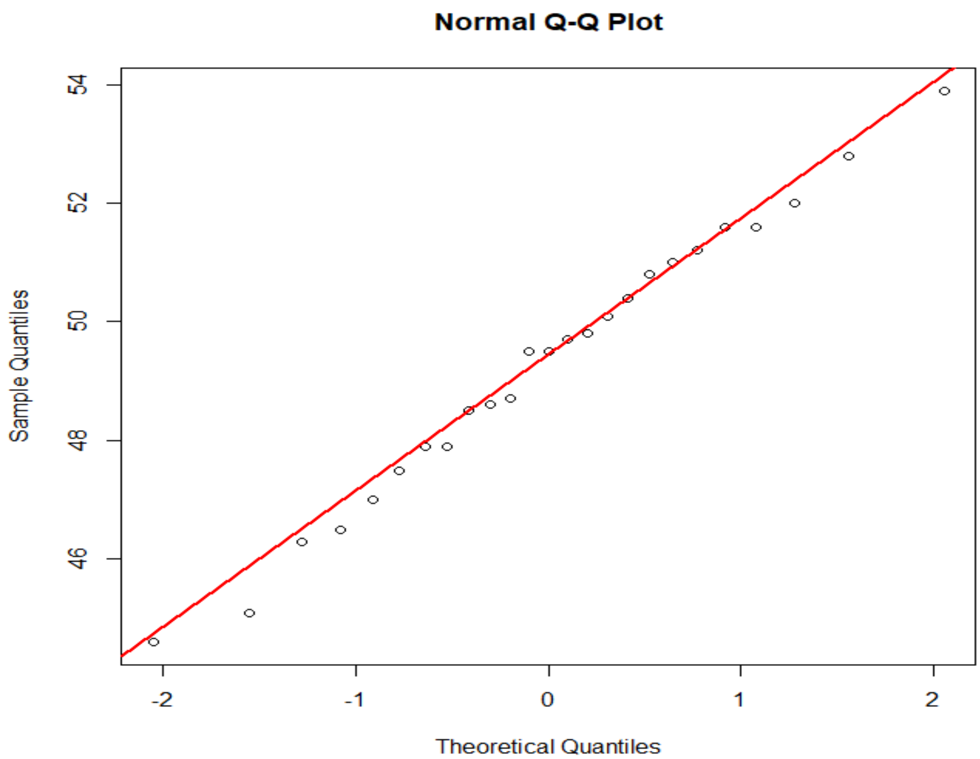
STAT 231 Tutorial Questions – Friday, June 28

1. A hospital lab has just purchased a new instrument for measuring levels of dioxin (in parts per billion). In order to calibrate the instrument, 25 samples of a "standard" water solution, known to contain 50 parts per billion are measured by this new instrument. The observed data, $y_1, y_2, \ldots, y_{25}$ are given below:

45.1	51.0	51.6	46.3	49.8	52.8	49.5	50.1	47.9	49.5	47.5	46.5	44.6
47.0	50.8	53.9	51.6	47.9	52.0	48.7	50.4	49.7	51.2	48.5		

Summary information: $\sum_{i=1}^{25} y_i = 1232.5$

It is assumed that the measurements are Normally distributed. Here is a QQ Plot of the sample data:



a. Comment on the assumption of Normality.

Let Y_i represent the i^{th} measurement by this device.

It seems reasonable to assume $Y_i \sim G(\mu, \sigma)$, $i = 1,2,\ldots, 25$; independent. In this question, we will assume that σ is known to be equal to 2.

b. Using the given information, construct a 90% confidence interval for μ.

c. Now, suppose we want to test H_o: $\mu = 50$ (versus a two-sided alternative),

H_A: $\mu \neq 50$). We start by determining the appropriate discrepancy measure / test statistic, D, and state the distribution of D, assuming that H_o is true.

d. Now calculate the observed value of the test statistic, d, and use it to calculate the appropriate p-value.

e. Use the Table 5.1 guidelines to assess the amount of evidence against H_o.

f. Using a threshold value, $\alpha = 10\%$, and the p-value from part e., decide whether to reject or not reject H_o. Justify your answer.

g. Now, let's revisit the 90% CI for μ: [48.642, 49.958]. Based on this CI, do your answers make sense in parts e. and f.?

h. Suppose that we had conducted our hypothesis test at a 5% level of significance. Would our decision in part f. change?

i. **Apply the Concepts:** Would you expect the corresponding 95% CI for μ to include the null value of 50? Explain.