# Data Science, 2022 Tut 5: Evaluation and Measurement-Hypothesis Testing

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Make Assumptions about values when it is necessary in a consistent manner. Refer to the necessary table from the 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  $H : p < p_n, p > p_o, \text{ or } p \neq p_o$
- 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

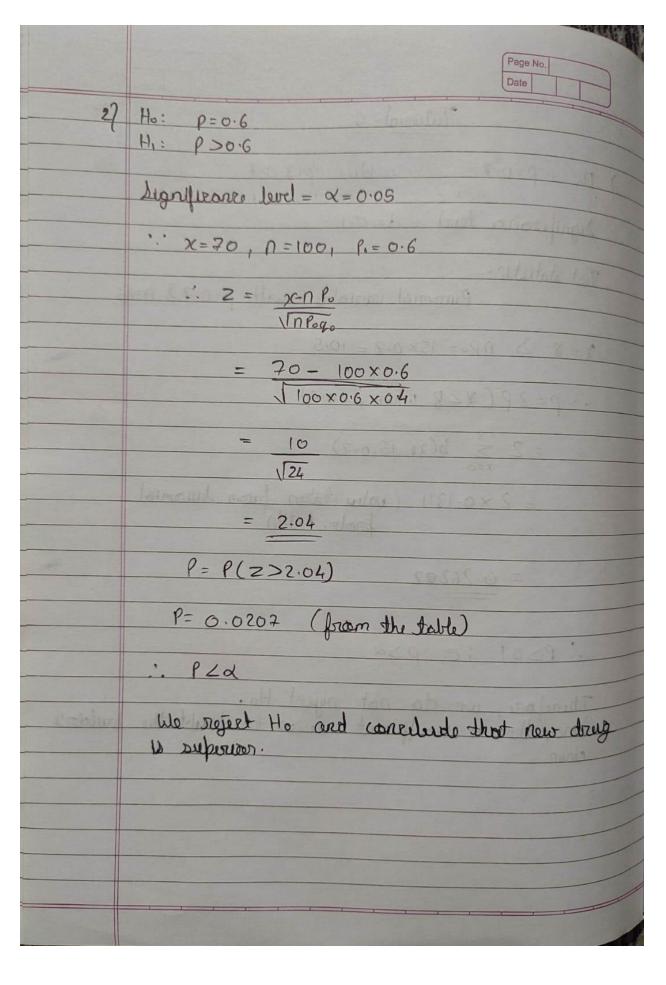
#### Ex. 1

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

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	Tutorial - 5	2 723 18 52	
1)	Ho: P=0.7 H: P + 0.	7	
1	110 . 1-0.4	bonastaad	
	Significance level = d= 0.1		
	Tost statistic:	- Oke X	
	Binomial variable x with	h p=0.73 n=15	
	X=8 & npo= 15x0.7 = 10.5		
	:. p=2p(X < B when p=0.7)		
	$= 2 \sum_{x=0}^{8} b(x_{1}, 15, 0.7)$		
	= 2 × 0.1311 (value taken fr	on Innomal	
	prob. talt)		
	= 0.262@2 (Add See	0-91	
	· Ox al in axis and con	9 000	
	.: PSOI 1:e psa	629.	
	Therefore, we do not reject Ho	0.48	
	Therefore, we do not reject Ho Dinco, there is insufficient reason to	s doubt the bullers	
	Clouit	sample of	

