

Learning Goal: Recognize Type I and Type II errors.

Our conclusion in a hypothesis test is based on probability. Because of this, there is a chance that our conclusion is wrong.

1) What can go wrong?

a) Indicate which cells in the table are correct decisions.

| | | <i>Our actions</i> | |
|------------------------|----------------------------------|---|---|
| | | We reject H_0 (in favor of H_a) | We fail to reject H_0 (not enough evidence in favor of H_a) |
| <i>Unknown reality</i> | H_0 is true. | | |
| | H_0 is false. (H_a is true) | | |

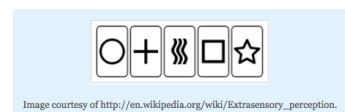
b) If H_0 is true, but we reject it, this is Type I error.
If H_0 is false, but we fail to reject it, this is a Type II error.
Label each type of error in the table.

2) In testing for bacterial counts on meat, we have the following hypotheses
 H_0 : Meat is not spoiled. H_a : Meat is spoiled.

Describe Type I and Type II errors in this context.

3) In the early 1900s researchers used Zener cards to try to identify people with ESP. A person would try to identify the symbol on a hidden card.

Someone who is just guessing has a 1 in 5 chance of a correct guess, which is 0.20. Imagine a person correctly identified 5 symbols out of 10 tries.



H_0 : person is guessing ($p=0.20$) (does not have ESP)
 H_a : person is not guessing ($p>0.20$) (may have ESP)

With 10 tries, the distribution associated with guessing gives a P-value of 0.009 for this person.

a) What do we conclude based on the P-value?

b) Which type of error is possible here?

- 4) Thousands of women every year use home pregnancy tests, which are sold in drug stores and supermarkets. Home pregnancy tests give a result of positive (pregnant) or negative (not pregnant). A systematic review published in 1998 showed that home pregnancy test kits, when used by experienced technicians, are almost as accurate as professional laboratory testing (97.4%). When used by consumers, however, the accuracy fell to 75%: the review authors noted that many users misunderstood or failed to follow the instructions included in the kits. Improper usage may cause both false positives (Type I error) and false negatives (Type II error).

Describe both types of error relative to the hypotheses below. Use the terms “false positive” and “false negative.”

Ho: woman is not pregnant

Ha: woman is pregnant