Harris Christiansen
christih@purdue.edu
STAT350 - Lab 4
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A.

```
n <- 40
result = matrix(0,30,2)
for(i in 1:30) {
    rData <- rnorm(n,10,2)
    t=t.test(rData, conf.level=0.95)
    result[i,] = t$conf[1:2]
}
```

1. Confidence Intervals (30 Results):

```
          [,1]      [,2]
 [1,]  9.152501 10.161657 - Contains Mean of 10
 [2,]  9.621898 10.900753 - Contains Mean of 10
 [3,]  9.354138 10.724223 - Contains Mean of 10
 [4,]  9.610565 11.084562 - Contains Mean of 10
 [5,]  9.762867 10.826493 - Contains Mean of 10
 [6,]  9.235979 10.601657 - Contains Mean of 10
 [7,]  9.340315 10.613428 - Contains Mean of 10
 [8,]  9.254185 10.486985 - Contains Mean of 10
 [9,]  9.311590 10.420717 - Contains Mean of 10
[10,]  9.094288  9.979801 - Does Not Contain Mean
[11,]  8.646393  9.997796 - Does Not Contain Mean
[12,] 10.012846 11.049281 - Does Not Contain Mean
[13,]  9.900995 11.001290 - Contains Mean of 10
[14,]  9.125279 10.435313 - Contains Mean of 10
[15,]  9.560541 11.025086 - Contains Mean of 10
[16,]  9.592384 11.029603 - Contains Mean of 10
[17,]  9.072929 10.366390 - Contains Mean of 10
[18,] 10.013928 11.493132 - Does Not Contain Mean
[19,]  9.056209 10.526811 - Contains Mean of 10
[20,]  9.628074 10.764784 - Contains Mean of 10
[21,]  8.906559 10.616914 - Contains Mean of 10
[22,]  9.325757 10.709958 - Contains Mean of 10
[23,]  9.370351 10.653410 - Contains Mean of 10
[24,]  9.936054 10.999220 - Contains Mean of 10
[25,]  9.205700 10.176211 - Contains Mean of 10
[26,]  9.495618 10.584090 - Contains Mean of 10
[27,]  9.237517 10.913429 - Contains Mean of 10
[28,]  8.897664 10.185586 - Contains Mean of 10
[29,]  9.405779 10.758203 - Contains Mean of 10
[30,]  9.096244 10.279407 - Contains Mean of 10
```

2. See Above. 26/30 trials contain mean of 10, so 4/30 do not contain mean of 10. 13% of trials do not contain the mean of the distribution of the sample data.
   Since the confidence level is 95%, we would except 1.5 trials (0.05*30) to not contain the mean.
   While 4 trials is significantly higher, it is still about what we would expect.

3. See Group Document

B.

```
n <- ___
alpha <- _____
muTest = _____

mu <- 6
sd <- 0.25
sdError <- sd/sqrt(n)
z <- qnorm(1 - alpha/2)
x1 <- mu - z*sdError
x2 <- mu + z*sdError
px1 <- pnorm(x1, muTest, sdError)
px2 <- pnorm(x2, muTest, sdError, lower.tail = FALSE)
power <- px1 + px2
power
```

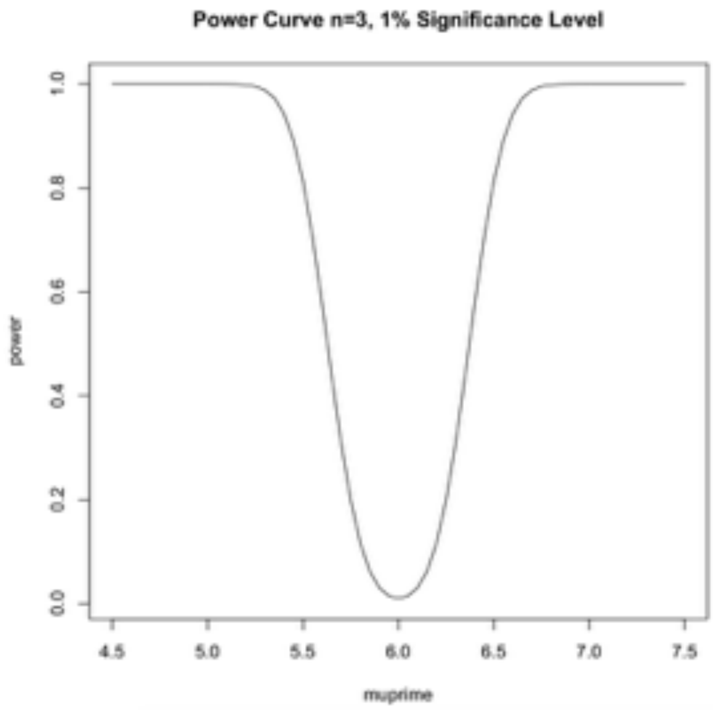
1. Calculating Powers
   1. n <- 3, alpha <- 0.01, muTest <- 6.5
      Power = 0.8128029
   2. n <- 3, alpha <- 0.05, muTest <- 6.5
      Power = 0.9337271
   3. n <- 3, alpha <- 0.01, muTest <- 6.75
      Power = 0.9956077
   4. n <- 3, alpha <- 0.01, muTest <- 6.5
      Power = 0.9710402
   5. Conclusion: The larger the significance level results in a larger power. The larger the alternative mean results in a larger power. The larger the sample size results in a larger power.

2.

```
n <- 3
alpha <- 0.01
muTest = seq(from=4.5,to=7.5,by=0.05)

mu <- 6
sd <- 0.25
sdError <- sd/sqrt(n)
z <- qnorm(1 - alpha/2)
x1 <- mu - z*sdError
x2 <- mu + z*sdError
```

```
px1 <- pnorm(x1, muTest, sdError)
px2 <- pnorm(x2, muTest, sdError, lower.tail = FALSE)
power <- px1 + px2
plot(muTest,power,main="Power Curve n=3, 1% Significance Level",type="1")
```



3. Sample Size should be at least 11

```
n <- 1:20
alpha <- 0.01
muTest = 6.3

mu <- 6
sd <- 0.25
sdError <- sd/sqrt(n)
z <- qnorm(1 - alpha/2)
x1 <- mu - z*sdError
x2 <- mu + z*sdError
px1 <- pnorm(x1, muTest, sdError)
px2 <- pnorm(x2, muTest, sdError, lower.tail = FALSE)
power <- px1 + px2
answer <- data.frame(n, power)
answer

   n      power
1   1 0.08451698
```

2	2	0.18977182
3	3	0.30946629
4	4	0.43021435
5	5	0.54278498
6	6	0.64190611
7	7	0.72543766
8	8	0.79340227
9	9	0.84712267
10	10	0.88855966
11	11	0.91985851 <-----------
12	12	0.94307157
13	13	0.96001259
14	14	0.97220011
15	15	0.98085565
16	16	0.98693152
17	17	0.99115150
18	18	0.99405411
19	19	0.99603281
20	20	0.99737057