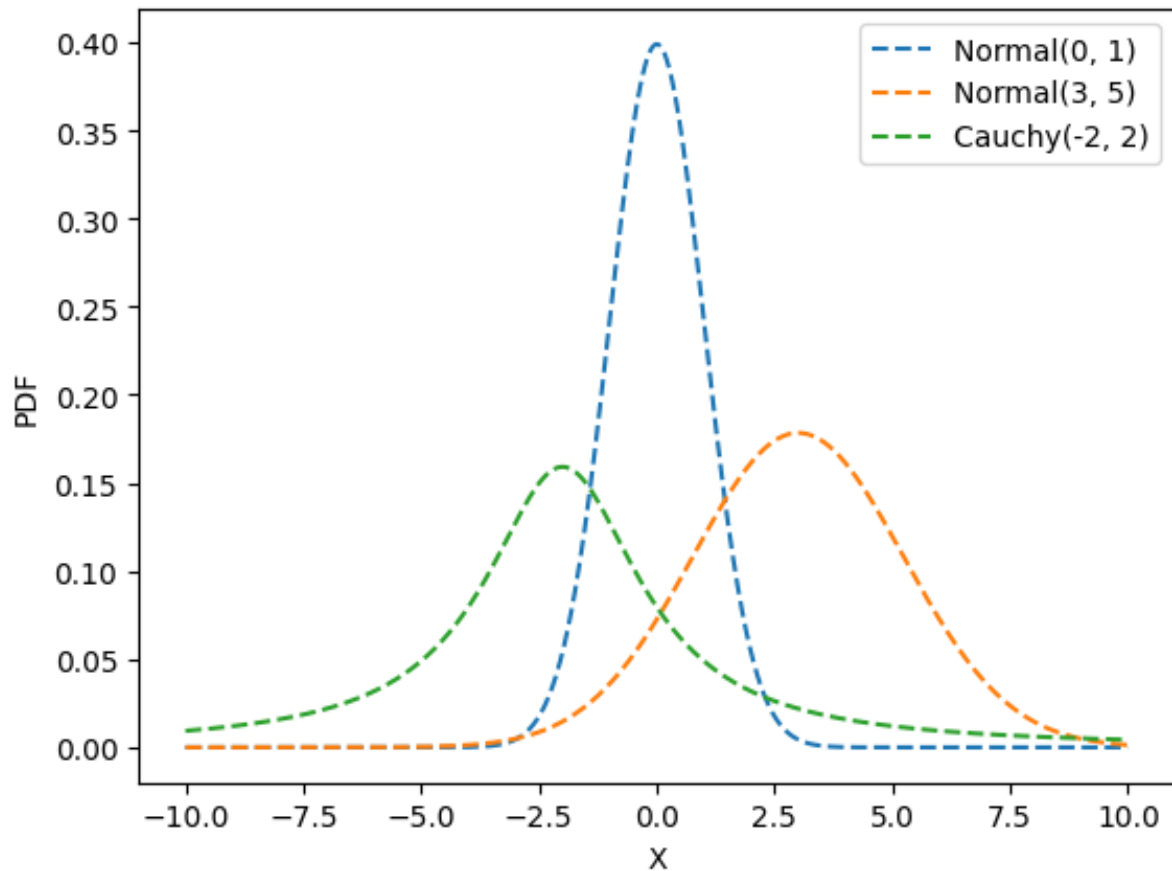


Statistics Exercise 1

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25th September 2023

Question 1.a



Key Observation

Normal Distribution - $\mathcal{N}(0, 1)$

- Has a narrow curve due to low variance, resulting in a high probability density around the mean (0).
- It has shorter tails - samples drawn from this distribution will be closer to the mean.
- Does not have long tails - chances of drawing extreme values are low.

