t-Tests

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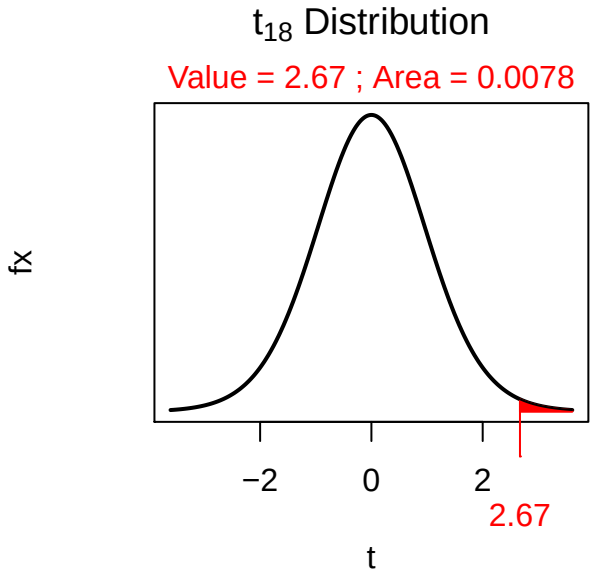
First Commands

```
> library(NCStats)
> setwd("C:/aaaWork/Web/GitHub/NCMTH107/lecture/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.

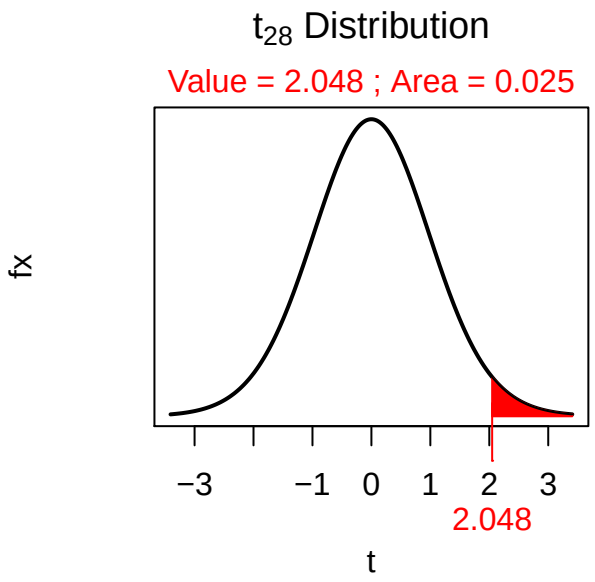
```
> ( distrib(2.67,distrib="t",df=18,lower.tail=FALSE) )
```




```
[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

Researchers (Based on data from Blem, C.R. and L.B. Blem. 1995. Journal of Herpetology 29:391-398) have determined that a population of cottonmouth snakes (**Agkistrodon piscivorus**) must have an average litter size of greater than 5.8 snakes in order for the population to grow. A sample of snake litters from this population was taken and the number of snakes in the litter was recorded. The results were recorded in Cottonmouth.csv on the class webpage. Test, at a very conservative level, if the average litter size is large enough for the population to grow.

