Solution for the Error Propagation exercise

The length and width of the table was measured to:

\[ L = 3.5 \pm 0.4 \text{ m} \quad W = 0.8 \pm 0.2 \text{ m} \]

The Circumference, Area and Diagonal and their errors are calculated as following (assuming no correlation):

\[
C = 2L + 2W \quad \sigma_C = \sqrt{(2\sigma_L)^2 + (2\sigma_W)^2} \\
A = L \cdot W \quad \sigma_A = \sqrt{(W\sigma_L)^2 + (L\sigma_W)^2} \\
C = 8.6 \pm 0.9 \text{ m} \quad A = 2.8 \pm 0.8 \text{ m} \\
D = \sqrt{\left(\frac{L\sigma_L}{\sqrt{L^2+W^2}}\right)^2 + \left(\frac{W\sigma_W}{\sqrt{L^2+W^2}}\right)^2} \\
D = 3.6 \pm 0.4 \text{ m}
\]

Now with correlation:

\[
C = 2L + 2W \quad \sigma_C = \sqrt{(2\sigma_L)^2 + (2\sigma_W)^2 + (4\sigma_{LW})^2} \\
A = L \cdot W \quad \sigma_A = \sqrt{(W\sigma_L)^2 + (L\sigma_W)^2 + 2LW\sigma_{LW}^2} \\
C = 8.6 \pm 1.2 \text{ m} \quad A = 2.8 \pm 0.8 \text{ m} \\
D = 3.6 \pm 0.4 \text{ m}
\]

Recall that \(\sigma_{LW}^2 = V_{LW}\) and \(\rho_{LW} = \frac{V_{LW}}{\sigma_L\sigma_W}\). By knowing \(\rho_{LW} = 0.5\), we can calculate \(V_{LW}\) and thereby find the errors with correlation:

\[ C = 8.6 \pm 1.2 \text{ m} \]
\[ A = 2.8 \pm 0.8 \text{ m} \]
\[ D = 3.6 \pm 0.4 \text{ m} \]