Stat 630 Lab8 Section 01

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Exercise 1

```
#install.packages("HistData")
library(HistData)
```

```
## Warning: package 'HistData' was built under R version 3.4.4
```

```
velocity=Michelson$velocity
t.test(velocity, mu=734.5)
```

```
##
##  One Sample t-test
##
## data:  velocity
## t = 14.922, df = 99, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 734.5
## 95 percent confidence interval:
##  836.7226 868.0774
## sample estimates:
## mean of x
##     852.4
```

With a t-value of nearly 15 and an extremely small p-value, we reject the null hypothesis and conclude the mean is not equal 734.5

Exercise 2

```
set.seed(630)
pvals=rep(0,10000)
for(i in 1:10000)
  {
  x=runif(30,min=0,max=1)
  pvals[i] = t.test(x, mu=0.5)$p.value
}
prop= ((sum(pvals <= .05))/10000) ; prop
```

```
## [1] 0.0488
```

The proportion of tests that incorrectly rejected the null hypothesis is 0.0488, which is close to our significance level of 0.05

Exercise 3

```r
set.seed(1209)
pvals=rep(0,10000)
for(i in 1:10000)
  {
  x=runif(2,min=0,max=1)
  pvals[i] = t.test(x, mu=0.5)$p.value
}
prop2= ((sum(pvals <= .05))/10000) ; prop2
```

```
## [1] 0.0745
```

The proportion of tests that incorrectly rejected the null hypothesis is 0.0745, which is noticeably greater than our significance level of 0.05. This is because our sample size is way too small to perform a t-test, as our data would not appear normal with such a small sample size when coming from a uniform distribution

Exercise 4

```r
#4a)
pow.05 = power.t.test(n=35, delta=1.5, sd=3, sig.level=.05, type=c("one.sample"), alternative=c("two.si
pow.05 ; type2error.05 = 1-pow.05 ; type2error.05
```

```
## [1] 0.8195351
```

```
## [1] 0.1804649
```

```r
pow.1 = power.t.test(n=35, delta=1.5, sd=3, sig.level=.1, type=c("one.sample"), alternative=c("two.side
pow.1 ; type2error.1 = 1-pow.1 ; type2error.1
```

```
## [1] 0.8949909
```

```
## [1] 0.1050091
```

As our Type I error increases, so does our power, meaning that as Type I error increases, Type II error decreases

```r
#4b)
z.alpha=abs(qnorm(.05))
z.beta=abs(qnorm(.2))
zazbsq=(z.alpha+z.beta)^2
sigmasq=9
deltasq=1
n=ceiling(((zazbsq)*sigmasq)/deltasq) ; n
```

```
## [1] 56
```

A sample size of 56 is needed to detect such a difference under the given circumstances