TEST OF SIGNIFICANCE

By: Sheen Thusoo

ID: 20728766

CONCEPT

Test of Significance

- A formal process for comparing the observed data with a claim or null hypothesis
  - The truth of this hypothesis is assessed
- For example, a null hypothesis H_0 could be
  - Sub-populations P_1 and P_2 were randomly drawn from the same Population
  - Sub-populations P_1 and P_2 were generated randomly
  - Sub-populations P_1 and P_2 were created by randomly assigning units in one population to each sub-population
- A Discrepancy Measure $D(P_1, P_2)$ helps us compare and quantify how inconsistent the data is with the null hypothesis
  - *Ex:* $D(P_1, P_2) = |\bar{y}_1 - \bar{y}_2|$
- Result: A p-value whose value indicates how strong the evidence is against H_0

MECHANISM/LOGIC

1. State the Null Hypothesis H_0
   - Ex: P_1 (Fiction Books) and P_2 (Non-Fiction Books) are randomly drawn from the same population
2. Establish Measure of Discrepancy $D(P_1, P_2)$
   - Large values indicate evidence against H_0
   - Ex: $D(P_1, P_2) = | \bar{y}_1 - \bar{y}_2 |$
3. Calculate Observed Discrepancy d_{obs}
   - $D(P_1, P_2)$ calculated on the unshuffled sub-populations
4. Shuffle Sub-Populations *M* times & Calculate Observed p-value

$$p\text{-value} = Pr\left(D \geq d_{obs} \,\middle|\, H_0 \text{ is true}\right) \approx \frac{1}{M} \sum_{i=1}^{M} I\left(D(\mathcal{P}^{\star}_{1,i}, \mathcal{P}^{\star}_{2,i}) \geq d_{obs}\right)$$

P-Value	Specification
< 0.001	Very strong evidence against H_0
0.001 < p-value < 0.01	Strong evidence against H_0
0.01 < p-value < 0.05	Evidence against H_0
0.05 < p-value < 0.1	Weak evidence against H_0
p-value > 0.1	No evidence against H_0