6. The expectation is \( E[T] = ab \).

2a. If \((X, Y)\) is bivariate normal with parameters \(\mu_1, \mu_2, \sigma_1^2, \sigma_2^2, \rho\), then \(X \sim N(\mu_1, \sigma_1^2)\) and the conditional distribution of \(Y\) given that \(X = x\) is \(N(\mu_2 + \rho \frac{\sigma_2}{\sigma_1}(x - \mu_1), \sigma_2^2(1 - \rho^2))\). To generate \(n\) observations on such a bivariate normal distribution in Matlab, do

\[
x = \text{random}('\text{norm}', \mu_1, \sigma_1, 1, n);
y = \text{random}('\text{norm}', \mu_2 + \rho \frac{\sigma_2}{\sigma_1}(x - \mu_1), \text{sqrt}(\sigma_2^2(1 - \rho^2)), 1, n);
\]

b. With these parameter values, the Matlab commands become
\[
x = \text{random}('\text{norm}', 0, 1, 1, 1000); \quad y = \text{random}('\text{norm}', \rho * x, \text{sqrt}(1 - \rho * \rho));
\]

and the plots should look something like this:
\( \rho = -0.9 \)

\( \rho = -0.5 \)

\( \rho = 0 \)

\( \rho = 0.5 \)

\( \rho = 0.9 \)