

Practice: Comparing Interval Estimates

In the Michelson speed of light experiments, a total of 100 velocity measurements were recorded. The data are in the file **Michelson 1879.jmp**.

In this practice, you use these data to construct and interpret three intervals. You put yourself in the position of an analyst explaining your findings to others, and then you compare and contrast these intervals.

1. What is the 95% confidence interval for the mean? Interpret this interval. (That is, explain what it means.)

Hint: Use **Analyze, Distribution**. Then use the red triangle options to create the prediction interval and the tolerance interval.

The 95% CI is [299,836 to 299,868]. You are 95% confident that the true mean is in this interval.

2. What is the 95% prediction interval for the next value? Interpret this interval.

The 95% PI for the next observation is [299,694 to 300,010]. You are 95% confident that the next measurement taken, using this same process, will be in this interval.

3. What is the 95% - 95% tolerance interval (the 95% interval that will encompass at least 95% of future values)? Interpret this interval.

The 95%-95% TI is [299,676 to 300,029]. You are 95% certain that at least 95% of all future measurements, using this same process, will fall in this interval.

4. Compare and contrast these three intervals. Which of the three intervals is the widest? Which interval is the narrowest? Why are they different widths?

The widest is the tolerance interval. There is added uncertainty in estimating the entire population. The prediction interval is narrower than the tolerance interval because we are estimating only an individual observation rather than the entire population. The narrowest is the confidence interval because we are estimating a mean, and there is less uncertainty in estimates of the mean than there is in estimating individual observations.

5. The speed of light published today is 299,792 km/s. Let's consider this the true population mean. Which interval should Michelson have used to estimate this value? Does the interval that you computed capture this value?

The confidence interval should be used as the estimate of the true mean. The 95% CI, based on Michelson's 100 measurements, does not include this value. It overestimates the true mean speed of light.

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