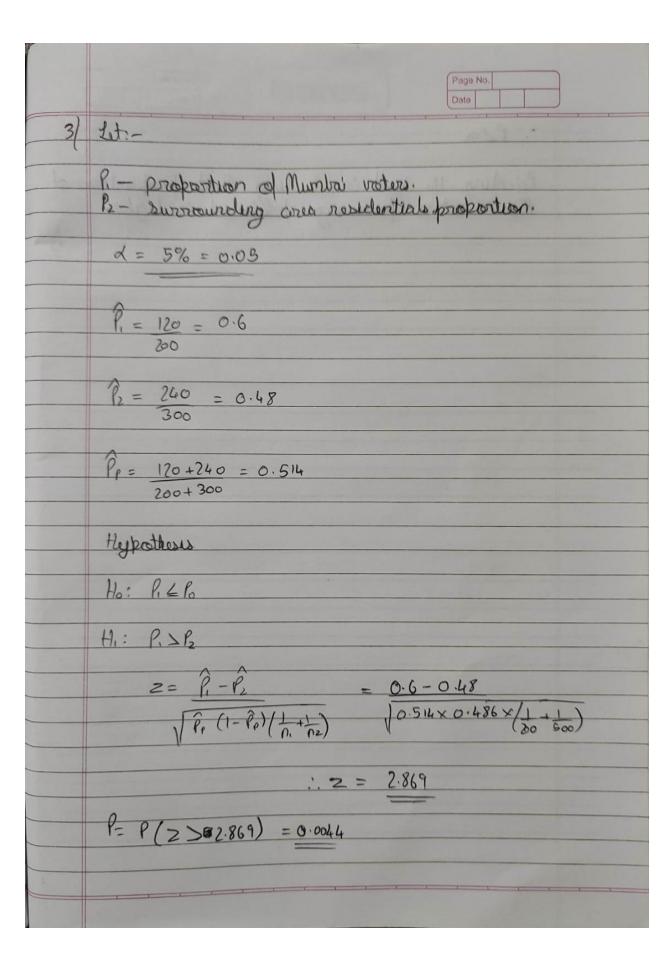
# <u>Ex.2</u>

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.



#### <u>Ex.3</u>

A vote is to be taken among the residents of 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 of 200 Mumbai voters favor the proposal and 240 of 500 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 a = 0.05 level of significance.



Page No. Date · . 920 Rejecting to and concluding that proportion of Municipalities formular voters formular proposal is higher.

## Ex.4

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 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.

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<u>a)</u>	Mul Hypothesis
	Ho: P= 0.20
	Alternature Hypothesis  H1: P>0.20
	The outred region is in right tail.
bl	Alul Hypothesis
	Ho: M=3
	Alternatur Hypothesis
	H.: W +3
1	The writeral region is in both talls.
c)	Null Hypothesis
	Ho: P=0.15
	Alternatur Hypothesis
	H1: P20.15
	The writual region is in the left tail.
The same of the same of	

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d	Mull Hypothesis
	and the state of t
	Ho: 4=300
	Alternatur Hykothesis
-	14 5 11
	H1: 4>500
	The state of the s
	The critical region is in right tail.
e)	Mull Hypotheses
	Hb: 4=19
	-A.A.
	Alternature Hypothesis
	286
	H,: 4 + 15
	The criteral region is is lath tails.
	P+5-01+1-11+F-11+101+601+2P+2-P+11-4
	ESC. 1 = 20 et : 1 2 0 - 97 = 1 20 2
	P 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
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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?

5) Let u S 42 be population mean reductions of laptops supplied by company A & company B respectively.

Ho: W1 = H2

Significance buch = < = 0.05

 $\bar{\chi}_{i} = \frac{1}{n_{i}} \sum_{i=1}^{n_{i}} \chi_{i}$ 

= 9.3+8.8+6.8+8.7+8.5+6.7+8+6.5+9.2+7

10

 $=\frac{7.95}{1}$ 

= 11+9.8+9.9+10.2+10.1+9.7+11+11.1+10.2+9.6

: X2 = 10.26

 $S_{i}^{2} = \frac{1}{n_{i-1}} \left[ \sum_{i=1}^{n} \chi_{i,i}^{2} - n_{i} \bar{x}_{i}^{2} \right] = 10-65 = 1.207$ 

Similarly,  $S_2^2 = 0.325$ 

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Dince sample variances came different we cannot assume the population variances are equal. Hence, we will use unpooled t-test.
The degrees of freedom for this test are calculated as:-
$V = \frac{\left(S_{1}^{2} + S_{2}^{2}\right)^{2}}{\left(n_{1} + \frac{S_{2}^{2}}{n_{2}}\right)^{2}}$ $\frac{1}{n_{1}-1} \frac{\left(S_{1}^{2}\right)^{2} + \frac{1}{n_{2}-1} \left(\frac{S_{2}^{2}}{n_{2}}\right)^{2}}{\left(n_{2}-1\right)^{2}}$
= 10.3
The test statistic used to test the hypothesis is
$T = X_1 - X_2 - (M_1 - M_2)$ $S^2 + S_3^2$ $N_1 - N_2$
this under the null hypothesis follows approximate to-distribution with V=10 degrees of freedom
Also, under rull hypothesis 4,-42=0
T = 7A3 - 10.26 = -5.9 $12.07 + 0.325$ $10$