

Hypothesis Testing – Quiz

Probability & Statistics

Question 1

The null hypothesis (H_0) represents:

- A. What we are trying to prove
- B. The default or status quo position
- C. The alternative to be tested
- D. The sample statistic

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Answer: B

H_0 is the default position we assume unless the evidence strongly contradicts it. We never 'accept' H_0 , only fail to reject it.

Question 2

A Type I error occurs when:

- A. We fail to reject a false H_0
- B. We reject a true H_0
- C. We accept H_1 correctly
- D. The sample size is too small

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Answer: B

Type I error (false positive) is rejecting H_0 when it is actually true - a 'false alarm.'

Question 3

A Type II error occurs when:

- A. We reject a true H_0
- B. We fail to reject a false H_0
- C. We correctly reject H_0
- D. The p-value is too high

Question 3

A Type II error occurs when:

- A. We reject a true H_0
- B. We fail to reject a false H_0
- C. We correctly reject H_0
- D. The p-value is too high

Answer: B

Type II error (missed detection) is failing to reject H_0 when it is actually false - missing a real effect.

Question 4

The significance level alpha controls:

- A. Type II error rate
- B. Type I error rate
- C. Sample size
- D. Effect size

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- C. Sample size
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Answer: B

Alpha is the maximum probability of Type I error we are willing to accept. Common values are 0.05 or 0.01.

Question 5

The p-value represents:

- A. Probability that H_0 is true
- B. Probability of observing data as extreme or more, assuming H_0 is true
- C. Probability of Type II error
- D. The effect size

Question 5

The p-value represents:

- A. Probability that H_0 is true
- B. Probability of observing data as extreme or more, assuming H_0 is true
- C. Probability of Type II error
- D. The effect size

Answer: B

P-value is the probability of obtaining results as extreme as observed, assuming H_0 is true. It is NOT the probability H_0 is true.

Question 6

We reject H_0 when:

- A. p-value $<$ alpha
- B. p-value $=$ alpha
- C. p-value $= 0.5$
- D. p-value is undefined

Question 6

We reject H_0 when:

- A. p-value $<$ alpha
- B. p-value \leq alpha
- C. p-value = 0.5
- D. p-value is undefined

Answer: B

If p-value \leq alpha, the evidence against H_0 is strong enough to reject it at the alpha significance level.

Question 7

Statistical power is defined as:

- A. $P(\text{Type I error})$
- B. $1 - P(\text{Type II error})$
- C. The p-value
- D. The effect size

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Answer: B

Power = $1 - \beta$ = probability of correctly rejecting H_0 when it is false. Higher power means better ability to detect real effects.

Question 8

A two-tailed test is used when:

- A. We only care if the parameter is greater than H_0
- B. We only care if the parameter is less than H_0
- C. We care about deviations in either direction from H_0
- D. The sample size is small

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- C. We care about deviations in either direction from H_0
- D. The sample size is small

Answer: C

Two-tailed tests ($H_1: \mu \neq \mu_0$) are used when we want to detect differences in either direction from the null value.

Question 9

The test statistic measures:

- A. The sample size
- B. How far the observed data is from what H_0 predicts, in standardized units
- C. The population mean
- D. The confidence level

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Answer: B

Test statistic = (observed - expected under H0) / standard error. It measures how surprising the data is if H0 were true.

Question 10

Statistical significance means:

- A. The effect is large and important
- B. The result is unlikely under H_0
- C. The study is well-designed
- D. There are no errors

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Statistical significance means:

- A. The effect is large and important
- B. The result is unlikely under H_0
- C. The study is well-designed
- D. There are no errors

Answer: B

Statistical significance only means the result is unlikely if H_0 were true. It says nothing about the size or practical importance of the effect.

