

Statistics: Type I and Type II Errors

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DIRECTIONS

For each scenario, identify the type of error or compute the requested value. Use: Type I Error = reject a true H_0 (α); Type II Error = fail to reject a false H_0 (β); Power = $1 - \beta$.

1 Identify the type of error:

H_0 is true, but we reject H_0

Answer: _____

2 Identify the type of error:

H_0 is false, but we fail to reject H_0

Answer: _____

3 Find the power of the test given β :

$$\beta = 0.20$$

Answer: _____

4 Identify the error: A drug has no effect, but the test says it does.

H_0 : drug has no effect (true)

Answer: _____

5 Identify the error: A disease is present, but the test says it is not.

H_0 : no disease (false)

Answer: _____

6 If $\alpha = 0.05$, what is $P(\text{Type I Error})$?

$$\alpha = P(\text{Type I Error})$$

Answer: _____

7 Which error is also called a "false positive"?

False Positive = Reject true H_0

Answer: _____

8 Which error is also called a "false negative"?

False Negative = Miss a real effect

Answer: _____

Answer Key & Solutions

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TEACHER NOTES

Type I (α) = false positive: reject true H_0 . Type II (β) = false negative: miss a real effect. Power = $1 - \beta$. Decreasing α increases β and lowers power (trade-off). Larger samples increase power.

1 Identify the type of error:

H_0 is true, but we reject H_0

= Type I Error (α)

Rejecting a true null hypothesis is a false positive — Type I Error.

2 Identify the type of error:

H_0 is false, but we fail to reject H_0

= Type II Error (β)

Failing to reject a false null hypothesis is a false negative — Type II Error.

3 Find the power of the test given β :

$$\beta = 0.20$$

= Power = $1 - \beta = 0.80$

Power = $1 - P(\text{Type II Error})$. Higher power means better ability to detect a true effect.

4 Identify the error: A drug has no effect, but the test says it does.

H_0 : drug has no effect (true)

= Type I Error

H_0 is true (no effect), but we rejected it — this is a false positive.

5 Identify the error: A disease is present, but the test says it is not.

H_0 : no disease (false)

= Type II Error

H_0 is false (disease exists), but we failed to reject it — false negative.

6 If $\alpha = 0.05$, what is $P(\text{Type I Error})$?

$$\alpha = P(\text{Type I Error})$$

= $P(\text{Type I Error}) = 0.05$

By definition, α is the probability of committing a Type I Error.

7 Which error is also called a "false positive"?

False Positive = Reject true H_0

= **Type I Error**

Type I Error: we claim an effect exists when it does not.

8 Which error is also called a "false negative"?

False Negative = Miss a real effect

= **Type II Error**

Type II Error: we miss a real effect — fail to reject a false H_0 .