Data Science, 2022

Tut 5: Evaluation and Measurement- Hypothesis Testing

Make Assumptions about values when it is necessary in consistent manner. Refer necessary table from following link when necessary.

https://www.sheffield.ac.uk/polopoly_fs/1.43999!/file/tutorial-10-reading-tables.pdf

Testing a Proportion of small samples

- 1. H_0 : $p = p_0$
- 2. One of the alternatives H\: $p < p_{n,} p > p_{o,}$ or $p \neq p_{o}$
- 3. Choose a level of significance equal to a.
- 4. Test statistic: Binomial variable X with $p = p_0$.
- 5. Computations: Find x, the number of successes, and compute the appropriate P-value.
- 6. Decision: Draw appropriate conclusions based on the P-value

Ex. 1

A builder claims that air-conditions are installed in 70% of all homes being constructed today in the city of Mumbai. Would you agree with this claim

if a random survey of new homes in this city shows that 8 out of 15 had air-conditions installed? Use a 0.10 level of significance

Tworlal 5

Ext

claim: 70%.

Random survey: 8 out of 15 have pumps 0.1 level of significance

HO P=0.7 H, P = 0.7

d= 0.1

Test Statistic:

we have a Binomial Vasuable X with P= 6.7 and n=15

Here x = 8 x = 8, x = 15 x = 15 x = 15 x = 15 x = 15x = 15

since if,

P= 2P (X < x, when p=po) if x<pre>rpo

since, 2=8 & npo= 10.5

: $P = 2P(X \le 8, \text{ when } P = 0.7)$

	classmate
	Page
	= 2 \(\frac{8}{2} = 0 \((0.7)^{92} \) \((0.3)^{15-22}\)
-	8 1 18 × 15-×
	= 2 3 (04) (03)
	= 2× 0.1311
-	21 0.1311
- 29×119	0.2622
	Bînce 0.2622 > 0.1
	we don't suject to. we don't have sufficient mason
	we don't have sufficient swason
	to doubt the claim.
	10 - 10
	Icet station
nt of	. use have a Elmonial Vastiable X
	elsa ban to of
	CI = N S = N S = X SIGH
	NP = (15) (0 3)
	201 =
	since it,
grove II (P 2 P (X 5 26 , when page
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140	=9 anda (82%) 95 = 9
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<u>Ex.2</u>

A commonly prescribed drug for relieving nervous tension is believed to be only 60% effective. Experimental results with a new drug administered to a random sample of 100 adults who were suffering from nervous tension show that 70 received relief. Is this sufficient evidence to conclude that the new drug is superior to the one commonly prescribed? Use a 0.05 level of significance.



* Claim = 0.6 < commonly prescribed

New drug:

Sample = 100

To received rules

Q Is this sufficient evidence to conclude that the new drug is superfor to the commonly prescribed

level of signi ficance = = 0.05

Ho: p=0.6

X = 0.05

Parties critical value of z = 1.645x = 70 n= 100 p= 0.7

z = 0.7 - 0.6 = 2.04

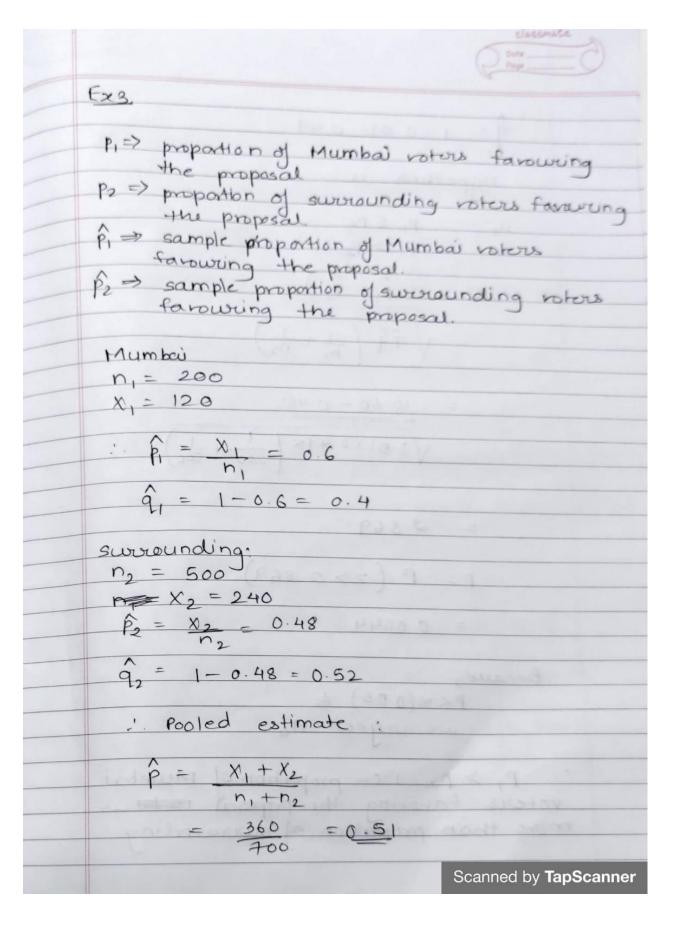
P = P(z > 2.04)< 0.0207 < 0.05 \propto

the new is superior.

