



How To Identify Type I and Type II Errors In Statistics

- Type 1 Errors and Type 2 Errors

Type I Error: Rejecting the null hypothesis when it is true.

Type 2 Error: Not rejecting the null hypothesis when it is false.

Type 1 Error and Type 2 Error

- Type 1 Error
 - Null hypothesis is rejected when it is true
- Type 2 Error
 - Null hypothesis is not rejected when it is false
- The probabilities of each error where T_1 is the type 1 error, T_2 is the type 2 error, H_0 is when the null hypothesis is true, \bar{H}_0 is when the null hypothesis is false, and R is the rejection of a hypothesis

$P(\text{type I error} / H_0 \text{ is true}) = \alpha$

$P(\text{type II error} / H_0 \text{ is false}) = \beta$

$P(\text{rejecting a false } H_0) = 1 - \beta$

Probability of each error

- $P(T_1 | H_0) = \alpha$
- $P(T_2 | \bar{H}_0) = \beta$
- $P(R | \bar{H}_0) = 1 - \beta$ and this is also known “Power of the Test”
- Summarising the Type of Errors

	H_0	
	True	False
Reject H_0	Type I error	✓
Fail to Reject H_0	✓	Type II error

Summary of Type of Errors

- Question 1

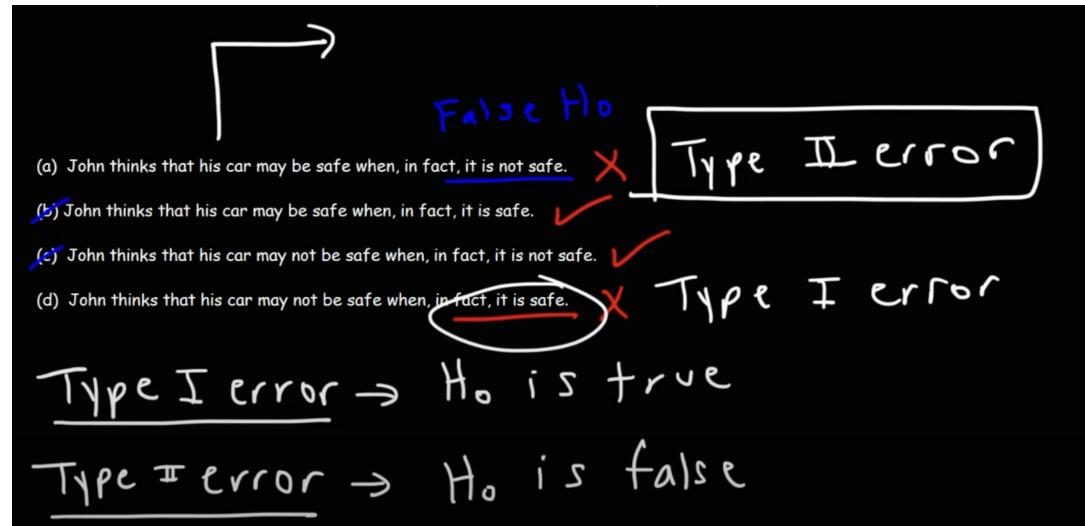
1. Let's say that the null hypothesis H_0 is: John's used car is safe to drive. (a) Which statement represents a type I error? (b) Which statement represents a type II error? (c) Which type of error has greater consequence?

- (a) John thinks that his car may be safe when, in fact, it is not safe.
- (b) John thinks that his car may be safe when, in fact, it is safe.
- (c) John thinks that his car may not be safe when, in fact, it is not safe.
- (d) John thinks that his car may not be safe when, in fact, it is safe.