Question 11

Practical significance refers to:

- A. Whether the p-value is small
- B. Whether the effect size is large enough to matter in practice
- C. Whether the test is one-tailed
- D. The sample size used

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- A. Whether the p-value is small
- B. Whether the effect size is large enough to matter in practice
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Answer: B

Practical significance asks: Is the effect meaningful in the real world? With large n , tiny (unimportant) effects can be statistically significant.

Question 12

Effect size measures:

- A. The p-value
- B. The magnitude of the difference or relationship (standardized)
- C. Sample size
- D. Type I error rate

Question 12

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- A. The p-value
- B. The magnitude of the difference or relationship (standardized)
- C. Sample size
- D. Type I error rate

Answer: B

Effect size (like Cohen's d) quantifies how large the effect is in a standardized way, independent of sample size.

Question 13

The one-sample t-test is used to:

- A. Compare two independent samples
- B. Test if a population mean equals a specific value
- C. Test if two proportions are equal
- D. Compare more than two groups

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- B. Test if a population mean equals a specific value
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Answer: B

The one-sample t-test tests whether the population mean equals a hypothesized value ($H_0: \mu = \mu_0$).

Question 14

Lowering alpha will:

- A. Decrease Type I error, increase Type II error
- B. Decrease both Type I and Type II errors
- C. Increase Type I error, decrease Type II error
- D. Have no effect on errors

Question 14

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- A. Decrease Type I error, increase Type II error
- B. Decrease both Type I and Type II errors
- C. Increase Type I error, decrease Type II error
- D. Have no effect on errors

Answer: A

There is a trade-off: lowering alpha reduces false positives (Type I) but increases false negatives (Type II), making it harder to detect real effects.

Question 15

Power increases when:

- A. Sample size decreases
- B. Effect size decreases
- C. Sample size increases or effect size increases
- D. Alpha decreases

Question 15

Power increases when:

- A. Sample size decreases
- B. Effect size decreases
- C. Sample size increases or effect size increases
- D. Alpha decreases

Answer: C

Power increases with larger sample size, larger effect size, and (to a lesser extent) larger alpha.

Question 16

The multiple testing problem refers to:

- A. Running the same test multiple times
- B. Increased false positive rate when testing many hypotheses
- C. Using multiple samples
- D. Having too few observations

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- D. Having too few observations

Answer: B

With many tests at $\alpha = 0.05$, the chance of at least one false positive increases dramatically. Corrections like Bonferroni or FDR address this.

Question 17

Bonferroni correction involves:

- A. Increasing sample size
- B. Dividing alpha by the number of tests
- C. Using a one-tailed test
- D. Ignoring p-values

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- B. Dividing alpha by the number of tests
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- D. Ignoring p-values

Answer: B

Bonferroni divides alpha by the number of tests to control the family-wise error rate. It is conservative.

When H_0 is true, p-values follow:

- A. Normal distribution
- B. Uniform distribution on $[0, 1]$
- C. Exponential distribution
- D. Chi-square distribution

Question 18

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- A. Normal distribution
- B. Uniform distribution on $[0, 1]$
- C. Exponential distribution
- D. Chi-square distribution

Answer: B

Under H_0 , p-values are uniformly distributed between 0 and 1. Any value is equally likely.

Question 19

The rejection region is:

- A. The range of p-values
- B. The set of test statistic values that lead to rejecting H_0
- C. The confidence interval
- D. The sample mean

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- A. The range of p-values
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Answer: B

The rejection region contains test statistic values extreme enough to reject H_0 . Its size is determined by alpha.

Question 20

A common misconception is that p-value equals:

- A. The probability the data is wrong
- B. The probability H_0 is true
- C. The sample size
- D. The effect size

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A common misconception is that p-value equals:

- A. The probability the data is wrong
- B. The probability H_0 is true
- C. The sample size
- D. The effect size

Answer: B

P-value is NOT $P(H_0 \text{ is true} \mid \text{data})$. It is $P(\text{data} \mid H_0 \text{ is true})$. This is a common and important distinction.