- **Mean of the binary (Bernoulli) distribution**:

$$\mu = p$$

- **Variance of the binary (Bernoulli) distribution**:

$$\sigma^2 = p(1-p)$$

- **Difference between binary distribution and binomial distribution**:

$$n = 1 \Rightarrow \textit{binary distribution}$$

$$n > 1 \Rightarrow \textit{binomial distribution}$$

Mean of the binomial distribution:

$$\mu = np$$

Variance of the binomial distribution:

$$\sigma^2 = np(1-p)$$

- **Conditions for binomial distribution**: Outcome is binary. We have n independent trials. The number of trials is fixed. The probability of success π must stay constant.

- **Probability of x successes in n trials**:

$$\Pr(X = x) = \binom{n}{x}\pi^x(1-\pi)^{n-x}$$

- Binomial coefficient ($\binom{n}{k}$):

$$\frac{n!}{(k!)(n-k)!}$$

Standard normal distribution(Z):

$$Z \sim N(\mu = 0, \sigma^2 = 1)$$

- μ **(normal distribution) moves the curve but does not change its shape**.

- σ **spreads the curve more widely about X =** μ **but does not alter the centre**.

- **Compare a relative frequency histogram with a probability distribution**: Relative frequency histogram represents a sample (smaller number of individuals). The probability density function represents a population (a large number of individuals).

- **How to estimate the value of the parameters if estimating a probability distribution curve from a relative frequency histogram**: μ is estimated by the sample mean. σ is estimated by the sample standard deviation, s.

- **What do the areas under the normal distribution curve represent? Probabilities**.

- **What is Z-score (Z-value)? Number of standard deviations away from the mean**.
- Any normal distribution value, $X \sim N(\mu_X, \sigma_X^2)$, can be put on the standard normal scale, $Z \sim N(0, 1)$. The Z-score follows a standard normal distribution.
- **Formula for Z-Value**:

$$Z = \frac{(X - \mu_X)}{\sigma_X}$$

- **When will the sampling distribution of the mean will follow a normal distribution? If x(the samples, not X) is large enough**.
- **Central Limit Theorem (CLT)**: The sampling distribution derived from a simple random sample will be approximately normally distributed.
- **What is the mean of the sampling distribution? Population mean**, $\mu_{\bar{X}} = \mu_X$.
- **Variance of the sampling distribution**:

$$\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}}$$

  The variability of sample means.
- **Notes on the sampling distribution**: If sample size n is greater, then the standard error of the mean is smaller (more compact distribution, greater precision). If X is normal, then X_{bar} is normal (for any n). If X is not normal, then X_{bar} is approximately normal for large n (central limit theorem).