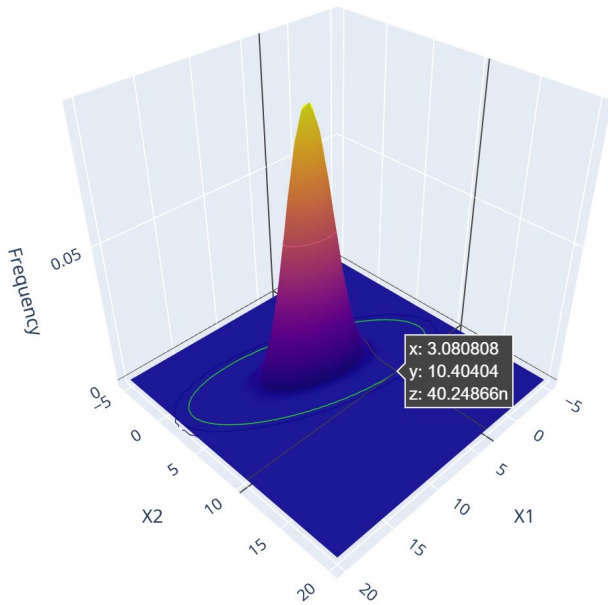
Mean = [5.004 8.019] Variance = [[0.999 -0.919] [-0.919 3.82]]



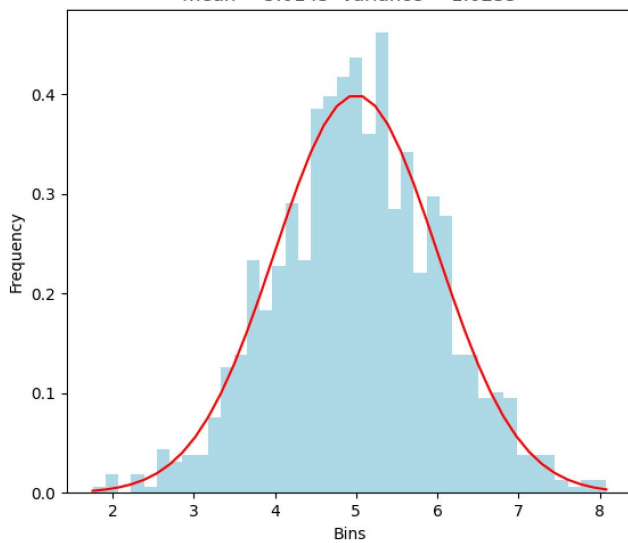
$a = -0.5$

Actual Multivariate Distribution Curve

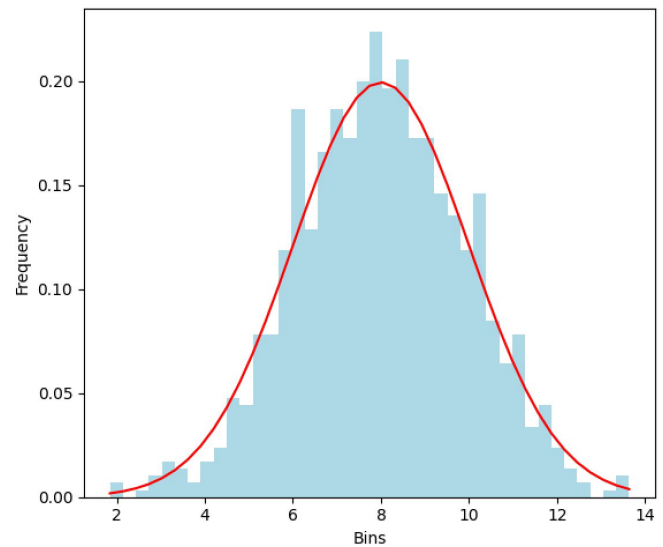
Mean = [5 8] Variance = $\begin{bmatrix} 1. & -1. \\ -1. & 4. \end{bmatrix}$