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<u>Ex.3</u>

A vote is to be taken among the residents of a Mumbai and the surrounding area to determine whether a proposed Nuclear plant should be constructed. The construction site is within the Mumbai limits, and for this reason many voters in the surrounding area feel that the proposal will pass because of the large proportion of Mumbai voters who favor the construction. To determine if there is a significant difference in the proportion of Mumbai voters and surrounding area voters favoring the proposal, a poll is taken. If $120 \text{ of } 200 \text{ Mumbai voters favor the proposal and } 240 \text{ of } 500 \text{ surrounding area residents favor it, would you agree that the proportion of Mumbai voters favoring the proposal is higher than the proportion of surrounding area voters? Use an <math>a = 0.05$ level of significance.



<u>Ex.4</u>

State the null and alternative hypotheses to be used in testing the following claims, and determine generally where the critical region is located:

- (a) At most, 20% of next year's wheat, crop will be exported to the Russia..
- (b) On the average, Indian homemakers drink 3 cups of tea per day.
- (c) The proportion of graduates in engineering this year majoring in the computer sciences is at least. 0.15.
- (d) The average donation to the Indian Autism Association is no more than 500 INR.
- (e) Residents in suburban Mumbai commute, on the average, 15 kilometers to their place of employment.

Ex4.

a) atmost 20%

. Null Hypothesis : Ho : p=0.20

Alternative Hypothesis: H; = p>0.20

I critical region is the right tail

b) On an arrige 3 cups of tea per day

Null Hypothesis: Ho: H= 3

Alternative Hypothesis: H,: 14 \$3

asince its + /= there fore it is two-tailed

c) at least 15%.

· Null Hypothesis: Ho: p=0.15

Alternative Hypothesis: H, p<0.15

2 on Head sugion is in left tail

d) average no more than 500 INR Null Hypothesis. Ho: 4 = 500 Alternative Hypothesis: Ho: 11 >500 critical region is in rught tail e) marviage = 15 km Null Hypothesis. Ho! $\mu = 15$ Alternative Hypothesis: H, =: 96 \$1.5 critical region is in both rails

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Ex.5

In a study conducted by the Department of computer Engineering and analyzed by the Statistics Consulting Center at SPIT the laptops supplied by two different companies were compared. Ten sample laptops were made out of the Intel chips supplied by each company and the "robustness" was studied. The data are as follows:

Company A: 9.3 8.8 6.8, 8.7 8.5 6.7 8.0 6.5 9.2 7.0

Company B: 11.0 9.8 9.9 10.2,10.1 9.7 11.0 11.1 10.2 9.6

Can you conclude that there is virtually no difference in means between the laptops supplied by the two companies? Use a P-value to reach your conclusion. Should variances be pooled here?

Null Hypothesis Ho: H= H2
Altonautre 11 H1: H1 f H2

assuming x = 0.05

 $\overline{X}_1 = \underline{\leq x_1}$ $\overline{N_1}$ = 79.5

= 7.95

 $\bar{x}_2 = \frac{102.6}{10}$

= 10.26

stand dev.

 $S_1^2 = \frac{1}{n_1 - 1} \left[\leq \chi_1^2 - n_1 \bar{\chi}_1^2 \right]$

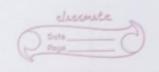
= 10.865 = 1.2072

 $S_2^2 = \frac{1}{n_2} \left[\frac{1}{2} \chi_2^2 - n_2 \bar{\chi}_2^2 \right]$

= 2.924

= 0.3248 SDPE

	Page
Now, we need to calcula	in degree of
	Land Harle
$V = \left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^2 + \left(\frac{1}{n_1-1}\right)\left(\frac{s_1^2}{n_1}\right)^2 + \frac{1}{n_2-1}\left(\frac{s_1^2}{n_1}\right)^2 + \frac{1}{n_2-1}\left(\frac{s_1^2}{n_2}\right)^2 + \frac{1}{n_2-1}\left(s_1$	$\left(\frac{s_{j}^{2}}{n_{2}}\right)^{2}$
1 1 2 2 702 1 83 11 2 4	18*2)
$\frac{1}{9} \left(\frac{1 \cdot 2072}{10} \right)^{2} + \frac{1}{9} \left(\frac{1 \cdot 2072}{10} \right)^{2}$	1 (80.3248)2
= 10.30	
: N= 10	
test statistics.	yet bruste
T = X, -X2 - (H1- H	
$\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$	01
considuring null hypor	-64
$\sqrt{\frac{1.2072}{10} + \frac{0.321}{10}}$	+8
= -5.902	-0 -
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considering two sided tail

14= 1-5.902= 5.902

· pralue = 2 P (T > 1+1)

= 2P (T>5.9)

t 0.00005 (10) = 4.587

1+1 = 59 us even.

P(T>,59) <00005

: pralue < 0.001

P< x :. Null Hypothesis is

mean robust ness is not same

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