STAT 511 HW#4
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1) μ_0 = 15 mg/day

Conjectured true population mean, μ_A = 17 mg/day

Hypothesis:

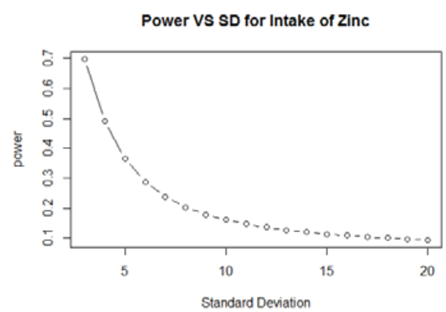
$H_0 : \mu <= \mu_0 : \mu <= 15$

$H_A : \mu > \mu_0 : \mu > 15$

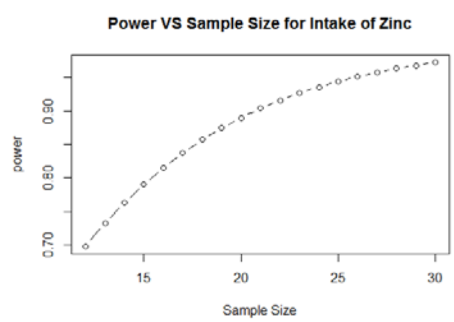
n = 12, α = 0.05, conjectured s.d σ = 3 mg/day

A) power = 0.6981908 [See appendix for R code and Calculation]

B) If the sample deviation was larger, the power would be lower than that of the power that was calculated in part A. Following graph shows the Power ~ SD relation for the data.



C) If the sample size was larger, power would increase. The following graph s hows the Power ~ Sample size relation for Zinc data.



D) If α = 0.10, power = 0.8260609 [See Appendix for calculation], which is higher than the power calc ulated in part A.

E) For μ_A = 16 mg/day, power = 0.2874441 [See Appendix for calculation], which is lower than the power calculated in part A.

F) For Power = 0.9, sample size = 21 (rounded up) [See Appendix for calculation].

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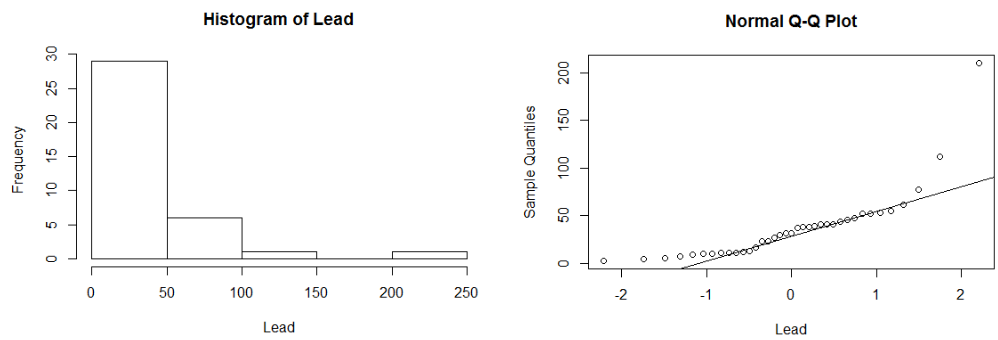
2) A)



Shapiro-Wilk normality test p-value = 1.928e-07 < 0.05. [See apendix]
So, the null hypothesis (lead sample data is normally distributed) can be rejected.

The result of the shapiro-wilk test matches the histogram and normal Q-Q plot. From the Histrogram we can see that the lead sample data is skewed right, and from the normal Q-Q plot we see that the plot is not a straight line.

B) Mean = 37.24324

Median = 32

C) H_0 : M = 30

H_A : M ≠ 30

From the sign test, we obtain,
s (#of values > 30) = 22

p-value = 0.6177

As P value > α = 0.05, we can not reject H_0 .

We do not have enough evidence to reject the population median = 30 with 95% confidence.

D)

95% confidence interval (using Upper Archieved CI) is (17.0000,41)

E)

$H_0 : \mu = \mu_0 : \mu = 30$

$H_A : \mu \neq \mu_0 : \mu \neq 30$

p-value = 0.2431 > α = 0.05. So we can not reject H_0.

We do not have enough evidence to reject that the population mean = 30 with 95% confidence.

F)

95 percent confidence interval: (24.86550,49.62099)

G) Studentized confidence interval mean= (27.46,57.19)

H) Assuming the cumulative lead exposure is of interest, the mean would be of more interest.

