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Theoretical Hypothesis Testing

Week 8: Recap

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Recap

1. Fundamentals
2. Hypothesis testing steps
3. Power analysis
4. Tests for normal distributed population mean(s)
5. Normality tests
6. ANOVA and Kruskal-Wallis test
7. Tests for population proportion(s)

Fill in the blanks

1. $H_0 : \mu \geq 0$ vs. $H_A : \dots\dots$
2. $H_0 : \mu = 0$ vs. $H_A : \dots\dots$
3. $H_0 : p \geq 0$ vs. $H_A : \dots\dots$
4. $H_0 : X \sim N(\mu, \sigma^2)$ vs. $H_A : \dots\dots$
5. $H_0 : \dots\dots$ vs. $H_A : \mu > 0$
6. $H_0 : \dots\dots$ vs. $H_A : \mu_1 \neq \mu_2$
7. $H_0 : \dots\dots$ vs. $H_A : \mu_1 - \mu_2 < 0$

Question #1

A research study is conducted, but the optimal sample size needs to be decided. One sample t-test will be used, the effect size is fixed as 0.5, and the intended power of the test is 0.92. Calculate the optimal sample size for the following hypothesis testing setup.

$$H_0 : \mu = 0$$

$$H_A : \mu \neq 0$$

Question #2

Suppose the IQ in a certain population is normally distributed with a mean of $\mu = 100$ and standard deviation of $\sigma = 15$. A scientist wants to know if a new medication affects IQ levels, so she recruits 20 patients to use it for one month and records their IQ levels at the end of the month.

88	92	94	94
96	97	97	97
99	99	105	109
109	109	110	112
112	113	114	115

$H_0 :$

$H_A :$

Question #3

Have you checked the normality assumption in the previous question?

Question #4

A teacher wants to compare the exam scores of 12 students who used an exam prep booklet to prepare for some exam vs. 12 students who did not. The following vectors show the exam scores for the students in each group:

booklet	90	85	88	89	94	91	79	83	87	88	91	90
no booklet	67	90	71	95	88	83	72	66	75	86	93	84

$H_0 :$

$H_A :$

Question #5

Have you checked the assumption(s) in the Question #4?

Question #6

Which one of the normality tests that we used in simulations performs better than others in the small samples?

Question #7

Suppose researchers want to know if three different fertilizers lead to different levels of plant growth. They randomly select 30 different plants and split them into three groups of 10, applying a different fertilizer to each group. At the end of one month they measure the height of each plant.

A	7	14	14	13	12	9	6	14	12	8
B	15	17	13	15	15	13	9	12	10	8
C	6	8	8	9	5	14	13	8	10	9

Question #8

A shop makes widgets with 80% effectiveness. They implement a new system that they hope will improve the rate of effectiveness. They randomly select 50 widgets from a recent production run and find that 46 of them are effective. Perform a test to determine if the new system leads to higher effectiveness.

Question #9

Have you checked the assumption(s) in the Question #8?

Question #10

It is wanted to test the effectiveness of a new version of a hotel booking website than the older version. For this, an experiment is conducted on the customers which are in the control and experimental group. Use the appropriate test and share your decision.

You can find the dataset named as Website Results.txt on Github.