Welcome

Statistical Decisions & Hypothesis: Critical Region and Best Critical Region

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01 What is Statistical Decision?

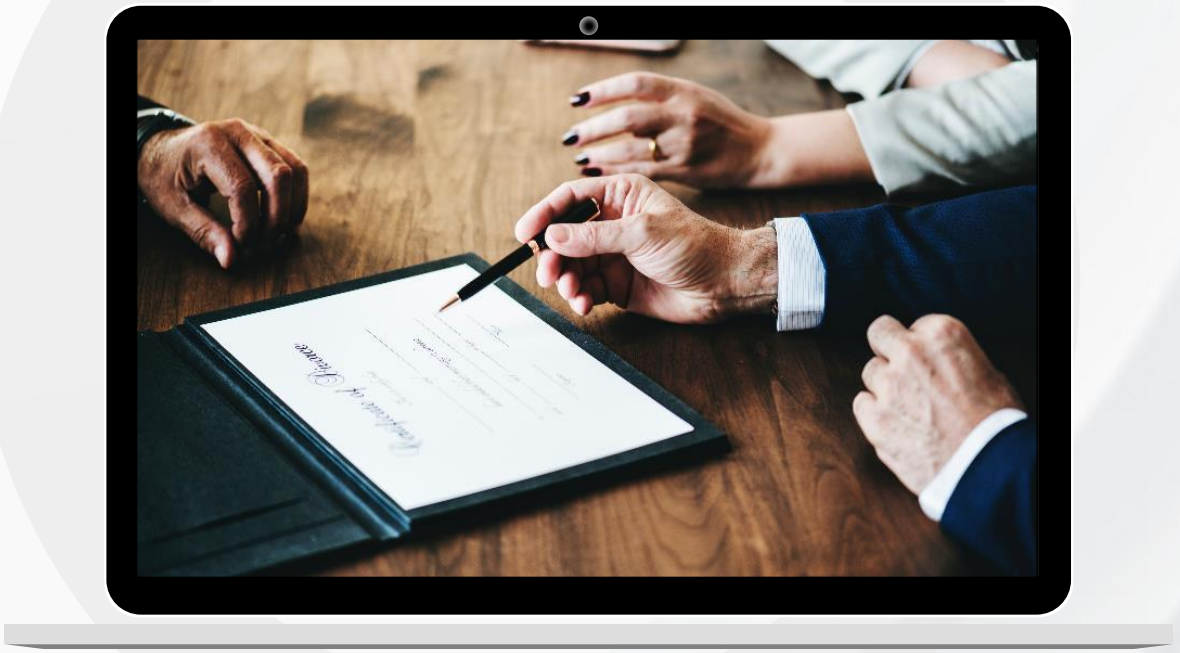
Process of making decisions using data and statistical methods

Two types of decisions in hypothesis testing:

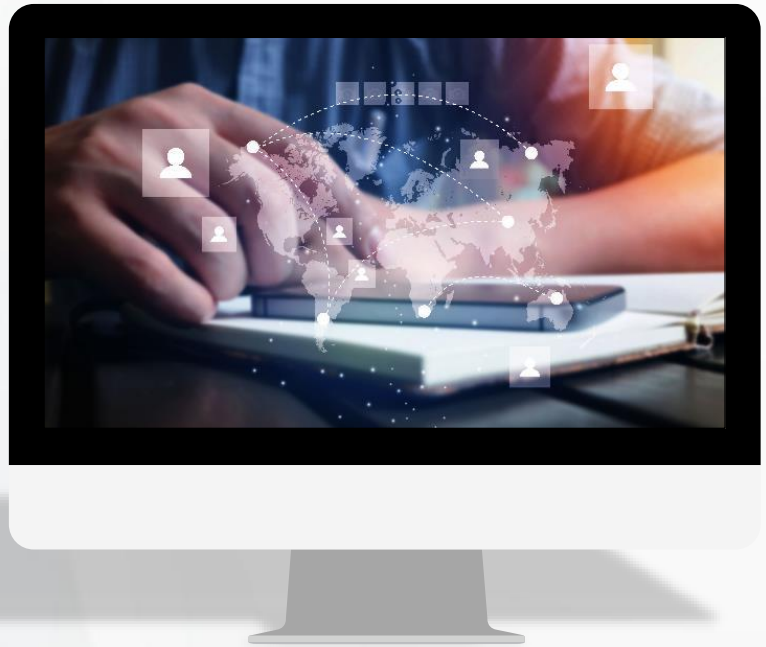
Reject the null hypothesis (H_0)

