

NYU Stern

STAT-UB3 - Regression and Forecasting Models

Homework 2

Exploratory Data Analysis and One Sample Tests

1. Simulate 10,000 observations of an exponential distribution with parameter equal to one.
 - a. Plot a histogram of the results. Use an appropriate number of breaks in the graph.
 - b. Draw a QQ-Plot against the Standard Normal Distribution. Repeat a. and b. for the sum of 2, 5 and 10 exponentials with parameter one.
2. The attached file contains the daily returns (in percentage points) of the New York Stock Exchange between February 2, 1984, and December 31, 1991.
 - a. Plot a histogram of the returns.
 - b. Draw a QQ-Plot of the observed returns against the Standard Normal Distribution.
 - c. Comment on the shape of the graph.
 - d. What happened when the lowest daily return was observed?
3. In a study in nuclear fuel waste management researchers discovered that when oxygen is inserted in molten salt at a *sparging* rate of 3.33×10^{-6} that the true mean bubble rising velocity is $\mu = .338$. In a routine monitoring of the process, inspectors measured the bubble rising velocities at 25 different points in time. The data is given in the table below.
 - a. Conduct a test of hypothesis to determine if the true rising velocity for a population from which the sample is selected is $\mu = .338$. Use $\alpha = 0.10$.
 - b. Do you think it is possible the actual mean μ could be 0.280?
 - c. Based on the test results, part a. do you believe that the data in the table were generated at the sparging rate? Explain.

Bubble Velocity

0.275	0.261	0.209	0.266	0.265
0.312	0.285	0.317	0.229	0.251
0.256	0.339	0.213	0.178	0.217
0.307	0.264	0.319	0.298	0.169
0.342	0.270	0.262	0.228	0.220

4. In a study of an anti-aging skin cream, 33 middle-aged women used it for 22 weeks. At the end of the experiment the skin of the subjects was examined and adjudged to show improvement (I) or no improvement (N). The results are in the table below.

- Do the data provide enough evidence to conclude that the cream improved the skin of more than 60% of the women?
- Find and interpret the p-value of the test.

Skin Evaluation

I	I	N	I	N	N	I	I	I	I	I
N	I	I	I	N	I	I	I	N	I	N
I	I	I	I	I	N	I	I	N	I	I

5. The Sign Test

The one-sample sign test is a non parametric hypothesis test first used by John Arbuthnot, a Scottish physician, in 1710. Sign test is used to test the null hypothesis that the median of a distribution is equal to some hypothesized value. The test is based on the direction or the data are recorded as plus and minus signs rather than numerical magnitude, hence it is called Sign test.

Use the Sign test to consider the null hypothesis that the population median is equal to zero ($H_0 : \eta = 0$) in the context of Darwin's experiment.

- What is the test statistic?
- What is the reference distribution?
- What is the p-value for the Darwin's data?

d. What would you say in light of the result in c. and of the p-value in the t-test?