t-Tests

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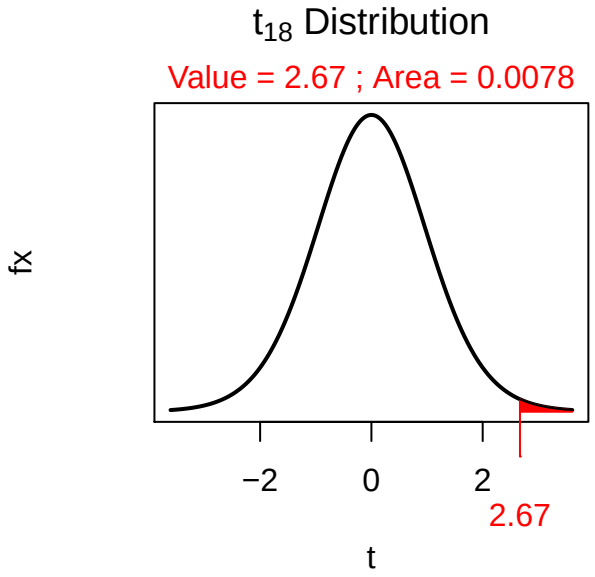
First Commands

```
> library(NCStats)
> setwd("C:/aaaWork/Web/GitHub/NCMTH107/resources/class/HOs")
> library(car)    # for leveneTest
```

t Distribution Calculations

An example of computing the p-value if $H_A : \mu > 70$, t=2.67, and df=18.

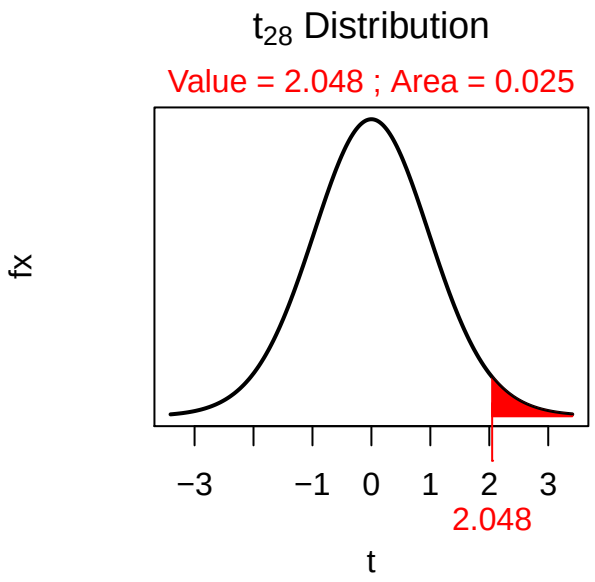
```
> ( distrib(2.67,distrib="t",df=18,lower.tail=FALSE) )
```




```
[1] 0.007807045
```

An example of finding t^* if $H_A : \mu \neq 70$, α=0.05, and df=28.

```
> ( distrib(0.025,distrib="t",df=28,type="q",lower.tail=FALSE) )
```




```
[1] 2.048407
```

One-Sample t-Test

Blem and Blem (1995) examined the reproductive characteristics of Eastern Cottonmouth snakes (*Agkistrodon piscivorus*), a once widely distributed snake whose numbers have decreased recently due to encroachment by humans. In one part of their study they determined that the population being examined must have an average litter size greater than 5.8 snakes for the population to grow. A random sample of snake litters from this population was taken and the number of snakes in each litter was recorded in in Cottonmouth.csv. Test, at a very conservative level, if the average litter size is large enough for this population to grow.

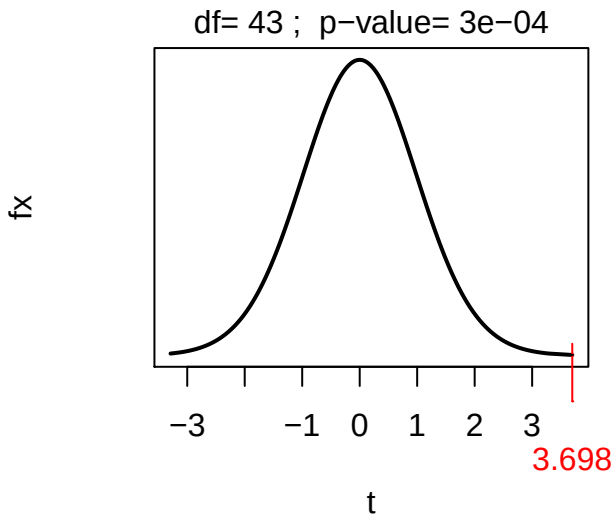
```
> cm  <- read.csv("Cottonmouth.csv")
> str(cm)
```

```
'data.frame':   44 obs. of  1 variable:
 $ num: int  5 12 7 7 6 8 12 9 7 4 ...
```

```
> # if n was <40 then I would have done -- hist(~num,data=cm,xlab="Number in Litter")
> ( cm.t <- t.test(cm$num,mu=5.8,alt="greater",conf.level=0.99) )
```

```
One Sample t-test with cm$num
t = 3.6985, df = 43, p-value = 0.0003055
alternative hypothesis: true mean is greater than 5.8
99 percent confidence interval:
 6.342094      Inf
sample estimates:
mean of x
 7.363636
```

```
> plot(cm.t)
```



Two-Sample t-Test

Sholl *et al.* (2000) performed an experiment to test the effect of sex (male, female) on spatial orientation ability. In one part of their study, the researchers took 30 males and 30 female to an unfamiliar wooded park and asked them to point to the south. The absolute pointing error (degrees, `abserr`) was recorded in SexDirection . Test if men have a better sense of direction than women, at the 1% level?