Normal Distribution - $\mathcal{N}(3, 5)$

In comparison with $\mathcal{N}(0, 1)$,

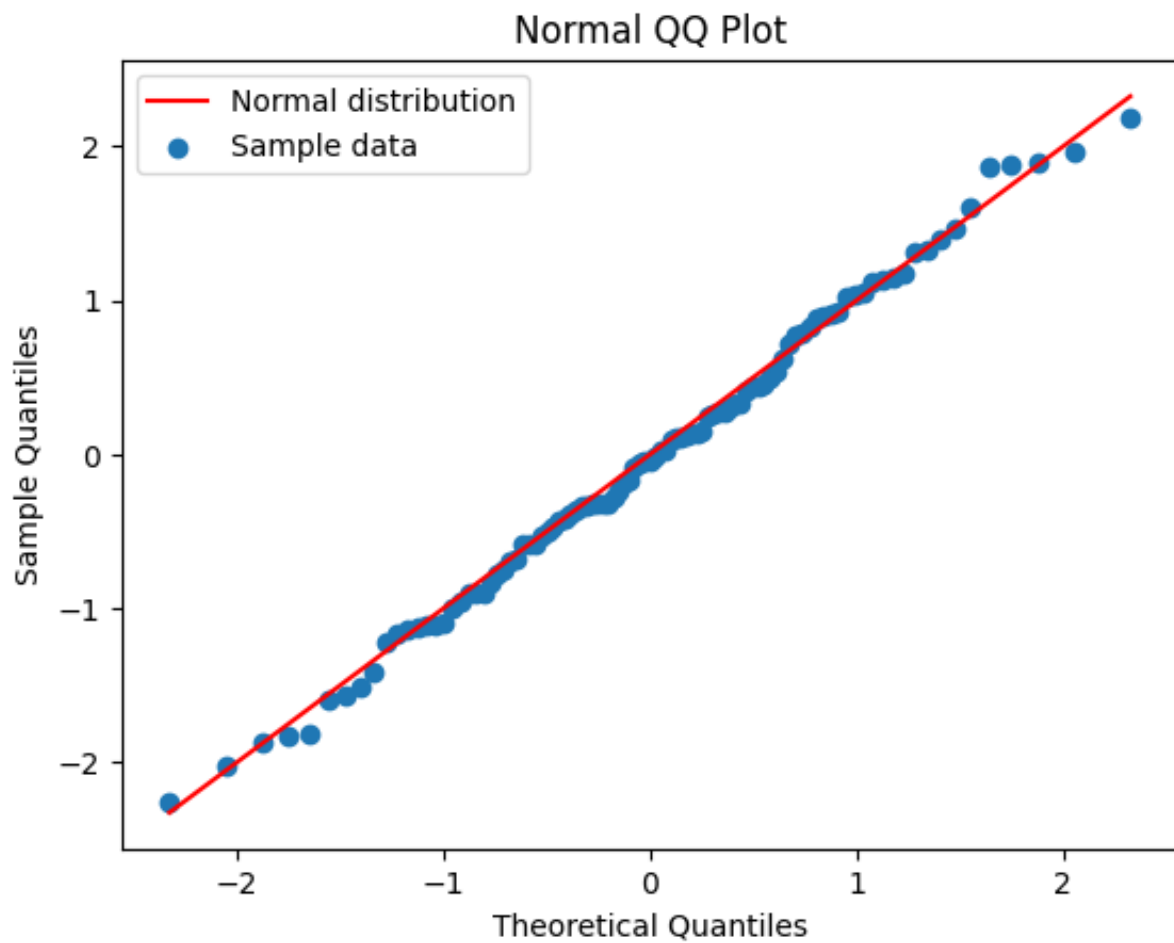
- Has a wider curve due to high variance, resulting in a lower probability density around the mean (3).
- It has longer tails - a significant number of samples drawn from this distribution can be away from the mean (due to high variance).
- Tails are slightly longer than $\mathcal{N}(0, 1)$, but chances of drawing extreme values are still low.

Cauchy Distribution - $Cauchy(-2, 2)$

- Has a narrower curve when compared to $\mathcal{N}(3, 5)$ and has longer tails.
- This distribution is not symmetric and does not have a mean or variance.
- Chances of drawing extreme values are higher when compared to Normal distribution.