$X1 \sim N(\mu, \sigma)$
 $a = -0.5$
mean = 5.0145 variance = 1.0235



$X2 \sim N(\mu, \sigma)$
 $a = -0.5$
mean = 8.0081 variance = 3.6356

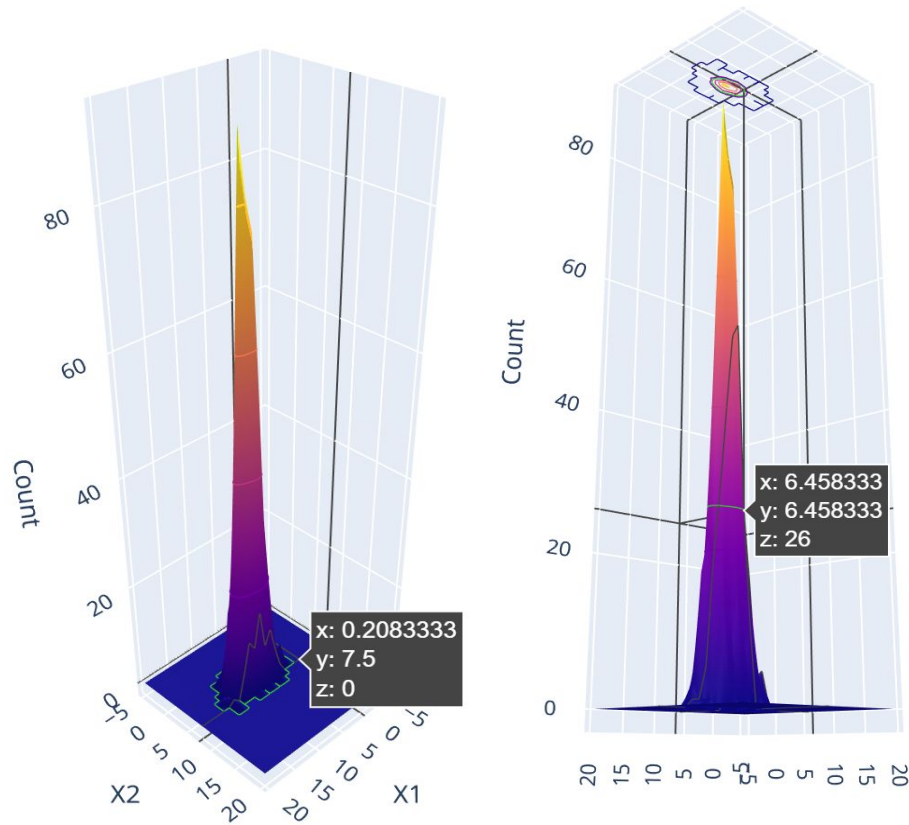


- $a = 0$

$a = 0$

SIMULATED Multivariate Distribution Curve

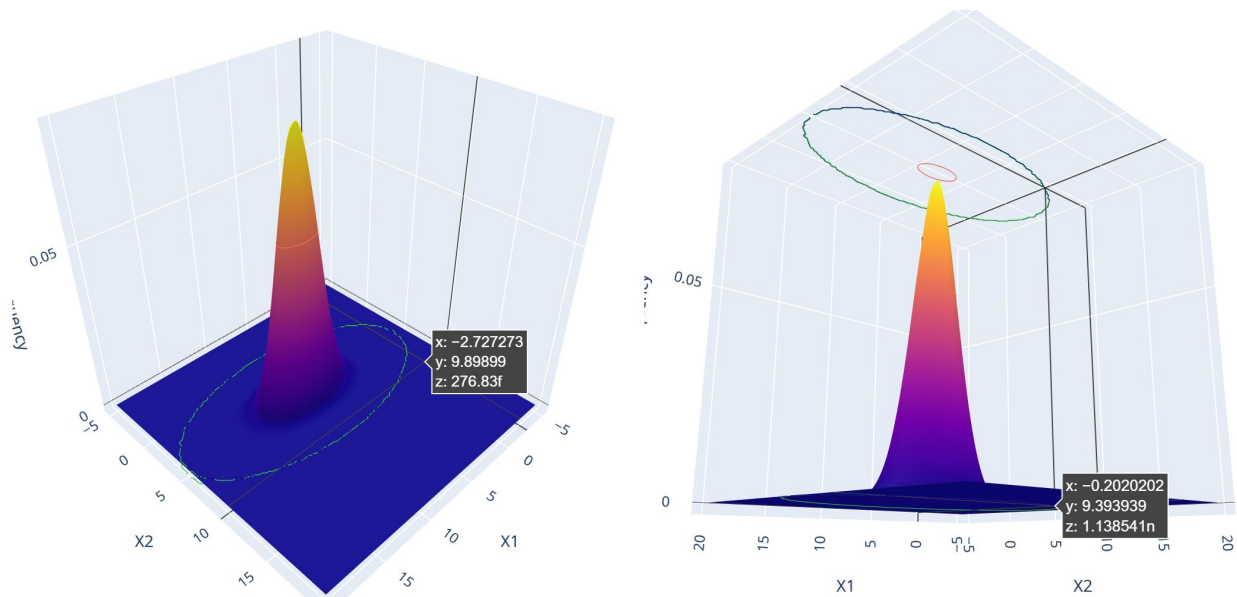
Mean = [4.992 8.057] Variance = [[0.957 -0.047] [-0.047 3.831]]

