STAT 40001/STAT 50001 Statistical Computing Fall 2024

Lab-11

1) The estimation of the average shrinkage percentage of plastic clay should have an error bound of 0.2 with 98% confidence. A pilot sample of 50 gave standard deviation of 1.2. Determine the sample size that should be used.

```
> install.packages("BSDA")
> library(BSDA)
> nsize(b = 0.2, sigma = 1.2, conf.level = 0.98, type = "mu")

The required sample size (n) to estimate the population
mean with a 0.98 confidence interval so that the margin
of error is no more than 0.2 is 195 .
```

2) A food processing company, considering the marketing of a new product, is interested in the proportion p of consumers that would try the new product. In a pilot sample of 40 randomly chosen consumers, 9 said that they would purchase the new product and give it a try. What sample size is needed for the 90% CI for p to have length 0.1.

```
> install.packages("BSDA")
> library(BSDA)
> nsize(b=0.1, p = 9/40, conf.level=0.9, type="pi")

The required sample size (n) to estimate the population
proportion of successes with a 0.9 confidence interval
so that the margin of error is no more than 0.1 is 48 .
```

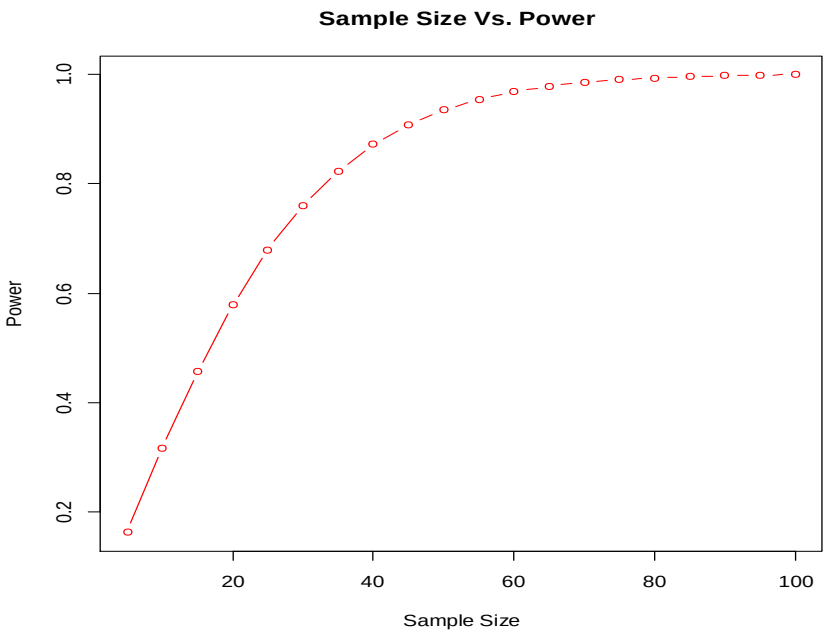
3) Suppose that you are determining the power of the test for a given sample size for a two-sided independent samples t-test with significant level of 0.05 and effect size d=0.7. Generate a table showing the power of the test for following sample size:

n=5,10,15,20,25,30,35,40,45,50,55,60,65,70,75,80,85,90,100

```
> library(pwr)
> power=cbind(NULL,NULL)
> for(i in seq(5,100,5)){
+ p1=power.t.test(d=0.7,n=i,sig.level=0.05,alt="two.sided",type="two.sample")
+ power=rbind(power,cbind(p1$n,p1$power))}
> power
      [,1]      [,2]
 [1,]    5 0.1631800

 [2,]   10 0.3163866

 [3,]   15 0.4566869

 [4,]   20 0.5782714

 [5,]   25 0.6790886
```

```
 [6,]   30 0.7599031
 [7,]   35 0.8229728
 [8,]   40 0.8711328
 [9,]   45 0.9072448
[10,]   50 0.9339067
[11,]   55 0.9533297
[12,]   60 0.9673141
[13,]   65 0.9772788
[14,]   70 0.9843134
[15,]   75 0.9892382
[16,]   80 0.9926597
[17,]   85 0.9950205
[18,]   90 0.9966389
[19,]   95 0.9977420
[20,]  100 0.9984898
```

```
> plot(power,xlab="Sample Size", ylab="Power", main="Sample Size Vs. Power ",type="b",col=2)
```



4) Suppose that you are determining the required sample size for a two-sided independent samples t-test with 80% power and significant level of 0.05.

Generate a table showing the required sample size for each of the following effect sizes:

d = 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 1.1, 1.2, 1.3, 1.4, 1.5

Create a table showing the effect size versus sample size. Plot the graph for effect size versus sample size.

```
> install.packages("pwr")
> library(pwr)
> power=cbind(NULL,NULL)
> for(i in seq(0.1,1.5,0.1)){
+         p1=power.t.test(d=i,power = 0.8,sig.level=0.05,alt="two.sided",type="two.sample")
+         power=rbind(power,cbind(p1$d,p1$n))}
> power
      [,1]       [,2]
 [1,]  0.1 1570.73689
 [2,]  0.2  393.40666
 [3,]  0.3  175.38510
 [4,]  0.4   99.08057
 [5,]  0.5   63.76576
 [6,]  0.6   44.58590
 [7,]  0.7   33.02467
 [8,]  0.8   25.52463
 [9,]  0.9   20.38638
[10,]  1.0   16.71477
[11,]  1.1   14.00193
[12,]  1.2   11.94228
[13,]  1.3   10.34305
[14,]  1.4    9.07768
[15,]  1.5    8.06031
> plot(power,xlab="Effect Size", ylab="Sample Size ", main="Effect Size vs Sample Size",type="b",
col=2, lwd = 2, pch = 17)
```