EX: An engineer measures the following beta values for bipolar transistors with the aim of finding nominal values of gain, (i.e., beta), to list on a datasheet.

$\beta_1 = 111$ $\beta_2 = 136$ $\beta_3 = 159$ $\beta_4 = 141$ $\beta_5 = 109$ $\beta_6 = 121$

$\beta_7 = 117$ $\beta_8 = 105$ $\beta_9 = 99$ $\beta_{10} = 102$

Using the above data, find the confidence interval for the true mean at the 1 % significance level (a.k.a. the 99 % confidence interval). (Assume the underlying distribution for the measured data is gaussian.)

SOL'N: The confidence interval is a function of the sample mean, $\bar{x}$, the level of significance, $\alpha = (100\%\text{-}99\%)/100\% = 0.01$, the sample standard deviation, s, the number of data points, $n = 10$, and the critical point of the t–distribution, $t_{n-1,\frac{\alpha}{2}}$.

$$\left(\bar{x} - t_{n-1,\frac{\alpha}{2}} \cdot \frac{s}{\sqrt{n}},\ \bar{x} + t_{n-1,\frac{\alpha}{2}} \cdot \frac{s}{\sqrt{n}}\right)$$

The value of $\bar{x}$ is found with a spreadsheet to be 120, and the value of s is found to be approximately 19.5.

For the critical point, we use a table (e.g., see Ref):

$$t_{n-1,\frac{\alpha}{2}} = t_{9,0.005} = 3.250$$

Using these values we find the confidence interval:

$$\left(120 - 3.250 \cdot \frac{19.5}{\sqrt{10}},\ 120 + 3.250 \cdot \frac{19.5}{\sqrt{10}}\right) \approx (120 - 20,\ 120 + 20) = (100,\ 140)$$

REF: Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, and Keying Ye, *Probability and Statistics for Engineers and Scientists,* 7th Ed., Upper Saddle River, NJ: Prentice Hall, 2002.