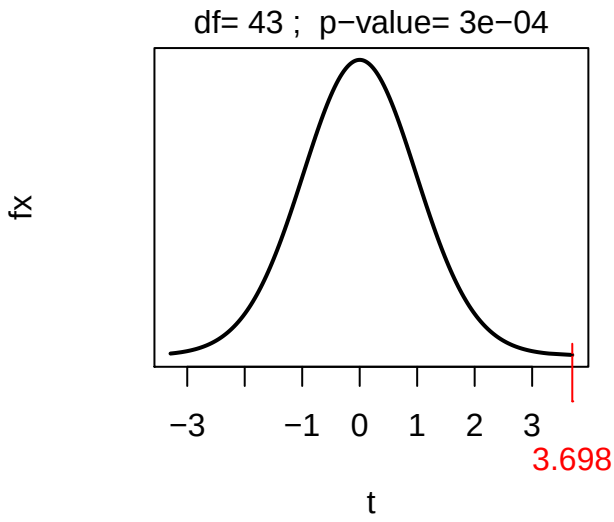
```
> cm  <- read.csv("Cottonmouth.csv")
> str(cm)
```

```
'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

A sample (from Sholl, M.J., **et al.** 2000. The relation of sex and sense of direction to spatial orientation in an unfamiliar environment. Journal of Environmental Psychology. 20:17-28.) of 30 males and 30 female was taken to an unfamiliar wooded park and given spatial orientation tests, including pointing to the south. The absolute pointing error, in degrees, was recorded. The results are in the SexDirection on the class webpage. Test if men have a better sense of direction than women, at the 1% level?

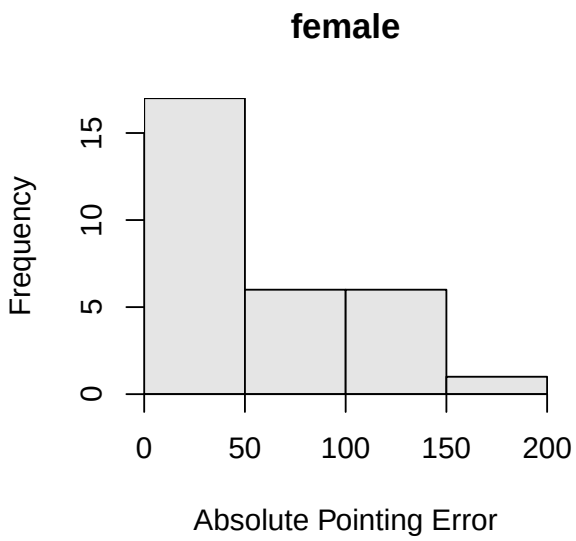
```
> sdir <- read.csv("SexDirection.csv")
> str(sdir)
```

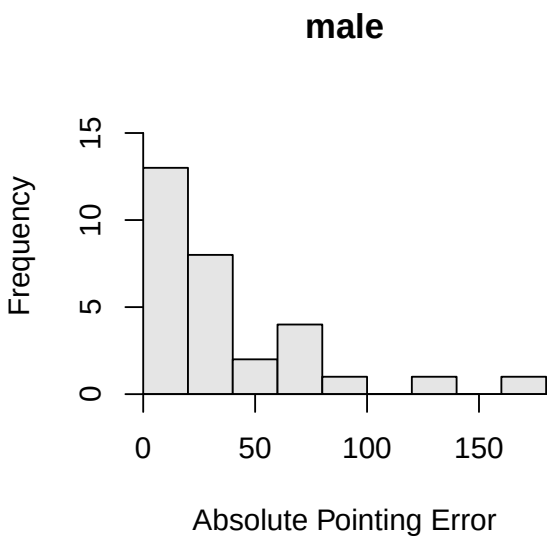
```
'data.frame':   60 obs. of  2 variables:
 $ abserr: int  13 13 38 59 58 8 130 68 23 5 ...
 $ sex   : Factor w/ 2 levels "female","male": 2 2 2 2 2 2 2 2 2 2 ...
```

```
> 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")
```





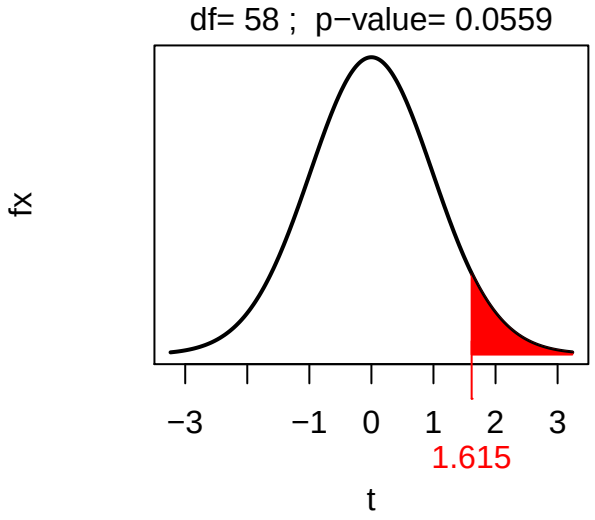

```
> leveneTest(abserr~sex,data=sdir)
```

```
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