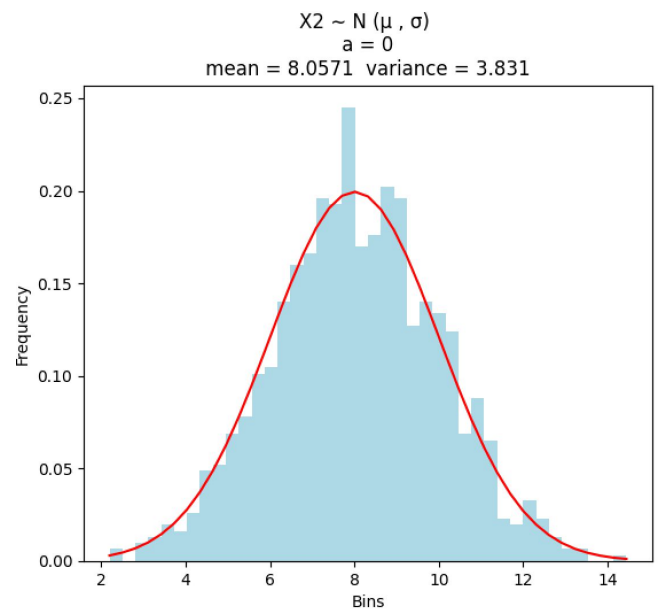
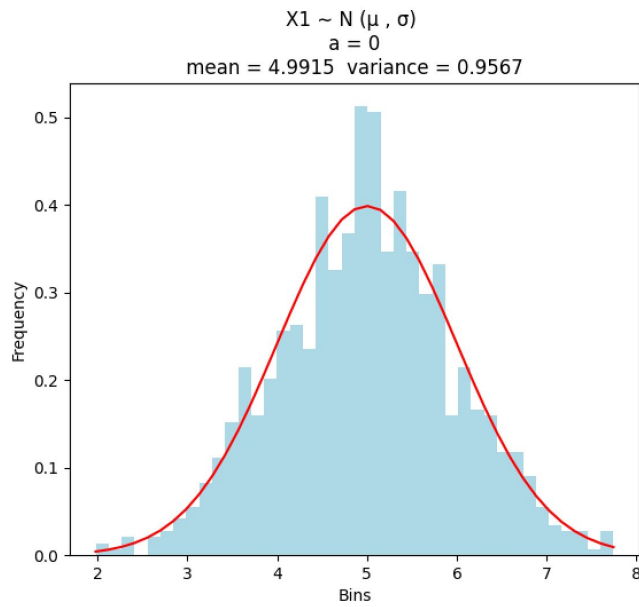


$a = 0$

Actual Multivariate Distribution Curve

Mean = [5 8] Variance = [[1 0] [0 4]]