Question 1.c

QQ plot for samples from $\mathcal{N}(0, 1)$

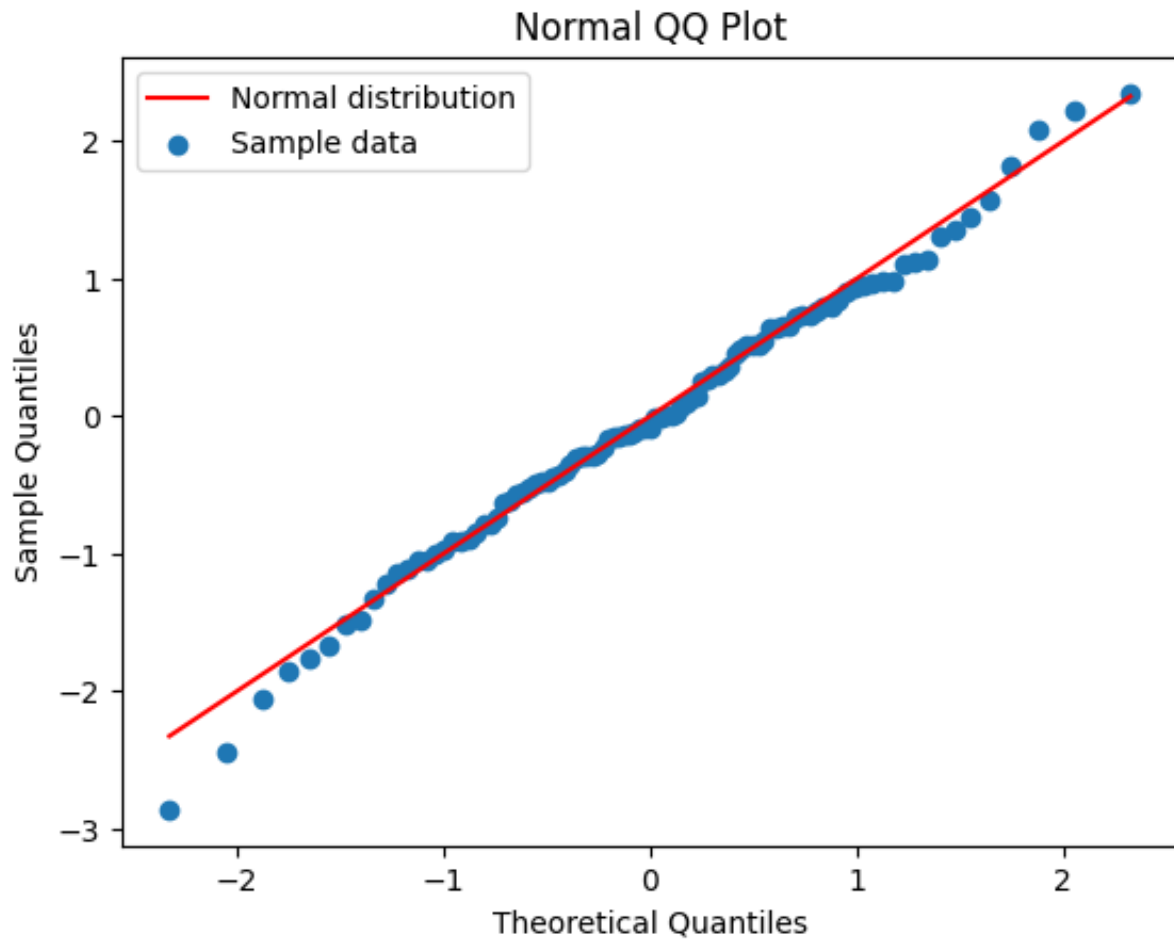


From the QQ plot,

- We can observe that the samples drawn from $\mathcal{N}(0, 1)$ closely align with the theoretical quantiles of normal distribution.
- They form a straight line, indicating that the samples are normally distributed.