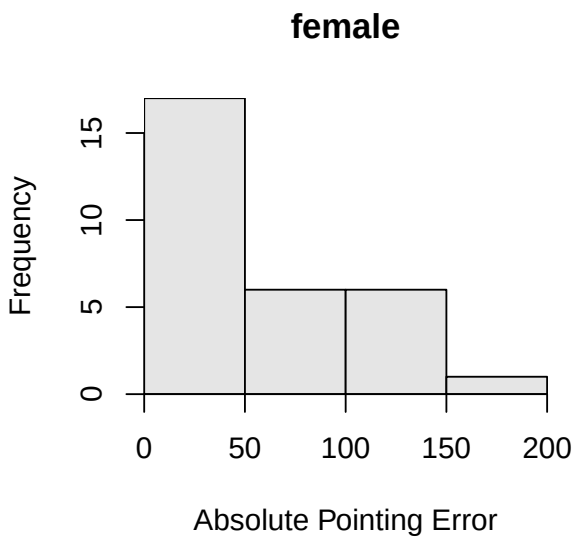
```
> sdir <- read.csv("SexDirection.csv")
> str(sdir)
```

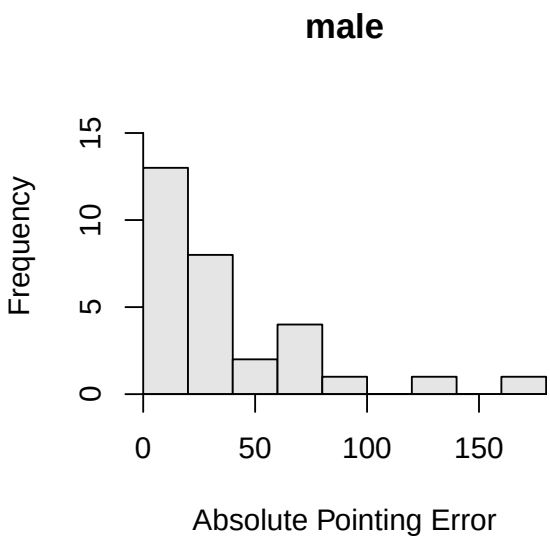
```
'data.frame':   60 obs. of  2 variables:
 $ abserr: int  13 13 38 59 58 8 130 68 23 5 ...
 $ sex   : Factor w/ 2 levels "female","male": 2 2 2 2 2 2 2 2 2 2 ...
```

```
> Summarize(abserr~sex,data=sdir,digits=1)
```

```
     sex  n nvalid mean   sd min   Q1 median   Q3 max percZero
1 female 30     30 55.8 48.3   3 15.8   35.0 88.2 176        0
2   male 30     30 37.6 38.5   3 11.5   22.5 58.8 167        0
```

```
> hist(abserr~sex,data=sdir,xlab="Absolute Pointing Error")
```





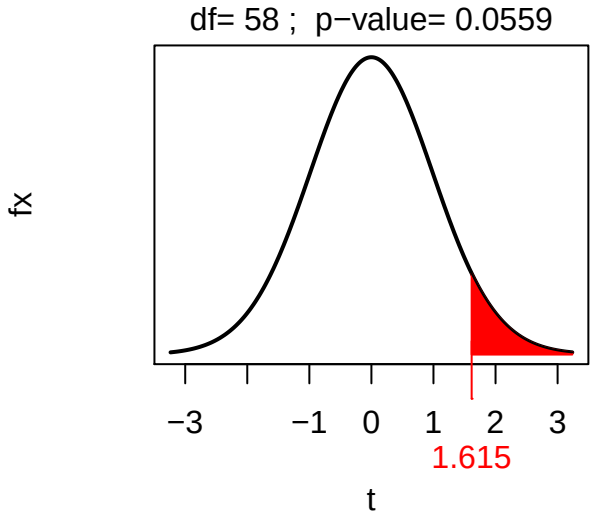

```
> leveneTest(abserr~sex,data=sdir)
```

```
Levene's Test for Homogeneity of Variance (center = median)
      Df F value Pr(>F)
group  1  2.1692 0.1462
      58
```

```
> ( t2 <- t.test(abserr~sex,data=sdir,var.equal=TRUE,alt="greater",conf.level=0.99) )
```

```
 Two Sample t-test with abserr by sex
t = 1.6149, df = 58, p-value = 0.05588
alternative hypothesis: true difference in means is greater than 0
99 percent confidence interval:
 -8.761457       Inf
sample estimates:
mean in group female   mean in group male
                55.8                 37.6
```

```
> plot(t2)
```


df= 58 ; p−value= 0.0559
fx
−3
−1
0
1
2
3
1.615
t