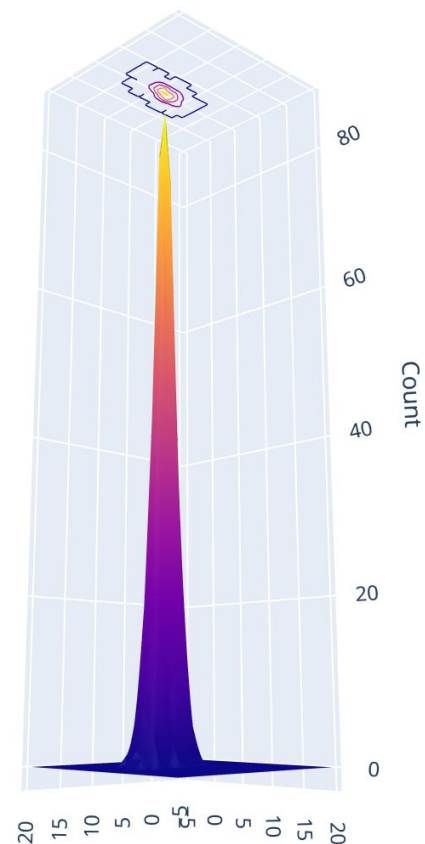
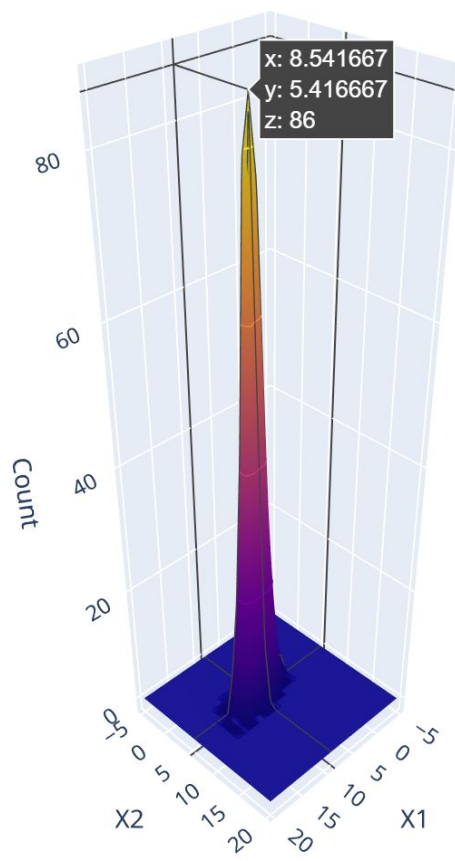


