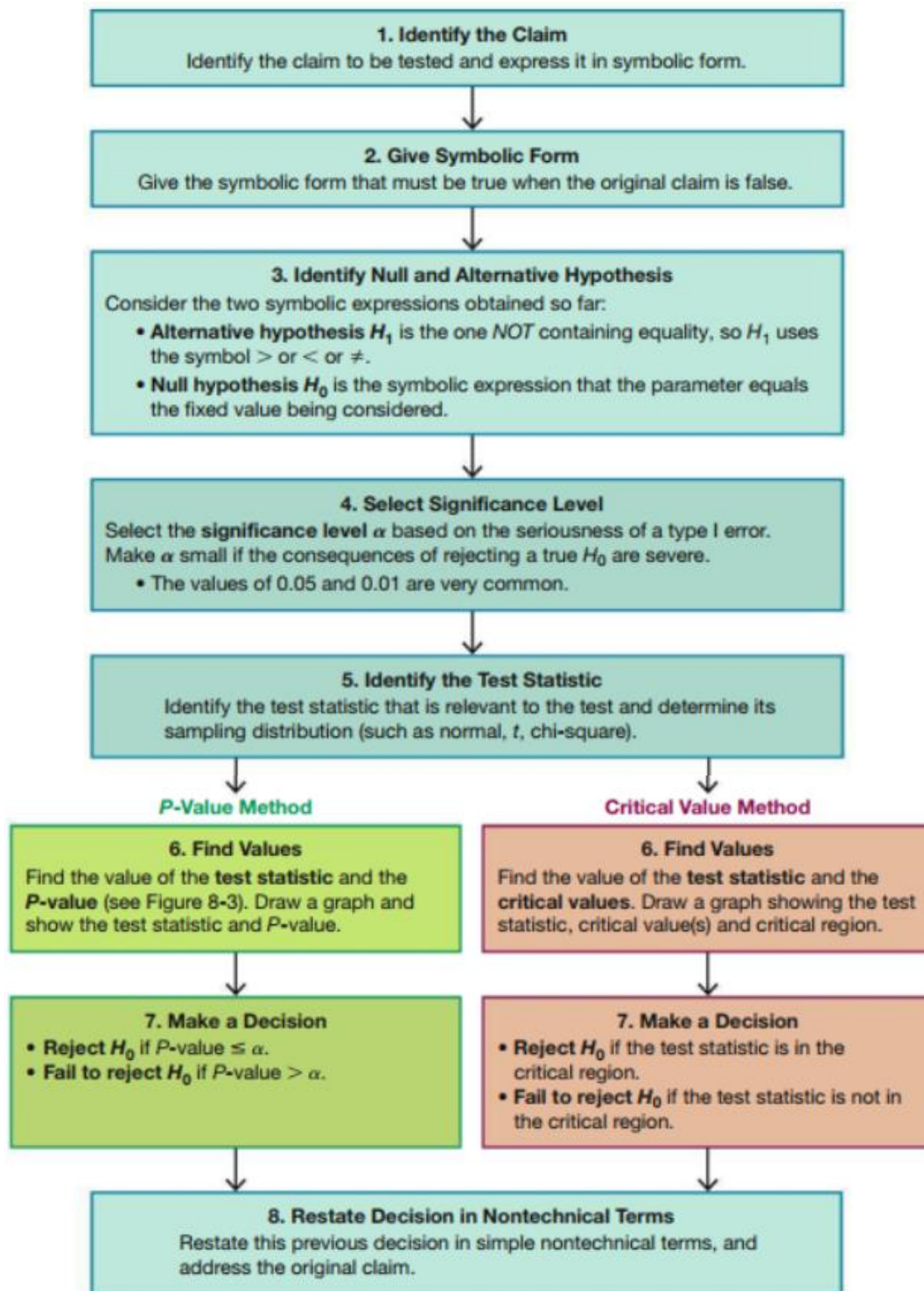


MAT1080 Worksheet #8 Examples and Notes

Actual worksheet problems are separate

Hypothesis Testing Steps

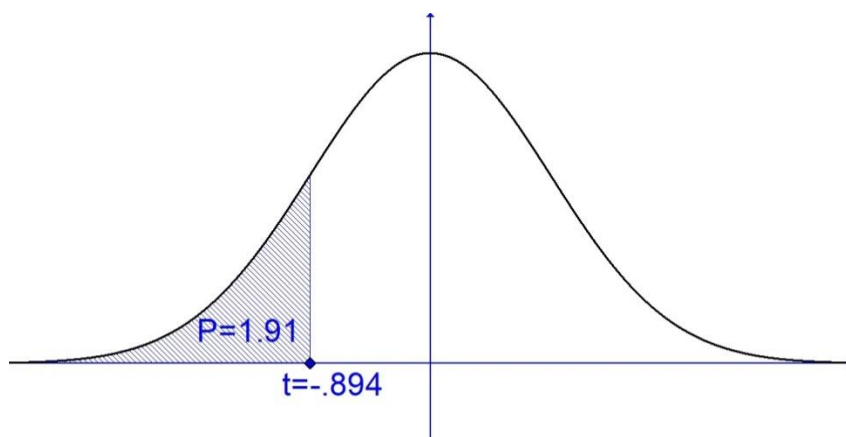
The 8 steps for doing any hypothesis test are the following (page 360 of the book):



Example 1. Do a full hypothesis test . Use the P-Value Method and clearly show all eight steps given in the book. Verify the value of the test statistic using a manual calculation (showing all work), technology is recommended for the rest of the problem.