APPENDIX

```
#QUESTION 1
> #1A
> power.t.test(n=12,delta=2,sd=3,sig.level = 0.05,type = "one.sample", altern
ative = "one.sided")

     One-sample t test power calculation 

              n = 12
          delta = 2
             sd = 3
      sig.level = 0.05
          power = 0.6981908
    alternative = one.sided

> 
> #1B
> testSD<-seq(3,20,1)
> powerVal1B_DiffSD <- power.t.test(n=12,delta=2,sd=testSD,sig.level = 0.05,t
ype = "one.sample", alternative = "one.sided")
> plot(powerVal1B_DiffSD$power ~ testSD, type = "b", xlab = "Standard Deviati
on", ylab = "power", main = "Power VS SD for Intake of Zinc")
> 
> #1C
> testSampleSize <- seq(12,30,1)
> powerVal1C_Diffn <- power.t.test(n=testSampleSize,delta=2,sd=3,sig.level = 
0.05,type = "one.sample", alternative = "one.sided")
> plot(powerVal1C_Diffn$power ~ testSampleSize, type = "b", xlab = "Sample Si
ze", ylab = "power", main = "Power VS Sample Size for Intake of Zinc")
> 
> #1D
> power.t.test(n=12,delta=2,sd=3,sig.level = 0.10,type = "one.sample", altern
ative = "one.sided")

     One-sample t test power calculation 

              n = 12
          delta = 2
             sd = 3
      sig.level = 0.1
          power = 0.8260609
    alternative = one.sided

> 
> #1E
> power.t.test(n=12,delta=1,sd=3,sig.level = 0.05,type = "one.sample", altern
ative = "one.sided")

     One-sample t test power calculation 

              n = 12
          delta = 1
```

```
             sd = 3
      sig.level = 0.05
          power = 0.2874441
    alternative = one.sided

>
> #1F
> power.t.test(delta=2,sd=3,p=0.9,sig.level = 0.05,type = "one.sample", alter
native = "one.sided")

     One-sample t test power calculation

              n = 20.69914
          delta = 2
             sd = 3
      sig.level = 0.05
          power = 0.9
    alternative = one.sided
```

#QUESTION2

```
> hist(DataHW4_2$X.Lead.,xlab = "Lead", main = "Histogram of Lead")
> qqnorm(DataHW4_2$X.Lead.,xlab = "Lead")
> qqline(DataHW4_2$X.Lead., )
> shapiro.test(DataHW4_2$X.Lead.)

        Shapiro-Wilk normality test

data:  DataHW4_2$X.Lead.
W = 0.69693, p-value = 1.928e-07


> #B
> mean(DataHW4_2$X.Lead.)
[1] 37.24324
> median(DataHW4_2$X.Lead.)
[1] 32
>
> #C
> hist(DataHW4_2$X.Lead.,xlab = "Lead", main = "Histogram of Lead")
> summary(DataHW4_2$X.Lead.)
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
   3.00   11.00   32.00   37.24   46.00  210.00
> sort(DataHW4_2$X.Lead.)
 [1]   3   5   6   7   9  10  10  11  11  11  12  13  17  23  23  27  30  32  32
[20]  37  38  38  39  41  41  41  44  46  48  52  52  53  55  62  77 112 210
> library(BSDA)
> SIGN.test(DataHW4_2$X.Lead., md=30)

        One-sample Sign-Test

data:  DataHW4_2$X.Lead.
s = 20, p-value = 0.6177
alternative hypothesis: true median is not equal to 30
95 percent confidence interval:
 17.34363 41.00000
sample estimates:
median of x
```

```
         32

                  Conf.Level  L.E.pt U.E.pt
Lower Achieved CI     0.9011 23.0000     41
Interpolated CI       0.9500 17.3436     41
Upper Achieved CI     0.9530 17.0000     41
```

```
> t.test(DataHW4_2$X.Lead. , mu=30)

        One Sample t-test

data:  DataHW4_2$X.Lead.
t = 1.1868, df = 36, p-value = 0.2431
alternative hypothesis: true mean is not equal to 30
95 percent confidence interval:
 24.86550 49.62099
sample estimates:
mean of x
 37.24324
```

2G

```
> mean.fun <- function(d,i)
+ {
+   m <- mean(d[i])
+   n <- length(i)
+   v <- (n-1)*var(d[i])/n^2
+   c(m,v)
+ }
> set.seed(7255)
> resultsHW4_2F <- boot(data=DataHW4_2$X.Lead.,mean.fun, R=1000)
> boot.ci(resultsHW4_2F,type="all")
BOOTSTRAP CONFIDENCE INTERVAL CALCULATIONS
Based on 1000 bootstrap replicates

CALL :
boot.ci(boot.out = resultsHW4_2F, type = "all")

Intervals :
Level      Normal              Basic             Studentized
95%   (25.31, 48.78 )   (23.66, 47.92 )   (27.46, 57.19 )

Level     Percentile            BCa
95%   (26.57, 50.83 )   (28.02, 53.82 )
Calculations and Intervals on Original Scale
Some BCa intervals may be unstable
```