



Coding Projects - Part 2

Confidence Intervals



The ABC Company produces screws. The length of the screws follows a **Normal Distribution** with **mean 100** (millimeters) and **standard deviation 2** (millimeters). Determine the **Confidence Interval** around the mean where **90%** of all observations can be found.

Confidence Interval Estimates (known population variance)



The ABC Company produces screws. The length of the screws follows a Normal Distribution with a (population) standard deviation of 2 millimeters (mm). Based on a recently drawn sample (sample size = 50), construct a 90% Confidence Interval for the true population mean length (Confidence Interval Estimate). The sample mean is 99.917 mm and the sample standard deviation is 2.448 mm.

Confidence Interval Estimates (unknown population variance)

The S&P 500, or just the S&P, is a stock market index that measures the stock performance of 500 large companies listed on stock exchanges in the United States. The S&P 500 is a capitalization-weighted index and the performance of the 10 largest companies in the index account for 21.8% of the performance of the index.

You have a random sample with 50 stocks/companies and their annual returns for the year 2017 (**sample size = 50**). Estimate the (equally-weighted) mean return for the whole S&P 500 population for the year 2017 by constructing a **95% Confidence Interval**. Assume a **sample mean of 25.32%** and a sample standard deviation of 30.50%.



Hypothesis Testing (two-tailed, known population variance)

The ABC Company produces screws with a target length of 100 millimeters (mm). The length of the screws follows a Normal Distribution with a (population) standard deviation of 2 mm.

The machines need to be cleaned and recalibrated once a week. After the cleaning/recalibration process, ABC produces a sample of 20 screws to check whether the machines are correctly calibrated (mean length = 100 mm).

After the most recent calibration you suspect that the machines are incorrectly calibrated. Based on the drawn sample (sample size = 20) with sample mean 100.929 mm, test on a 2% level of significance, whether the machine is correctly calibrated or corrupted (two-tailed). Calculate the z-statistic and the p-value of your test.



Hypothesis Testing (two-tailed, unknown population variance)

The S&P 500, or just the S&P, is a stock market index that measures the stock performance of 500 large companies listed on stock exchanges in the United States. The S&P 500 is a capitalization-weighted index and the performance of the 10 largest companies in the index account for 21.8% of the performance of the index.

You have a random sample with 50 stocks/companies and their annual returns for the year 2017 (**sample size = 50**). Test on a **5% level of significance**, whether the (equally-weighted) mean return for the whole S&P 500 population for the year 2017 is **equal to 0% or not**. Assume a **sample mean of 25.32%** and a **sample standard deviation of 30.50%**. Calculate the **t-statistic** and the **p-value** of your test.



Hypothesis Testing (one-tailed, unknown population variance)

The S&P 500, or just the S&P, is a stock market index that measures the stock performance of 500 large companies listed on stock exchanges in the United States.

The S&P 500 is a capitalization-weighted index and the performance of the 10 largest companies in the index account for 21.8% of the performance of the index.

You have a random sample with 50 stocks/companies and their annual returns for the year 2017 (sample size = 50). Test on a 5% level of significance, whether the (equally-weighted) mean return for the whole S&P 500 population for the year 2017 is equal to or less than 15% (H_0). Assume a sample mean of 25.32% and a sample standard deviation of 30.50%. Calculate the t-statistic and the p-value of your test.



Hypothesis Testing (normality)

The S&P 500, or just the S&P, is a stock market index that measures the stock performance of 500 large companies listed on stock exchanges in the United States. The S&P 500 is a capitalization-weighted index and the performance of the 10 largest companies in the index account for 21.8% of the performance of the index.

Based on the **full S&P 500 population**, test on a **2% significance level**, whether returns in 2017 follow a Normal Distribution (**normality**). Return the **p-value**.

