Sample covariance $S_{xy} = \frac{1}{n-1} \sum_{i=1}^{n} (X_i - \bar{X})(Y_i - \bar{Y})$ is an unbiased estimate of the population covariance $Cov(X,Y) = E(XY) - E(X)E(Y)$.

Proof. The equality

$$\begin{aligned}
\sum_{i=1}^{n} (X_i - \bar{X})(Y_i - \bar{Y}) &= \sum (X_i Y_i) - \bar{X} \sum (Y_i) - \bar{Y} \sum (X_i) + n(\bar{X}\bar{Y}) \\
&= \sum (X_i Y_i) - n(\bar{X}\bar{Y}) \\
&= \sum (X_i Y_i) - n^{-1} (\sum_{i=1}^{n} X_i)(\sum_{j=1}^{n} Y_j) \\
&= \sum (X_i Y_i) - n^{-1} (\sum_{i=1}^{n} X_i Y_i) - n^{-1} (\sum_{i \neq j} X_i Y_j)
\end{aligned}$$

entails due to independence between X_i and Y_j that

$$\begin{aligned}
E(\sum_{i=1}^{n} (X_i - \bar{X})(Y_i - \bar{Y})) &= n(1 - n^{-1}) E(XY) - n(n-1) n^{-1} E(X) E(Y) \\
&= (n-1) Cov(X,Y).
\end{aligned}$$