Question 1

- For option (a)
 1. Given null hypothesis is "John's used car is safe"
 2. Hypothesis is false as the car is in fact not safe
 3. John thinks that his car may be safe and does not reject the null hypothesis when it is false
 4. This is a type 2 error
- For option (b)
 1. Given null hypothesis is "John's used car is safe"
 2. Hypothesis is true as the car is in fact safe
 3. John thinks that his car may be safe and agrees with the null hypothesis when it is true
 4. This is a good decision
- For option (c)

1. Given null hypothesis is “John’s used car is safe”
 2. Hypothesis is false as the car is in fact not safe
 3. John thinks that his car may not be safe and rejects the null hypothesis when it is false
 4. This is a good decision
- For option (d)
1. Given null hypothesis is “John’s used car is safe”
 2. Hypothesis is true as the car is in fact safe
 3. John thinks that his car may not be safe and rejects the null hypothesis when it is true
 4. This is a type 1 error
- The type 2 error is more dangerous than the type 1 error here
 - Answer 1



Answer 1

o Question 2

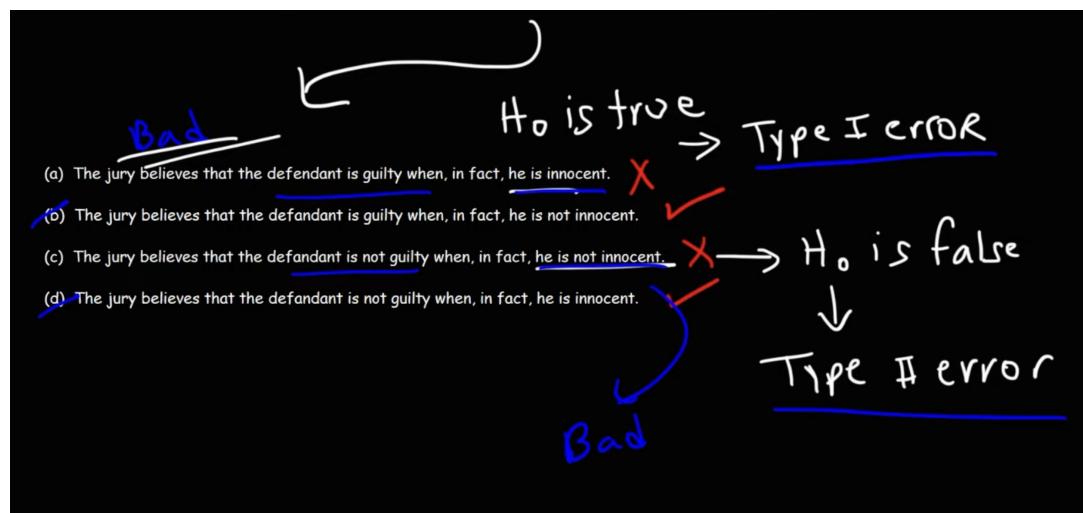
2. In a criminal court case, the null hypothesis H_0 is that the defendant is presumed innocent. (a) Which statement represents a type I error? (b) Which statement represents a type II error? (c) Which type of error has greater consequence?

- (a) The jury believes that the defendant is guilty when, in fact, he is innocent.
- (b) The jury believes that the defendant is guilty when, in fact, he is not innocent.
- (c) The jury believes that the defendant is not guilty when, in fact, he is not innocent.
- (d) The jury believes that the defendant is not guilty when, in fact, he is innocent.

Question 2

- For option (a)
1. Given null hypothesis is “defendant is presumed innocent”
 2. Hypothesis is true and in fact he is innocent

- 3. Jury thinks the defendant is guilty and rejects the null hypothesis when it is true
- 4. This is a type 1 error
- For option (b)
 1. Given null hypothesis is “defendant is presumed innocent”
 2. Hypothesis is false and in fact he is guilty
 3. Jury thinks the defendant is guilty and agrees with the null hypothesis when it is false
 4. This is a good decision
- For option (c)
 1. Given null hypothesis is “defendant is presumed innocent”
 2. Hypothesis is true and in fact he is guilty
 3. Jury thinks the defendant is innocent and rejects the null hypothesis when it is false
 4. This is a type 2 error
- For option (d)
 1. Given null hypothesis is “defendant is presumed innocent”
 2. Hypothesis is true and in fact he is innocent
 3. Jury thinks the defendant is innocent and agrees with the null hypothesis when it is true
 4. This is a good decision
- The type 2 error is more dangerous than the type 1 error here
- Answer 2



Answer 2