Introduction

Ref: https://www.csus.edu/indiv/j/jgehrman/courses/stat50/hypthesistests/9hyptest.htm

In hypothesis testing a decision between two alternatives, one of which is called the null hypothesis and the other the alternative hypothesis, must be made. As an example, suppose you are asked to decide whether a coin is fair or biased in favor of heads. In this situation the statement that the coin is fair is the null hypothesis while the statement that the coin is biased in favor of heads is the alternative hypothesis. To make the decision an experiment is performed. For example, the experiment might consist of tossing the coin 10 times, and on the basis of the 10 coin outcomes, you would make a decision either to accept the null hypothesis or reject the null hypothesis (and therefore accept the alternative hypothesis). So, in hypothesis testing acceptance or rejection of the null hypothesis can be based on a decision rule. As an example of a decision rule, you might decide to reject the null hypothesis and accept the alternative hypothesis if 8 or more heads occur in 10 tosses of the coin.

The process of testing hypotheses can be compared to court trials. A person comes into court charged with a crime. A jury must decide whether the person is innocent (null hypothesis) or guilty (alternative hypothesis). Even though the person is charged with the crime, at the beginning of the trial (and until the jury declares otherwise) the accused is assumed to be innocent. Only if overwhelming evidence of the person's guilt can be shown is the jury expected to declare the person guilty--otherwise the person is considered innocent.

Errors

In the jury trial there are two types of errors: (1) the person is innocent but the jury finds the person guilty, and (2) the person is guilty but the jury declares the person to be innocent. In our system of justice, the first error is considered more serious than the second error. These two errors along with the correct decisions are shown in the next table where the jury decision is shown in bold on the left margin and the true state of affairs is shown in bold along the top margin of the table.

	Truth is Person Innocent	**Truth is Person Guilty**
Jury Decides Person Innocent	Correct Decision	Type II Error
Jury Decides Person Guilty	Type I Error	Correct Decision

	In Fact H0 is True	**In Fact H0 is False**
Test Decides H0 True	Correct Decision	Type II Error
Test Decides H0 False	Type I Error	Correct Decision

Assumptions

In a jury trial the person accused of the crime is assumed innocent at the beginning of the trial, and unless the jury can find overwhelming evidence to the contrary, should be judged innocent at the end of the trial. Likewise, in hypothesis testing, the null hypothesis is assumed to be true, and unless the test shows overwhelming evidence that the null hypothesis is not true, the null hypothesis is accepted.

Type I and II Errors

```
type I : False positive
type II: False Negative e.g. (say not true when true)(say not produce too
many defects, when it is actually production defective items. )
```

4) Given the null hypothesis: that a process is producing no more than the maximum allowable rate of defective items. In this situation, a type II error would be:

a) to conclude that the process is producing too many defectives when it actually is not

b) to conclude that the process is not producing too many defectives when it actually is

c) to conclude that the process is not producing too many defectives when it is not

d) to conclude that the process is producing too many defectives when it is

Ans: **b) to conclude that the process is not producing too many defectives when it actually is**

A type II error is a statistical term used within the context of hypothesis testing that describes the error that occurs when one accepts a null hypothesis that is actually false.

268) A researcher concludes from his analysis that a placebo cures AIDS. What type of error is he making?

A) Type 1 error

B) Type 2 error

C) None of these. The researcher is not making an error.

D) Cannot be determined

Solution: (D)

By definition, type 1 error is rejecting the null hypothesis when its actually true and type 2 error is accepting the null hypothesis when its actually false. In this case to define the error, we need to first define the null and alternate hypothesis.

269) What happens to the confidence interval when we introduce some outliers to the data?

A) Confidence interval is robust to outliers

B) Confidence interval will increase with the introduction of outliers.

C) Confidence interval will decrease with the introduction of outliers.

D) We cannot determine the confidence interval in this case.

Solution: (B)

We know that confidence interval depends on the standard deviation of the data

We know that confidence interval depends on the standard deviation of the data. If we introduce outliers into the data, the standard deviation increases, and hence the confidence interval also increases.