

* Types of Alternative Hypotheses *

① H_1 - Two Tailed

يُستوفى في القيمة المختلفة عن H_0 أكبر منها ولا أهم منها
 (used when we don't know the expected direction of change)

② H_1 - Right Tailed

يُستوفى لو القيمة أكبر من قيمة H_0
 (used when we suspect an increase)

③ H_1 - left Tailed

يُستوفى لو القيمة أصغر من قيمة H_0
 (used when we suspect a decrease)

* P - Value *

⇒ The P-value represents the likelihood of observing the data assuming H_0 is True

→ P-value \neq probability that H_0 is True.

* How to Interpret P - value ?!

① $P < 0.05$ "صغيرة"

→ we reject H_0 because data provides strong evidence for H_1

② $P > 0.05$ "كبيرة"

→ we fail to reject H_0 because there isn't enough evidence for H_1 .

* How to Calculate P-Values *

- ① حدد H_0 و H_1
 ② Choose a statistical test والاختبار، يعتمد على نوع البيانات

- ① T-test → لو يكون بقرار بين 2 Means وعدد العينات صغير
 ② Z-test → لو عدد العينات كبير
 ③ Chi-square test → اختبار علاقة بين متغيرين (χ^2)

③ Calculate the test statistics

* t-test *

$$t = \frac{\bar{X} - M}{\frac{S}{\sqrt{n}}}$$

* \bar{X} → Sample mean

* M → القيمة المفترضة H_0

* S → Sample standard deviation

* n → sample size

④ Find the Value from test

① Two Tailed

$$P = 2 \times P(T > |t|)$$

② Right or left Tailed

$$P = P(T > t)$$

$$\text{or } P = P(T < t)$$

* Confidence Intervals (CIs) *

→ A Confidence Interval (CI) is a range of values that is likely to contain the True Population Parameter.

* How to Calculate CI *

$$CI = \bar{x} \pm Z * \frac{s}{\sqrt{n}}$$

\bar{x} → Sample mean

Z → Z-score ما الجد

s → Sample Standard deviation

n → Sample size.

→ CIs help us understand the reliability of estimates, but they don't guarantee exact values.

* Regression Analysis *

يساعد على التنبؤ بين متغيرين أو أكثر
→ It helps predict values and understand how variables influence each other.

* Simple Types of Regression *

① linear Regression

علاقة خطية بين متغيرين

② Multiple Regression

③ logistic Regression

* Equation → $Y = B_0 + B_1 X + E$

Y → dependent variable X → independent variable

B_0 → Intercept B_1 → slope E → error term

* Hypothesis Testing & The Null Hypothesis *

هو عبارة عن اختبار بعله لاتخاذ القرارات بناء على بيانات موجودة
عنى و هو ان عبارة عن ان يفرض فرضيه وبعد كذا يستخدم
البيانات اللى عنده عشان اتأكد ان الفرضيه دى صح ولا.

* Null Hypothesis - H_0 *

الفرضيه الصفريه (H_0) هي عبارة عن فرضيه يفترض انها صح مسبقا ويخارده
نختبر مدى صحتها

* Alternative Hypothesis - H_1 *

الفرضيه البديله اللى يقارننا مع الفرضيه الصفريه عشان اعرف صح ولا وبترفضها هو
في فرق ولا.

بعد كذا بيدأ احسب ال P-value وعلى اساسها بيدر انا هرفض ال H_0 ولا
لو P-value صغيره جدا هتقبل ال H_0
لو P-value كبيره جدا هتقبل ال H_1

* Types of errors *

① Type I Error (False Positive)

Rejecting H_0 when it's true

② Type II Error (False Negative)

Failing to reject H_0 when it's false

* Scales of Measurement *

① Nominal Scale Data

- Qualitative / Categorical.

- Names, Colors, Labels, Gender, ...
- Order doesn't matter.

② Ordinal Scale Data

- Ranking / Placement
- The Order matters
- Difference Can't be Measured

③ Interval Scale Data

- The Order Matters
- Difference can be measured (except ratios)
- No True "0" starting point.

④ Ratio Scale Data

- The order matters
- Difference are measurable (including ratios)
- Contains "0" starting point

→ Statistics

① Descriptive

(1) Organizing and Summarizing data using numbers, graphs

(2) Data Summary

→ Bar Graphs, Histograms, Pie Chart, -----

→ Shape of Graph and Skewness

(3) Measures of Central Tendency

→ Mean, Median, Mode

(4) Measures of Variability

→ Range, Variance, & Standard deviation.

② Inferential

(1) Using Sample data to make an inference or draw a conclusion of the population.

(2) Uses probability to determine how confident we can be that the conclusions we make are correct.

* Quantitative *

① Numerical Data - Two Types

② Discrete - (Counting)

③ Continuous (Measurement)

* Qualitative *

① Descriptive data based on observation

② Involves 5 Senses

③ See, taste, Feel, hear, smell