Employees at a construction and mining company claim that the mean salary of the company's mechanical engineers is less than that of the one of its competitors, which is \$68,000. A random sample of 20 of the company's mechanical engineers has a mean salary of \$66,900. Assume the sample standard deviation is \$5500 and the population is normally distributed. At $\alpha = 0.05$, test the employees' claim.

1. Claim $\mu < \$68,000$
2. Complement of the claim $\mu \geq \$68,000$
3. $H_0: \mu = \$68,000$
 $H_1: \mu < \$68,000$ (claim) $\leftarrow H_1$ is whichever of #1 & #2 not containing equality
4. $\alpha=0.05$
5. One-sample t-Test of mean, left-tailed $\leftarrow$ t-Test because population std. dev. is not known
 $\leftarrow$ left-tailed because H_1 has ' $<$ ' (points to left)
6. $t = \frac{\bar{x} - \mu}{s / \sqrt{n}} = \frac{66,900 - 68,000}{5500 / \sqrt{20}} \approx -0.894$ $\leftarrow$ manually verify t, even if given by technology
P = 1.91



← Could also show α region (rejection zone), showing if it is larger or smaller than P , but not required.

7. $P > \alpha$, outside of rejection zone, fail to reject H_0
8. At the 5% level of significance, there is not sufficient evidence to support the employee's claim that the mean salary is less than \$68,000.
 $\leftarrow$ fail to reject H_0 , fail to support H_1 (claim)

t-Test for the Correlation Variable

r is used for the sample correlation, $-1 \leq r \leq 1$

ρ (greek letter rho), $-1 \leq \rho \leq 1$, is used for the population correlation.

The test statistic is given by:

$$t = \frac{r}{\sqrt{\frac{1-r^2}{n-2}}} \text{ (d.f. = } n-2 \text{), where } n \text{ is the number of data pairs}$$

This test will only be done two-tailed in this course, so the null hypothesis is always $\rho=0$ (no correlation) and the alternate hypothesis $\rho \neq 0$ (there is significant correlation). Either one could be stated as the claim, although more typically the claim would be $\rho \neq 0$ (there is correlation).

In Statdisk, copy the data into two columns, choose Stat/Regression/Simple Linear, chose the 2 two data columns and then click compute. The r -value, t -value, and P -values will be given. Look for the P -value under "Analysis of variance table".

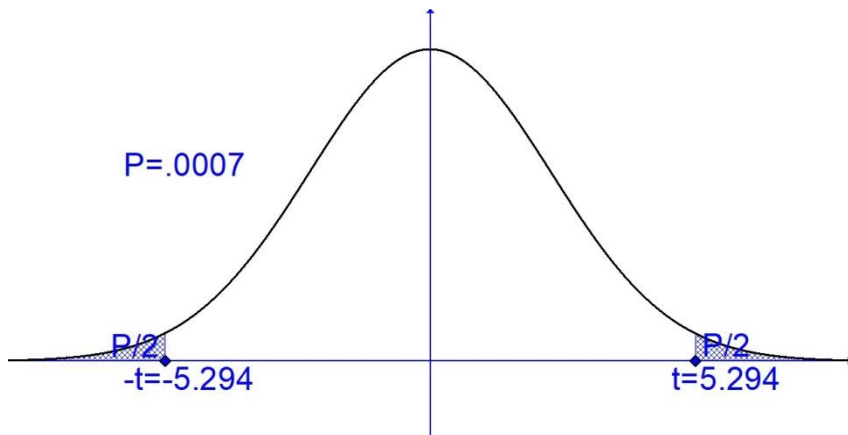
Example 2. Do a full hypothesis test . Use the P -Value Method and clearly show all eight steps given in the book. Verify the value of the test statistic using a manual calculation (showing all work), technology is recommended for the rest of the problem.

Is there a correlation between the following 10 data pairs at the 5% level?

GDP (trillions of \$), x	CO ₂ emission (millions of metric tons), y
1.6	428.2
3.6	828.8
4.9	1214.2
1.1	444.6
0.9	264.0
2.9	415.3
2.7	571.8
2.3	454.9
1.6	358.7
1.5	573.5

Example 2 Solution

1. Claim $\rho \neq 0$
2. Complement of the claim $\rho = 0$
3. $H_0: \rho = 0$ $\leftarrow$ always equality
 $H_1: \rho \neq 0$ (claim) $\leftarrow$ correlation
4. $\alpha = 0.05$
5. t-Test of correlation, two-tailed $\leftarrow$ two-tailed because H_1 has ' $\neq$ '
6. $r = .882$ $\leftarrow$ r from technology
$$t = \frac{r}{\sqrt{\frac{1-r^2}{n-2}}} = \frac{0.882}{\sqrt{\frac{1-0.882^2}{10-2}}} \approx 5.294$$
 $\leftarrow$ manually verify t from r, even if given by technology
 $P = 0.0007$ $\leftarrow$ P from technology



$\leftarrow$ Could also show two-tailed α region (rejection zone), showing if it is larger or smaller than P, but not required.

7. $P < \alpha$, in rejection zone, reject H_0
8. At the 5% level of significance, there is sufficient evidence to support the claim that there is a linear correlation between GDP and CO_2 emissions,
 $\leftarrow$ reject H_0 , support H_1 (claim)