DAE8 Problem 2.7

Given:

2.7. Suppose that we are testing $H_0 : \mu_1 = \mu_2$ versus $H_0 : \mu_1 > \mu_2$ where the two sample sizes are $n_1 = n_2 = 12$. Both sample variances are unknown but assumed equal. Find bounds on the *P*-value for the following observed values of the test statistic.

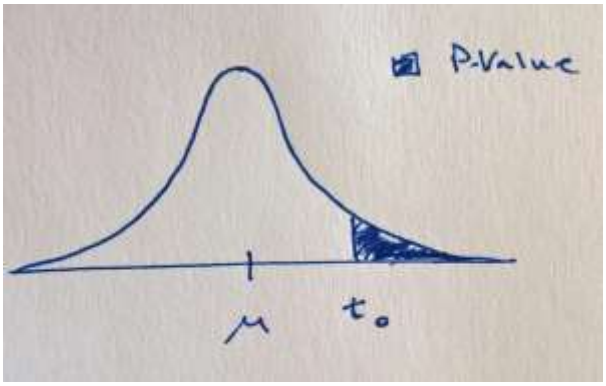
(a) $t_0 = 2.31$ **(b)** $t_0 = 3.60$ **(c)** $t_0 = 1.95$ **(d)** $t_0 = 2.19$

Solution:

Unknown sample variances, assumed equal => t-distribution with dF number of degrees of freedom

Number of degrees of freedom, dF=n1+n2-2=12+12-2=24-2=22

The test is one sided and therefore the P-value is the probability of greater values than t0 (see figure)



The P-value is therefore, P=P(t>t0)=1-tCDF(t0,dF)

Smaller values are more likely under H1.

The test statistic is computed as t0=(μ1-μ2)/(Sp*sqrt(1/n1+1/n2))

where Sp^2=[(n1-1)S1^2+(n2-1)S2^2]/dF

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

The following MATLAB code computes the P-values

```
t0=[2.31,3.6,1.95,2.19]';
n1=12;
n2=n1;
dF=n1+n2-2;
P=1-tcdf(t0,dF)
P =[0.0153,0.0008,0.0320,0.0197]';
```