- $a = 0.5$

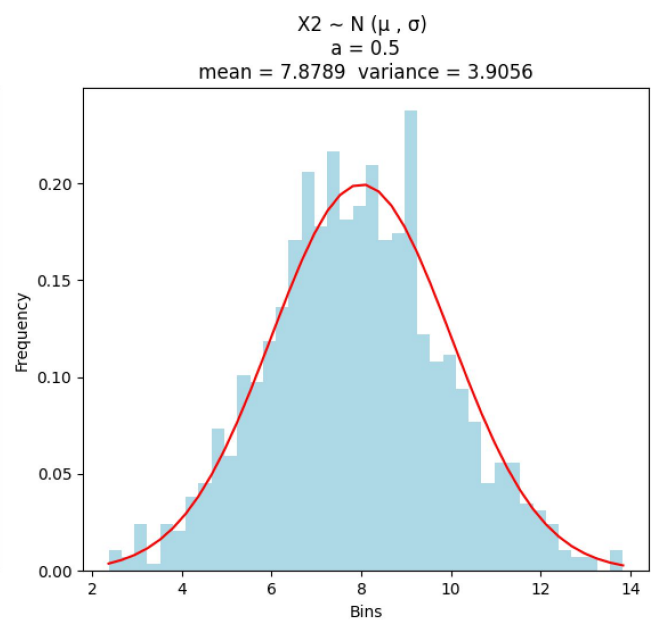
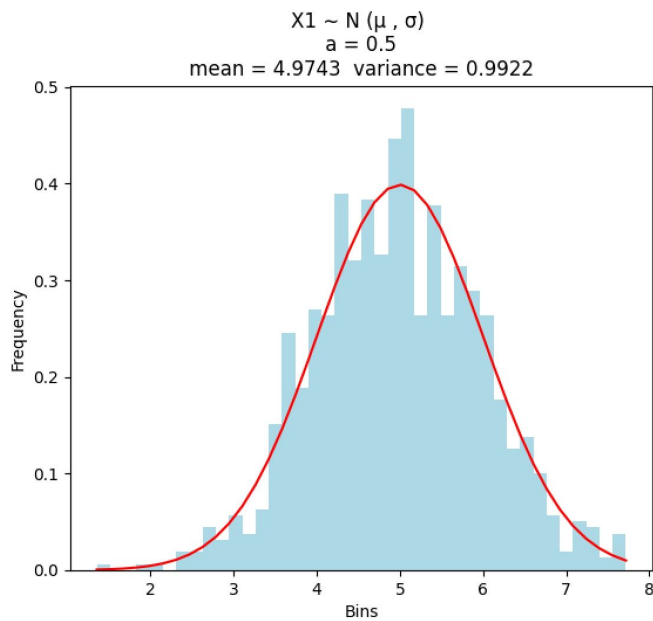
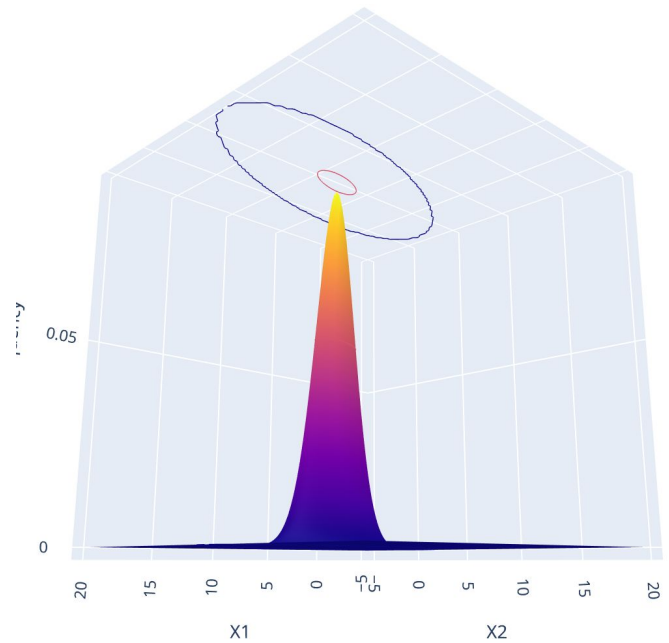
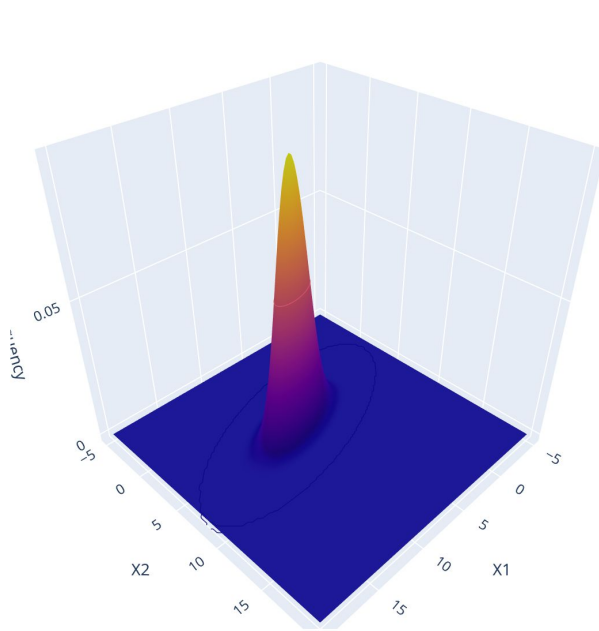
$a = 0.5$

SIMULATED Multivariate Distribution Curve

Mean = [4.974 7.879] Variance = [[0.992 0.831] [0.831 3.906]]



$a = 0.5$
 Actual Multivariate Distribution Curve
 Mean = [5 8] Variance = $\begin{bmatrix} 1. & 1. \\ 1. & 4. \end{bmatrix}$



- $a = 1$ (Since the Covariance-Matrix is non-invertible, there doesn't exist an actual distribution for it)

$a = 1$

SIMULATED Multivariate Distribution Curve

Mean = [5.002 8.005] Variance = [[0.995 1.989] [1.989 3.978]]