Do not reject the null hypothesis

Based on probability, sample data, and test statistics



02 Statistical Hypothesis



Hypothesis: A claim or assumption about a population

Null Hypothesis (H_0): Assumes no effect or no difference

Alternative Hypothesis (H_1): Represents a new claim or effect

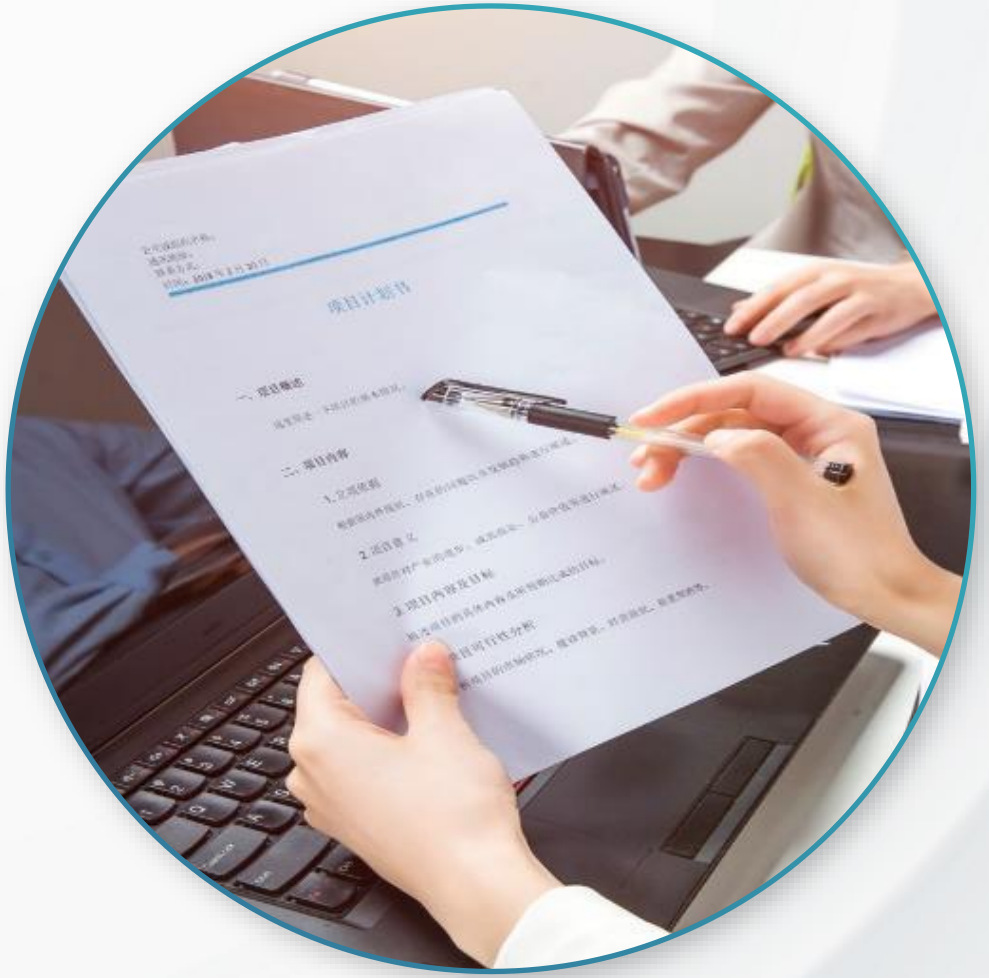
Goal: Use sample data to test whether H_0 can be rejected

03 Errors in Decision Making

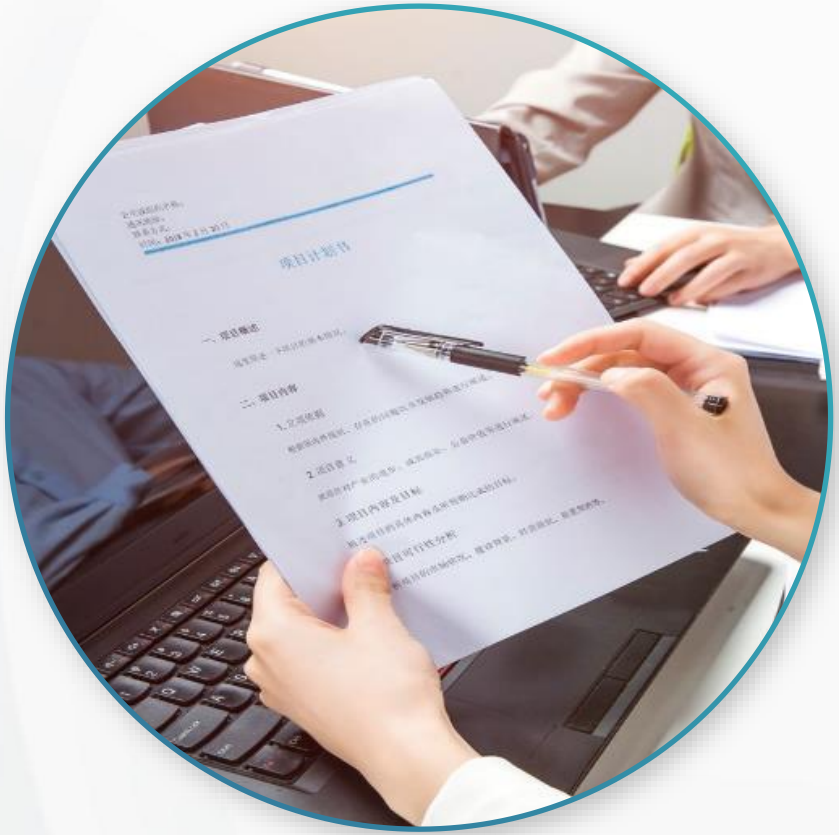
Type I Error (α): Rejecting H_0 when it is true

Type II Error (β): Failing to reject H_0 when it is false

Good test minimizes both errors, especially Type I



04 Critical Region (Rejection Region)



Region of test statistic values that leads to rejection of H_0

Based on significance level (α), e.g., 0.05 or 0.01

If test statistic falls in this region → reject H_0

Determined from sampling distribution of test statistic

05 Choosing the Critical RegionOne-tailed vs Two-tailed tests:

One-tailed: critical region in one end

Two-tailed: split across both ends

Depends on the nature of H_1

Example: H_1: $\mu > \mu_0 \rightarrow$ right-tailed test

06 Best Critical Region A best or most powerful critical region:

Maximizes the probability of detecting false H_0 (i.e., minimizes β)

Follows Neyman-Pearson Lemma:
For simple H_0 and H_1, the most powerful test uses likelihood ratio
Ensures the best chance to detect true effects

07

Summary & Conclusion

Statistical decisions involve accepting/rejecting hypotheses Critical region helps decide when to reject H_0 Best critical region gives the highest test power Balancing Type I and Type II errors is key in good testing

Thanks