

PR-3 - Derivable Judgement.

Q.1 what is inferential statistics?

→ It can use sample data to draw conclusion about a larger population, usually with probability statement.

Ex:- From 200 patients to estimate the average diabetes patients in the whole city.

Q.2 What is Hypothesis testing and its component.

→ Hypothesis testing is a formal process to decide if the data give strong enough evidence to ~~decide~~ reject a null hypothesis H_0 in favour of an alternative H_1 .

Ex:- "BMI vs exercise"

Suppose you want to check if mean bmi differ between people who exercise Daily and Never.

$H_0: \mu_{\text{Daily}} = \mu_{\text{Never}}$ (no difference)

$H_1: \mu_{\text{Daily}} \neq \mu_{\text{Never}}$ (some difference)

Q.3. Explain confidence interval and critical value

→ A confidence interval is a range of plausible values for a population parameter (e.g., mean or proportion) based on sample data plus a margin of error.

→ critical value is the cutoff of the sampling distribution that separate the "do not reject H_0 " and " ~~H_0~~ " reject H_0 " region at a chosen α .

Ex :- 95% is a confidence interval & z-critical value = 1.96.

Q.4 Define P-value

→ The P-value is the probability of observing the sample result assuming the null hypothesis is true. A smaller p-value provides stronger evidence against H_0 .

Ex :- If $P = 0.03 < 0.05$, reject the null hypothesis.

Q.5. Differentiate type I and type II error

→ Type I = Rejecting a true H_0 (false positive), probability = α .

Type II = Not rejecting a false H_0 (false negative), probability = β .

Ex :- Type II = Smoking doesn't increase the risk of diabetes when it actually does.

Type ~~II~~^I = Saying the treatment work on 3rd stage cancer when it actually doesn't.

- **chi-square test** :- Uses the chi-square distribution to test association between categorical variable or goodness-of-fit of observed counts to expected counts.
- **ANOVA** - (analysis of variance): compares means of three or more group by decomposing total variation into "between-group" and "within group" component; uses the F statistic.

Q.7. What is Covariance?

→ Covariance measures how two variable vary together, a positive value means they tend to move in the same direction, and a negative value means they move in opposite direction. Ex - Height & weight usually have positive covariance

Q.8. What is Correlation

→ Correlation rescales covariance to a standardized coefficient between -1 and +1, showing both the strength and direction of the linear relationship, independent of units.

Ex - Correlation = +0.85 mean between study hours and exam score indicates a strong positive relationship.