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Lab 6

Distribution 1 & Uniform:
#Here we see only the 0th quartile to be on the y = x graph, while both extremes are off y = x. If a normal distribution has all the data point on y = x, the two extremes here show that each end of the distribution has many data unlike the tips of the normal curve.

Distribution 2 & Normal:
When the two distribution are from same population, we see a distribution in qq plot to fit on the y = x plot. Even though some points are off at the low tip of the graph, most of the points are on y =x, telling that it is a normal distribution.

Distribution 3 & Beta:
Here the distribution generally appears to have a bell shape, yet the tail is on the right with a shape skewed right. This can be shown that on the right tail part of the distribution, it matches more like the normal distribution, while the left part of the distribution is unusually higher than it should be in a normal distribution. Such change is shown as the left tail of Distribution 3 is off the y = x.

Distribution 4 & t:
While both normal and t distribution show a normal curve, the t distribution has a fatter tail than the normal distribution. Therefore, each tail of the QQ plot is a little off from y = x as shown in Distribution 4.

Q1-1:

$$log\ L(\theta|x) = -\frac{n}{2}\log(2\Pi\sigma^2)\exp\left(-\frac{\sum_{i=1}^{n}(x_i-\mu)^2}{2\sigma^2}\right))$$

$$\frac{\partial}{\partial\sigma} log\ L(\theta|x) = 0 = \frac{\partial}{\partial\sigma}(\frac{n}{2}\log\left(\frac{1}{2\Pi\sigma^2}\right) - \frac{\sum_{i=1}^{n}(x_i-\overline{x})^2 + n(\bar{x}-\mu)^2}{2\sigma^2})$$

$$= -\frac{n}{\sigma} + \frac{\sum_{i=1}^{n}(x_i-\overline{x})^2 + n(\bar{x}-\mu)^2}{\sigma^3}$$

When setting the derivative equal to 0, the 0 point is the maximum point of the MLE graph, which is intuitively the maximum point of the value.