DAE8 Problem 2.6

Given:

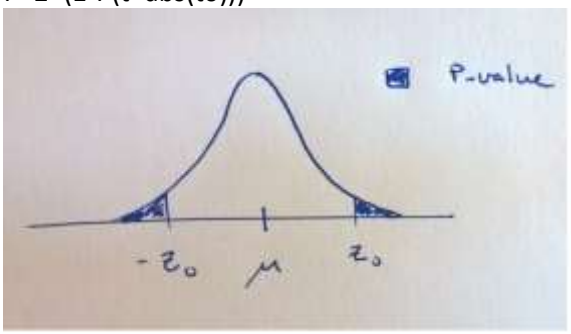
2.6. Suppose that we are testing $H_0: \mu_1 = \mu_2$ versus $H_0: \mu_1 \neq \mu_2$ where the two sample sizes are $n_1 = n_2 = 10$. Both sample variances are unknown but assumed equal. Find bounds on the P-value for the following observed values of the test statistic.

(a) $t_0 = 2.45$ **(b)** $t_0 = 3.25$ **(c)** $t_0 = 1.90$ **(d)** $t_0 = -2.50$

Solution:

The reference distribution is the students t-distribution as the variances are unknown. The test is double sided. The distribution is symmetric (see figure) and the P-value is therefore

P=2*(1-P(t>abs(t0)))



This is determined by the CDF of the t-distribution with dF degrees of freedom. The number of degrees of freedom in this case is

dF=n1+n2-2=10+10-2=18

The test statistics were computed as

t0=μ1-μ0/(Sp*sqrt(1/n1+1/n2)))

where Sp is the weighted average of the sample variances

S_p^2=[(n1-1)S_1^2+(n2-1)S_2^2]/dF

The sample variances are

S^2=sum(i={1,n},(y_i-<y>)^2)/(n-1)

The following MATLAB code generates the P-values

```
t0=[2.45,3.25,1.9,-2.5]'; %cases A-D in a col.-vector
n1=10;
n2=n1;
dF=(n1+n2-2);
P=2*(1-tcdf(abs(t0),dF))
P =[0.0247,0.0044,0.0736,0.0223]'
```

Where smaller values are more likely under H1