
Part A – Conceptual Questions

1 What is Bernoulli Distribution?

A **Bernoulli distribution** models a single experiment with only **two possible outcomes**: Success (1) or Failure (0).

It is defined by a single parameter **p**, which represents the probability of success.

 Example: A transaction being either *Successful* or *Failed*.

2 What is Binomial Distribution?

A **Binomial distribution** models the number of successes in a fixed number of independent Bernoulli trials.

It is defined by:

- **n** → Number of trials
- **p** → Probability of success

 Example: Number of successful transactions in a week.

3 What is Poisson Distribution?

A **Poisson distribution** models the number of events occurring in a fixed time interval when events happen randomly and independently.

It is defined by:

- **λ (lambda)** → Average number of events per interval

 Example: Number of transactions per day.

4 What is Log-Normal Distribution?

A **Log-Normal distribution** describes data where the logarithm of the variable follows a normal distribution.

It is commonly used for **positively skewed data**.

 Example: Transaction amounts, income, stock prices.

5 What is Power Law (Pareto) Distribution?

A **Power Law distribution** describes situations where a small number of observations contribute to a large portion of the total.

It shows **heavy-tailed behavior**.

- 📌 Example: Few customers generating most of the revenue.
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6 What Does “Heavy-Tailed” Mean?

Heavy-tailed data means extreme values (very large observations) occur more frequently than expected in a normal distribution.

- 📌 This indicates higher risk or high-value outliers.
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7 What is a Q-Q Plot?

A **Q-Q (Quantile-Quantile) plot** compares sample data with a theoretical distribution to check normality.

- 📌 If points lie on a straight line → Data is approximately normal.
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8 What is Box-Cox Transformation?

The **Box-Cox transformation** is used to make skewed data more normally distributed.

It helps:

- Stabilize variance
- Improve regression performance

- 📌 Requirement: Data must be strictly positive.
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9 What is Z-Score?

A **Z-score** measures how many standard deviations a value is from the mean.

Formula:

$$Z = \frac{X - \mu}{\sigma}$$

📌 Used for detecting outliers and probability calculation.

10 What is PDF and CDF?

- **PDF (Probability Density Function)** shows the likelihood of a variable taking a specific value.
- **CDF (Cumulative Distribution Function)** shows the probability that a variable is less than or equal to a value.

📌 PDF → Single value probability

📌 CDF → Cumulative probability