Question 1.d

QQ plot for samples from $\mathcal{N}(3, 5)$

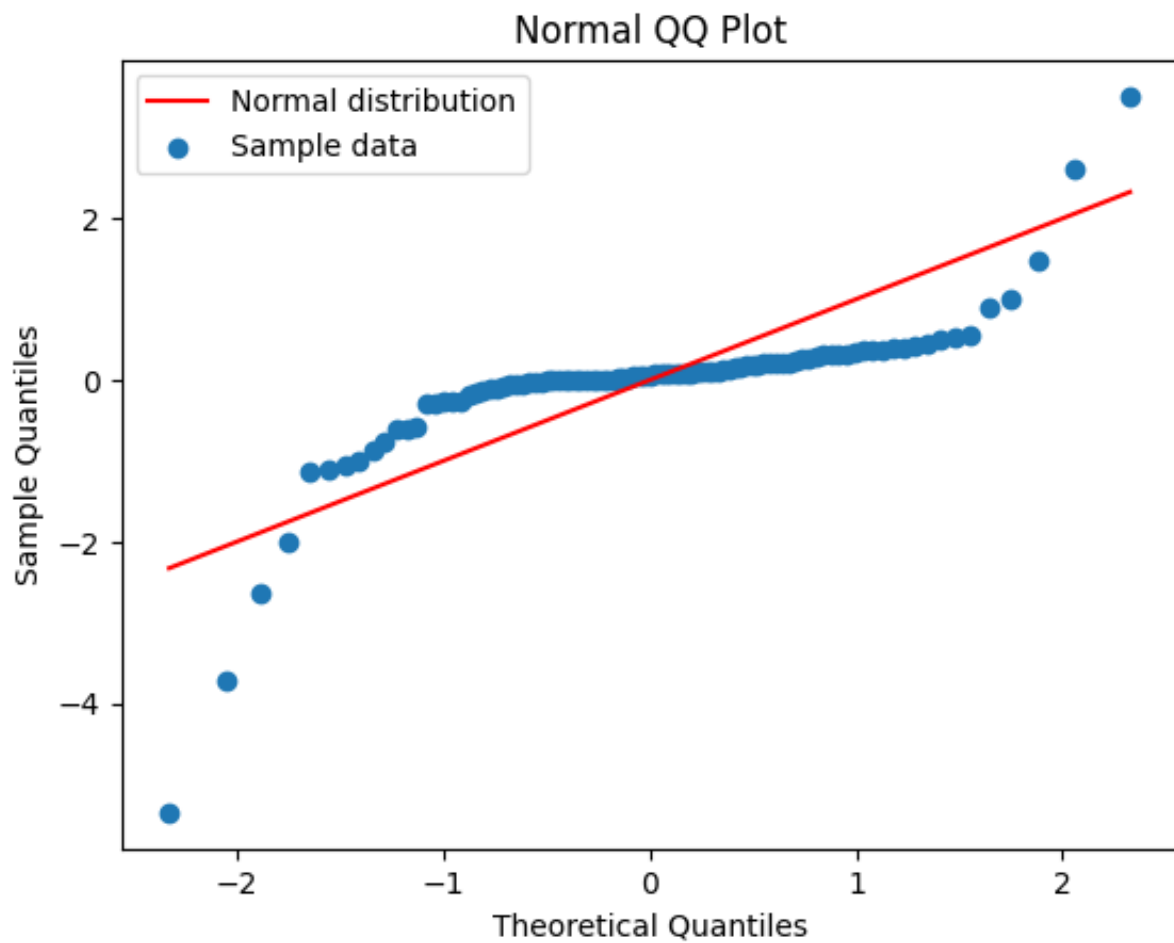


From the QQ plot,

- We can observe that the samples drawn from $\mathcal{N}(3, 5)$ closely align with the theoretical quantiles of normal distribution.
- We can see a few points away from the straight line in the plot. This is because of the high variance in the distribution.
- Ignoring a few outliers, the samples are closer to a straight line, indicating that the samples are normally distributed.

Question 1.e

QQ plot for samples from $\text{Cauchy}(-2, 2)$



From the QQ plot,

- We can observe that the samples drawn from $\text{Cauchy}(-2, 2)$ do not form a straight line - indicating that the samples are not normally distributed.
- In addition, we can see multiple outliers in the plot - indicating a longer tail.