Test 2 R Work

Alex Burgos

1

a.

```r
# Given data
n = 32
alpha = 0.01
stdDev = 60
mu = 500
sampleMean = 520

z = (sampleMean - mu)/(stdDev / sqrt(n))
cat("Test statistic: ", z ,"\n")
```

```
Test statistic:  1.885618
```

```r
criticalValue = qnorm(1 - (alpha/2))
cat("Critical Value: ", criticalValue, "\n")
```

```
Critical Value:  2.575829
```

```r
reject = abs(z) > criticalValue
reject
```

```
[1] FALSE
```

b.

```r
#B
mu = 500
muAlt = 525
stdDev = 60
alpha = 0.01
criticalValue = qnorm(1 - (alpha/2))

lowerRange = mu - criticalValue * (stdDev / sqrt(n))
upperRange = mu + criticalValue * (stdDev / sqrt(n))
cat("(", lowerRange,",",upperRange, ")")
```

```
( 472.6792 , 527.3208 )
```

```r
B = pnorm(upperRange, mean = muAlt, sd = stdDev / sqrt(n)) -
  pnorm(lowerRange, mean = muAlt, sd = stdDev / sqrt(n))
cat("Probability of Type II Error:", B, "\n")
```

```
Probability of Type II Error: 0.5865993
```

c.

```r
n = 32
alpha = 0.01
stdDev = 60
mu = 500
muAlt = 525
sampleMean = 520
criticalValue = qnorm(1 - (alpha/2))

lowerRange = mu - criticalValue * (stdDev / sqrt(n))
upperRange = mu + criticalValue * (stdDev / sqrt(n))

# List of values
values = c(450, 460, 470, 480, 490, 510, 520, 530, 540, 550)

powers = sapply(values, function(mu) {
  lowerB = pnorm(lowerRange, mean = mu, sd = stdDev / sqrt(n))
  upperB = pnorm(upperRange, mean = mu, sd = stdDev / sqrt(n))
  beta = upperB - lowerB
  power = 1 - beta
```

```r
  return(power)
})

data.frame(mu = values, Power = powers)
```

```
    mu      Power
1  450 0.98375039
2  460 0.88403595
3  470 0.59971053
4  480 0.24503475
5  490 0.05144925
6  510 0.05144925
7  520 0.24503475
8  530 0.59971053
9  540 0.88403595
10 550 0.98375039
```

d.

```r
n = 64
mu = 500
muAlt = 525
sampleMean = 525
stdDev = 60
alpha = 0.01
criticalValue = qnorm(1 - (alpha/2))

lowerRange = mu - criticalValue * (stdDev / sqrt(n))
upperRange = mu + criticalValue * (stdDev / sqrt(n))

B = pnorm(upperRange, mean = muAlt, sd = stdDev / sqrt(n)) -
  pnorm(lowerRange, mean = muAlt, sd = stdDev / sqrt(n))
cat("Probability of Type II Error:", B, "\n")
```

```
Probability of Type II Error: 0.224374
```

e.

```r
alpha = 0.01
stdDev = 60
mu = 500
newMu = 520
muAlt = 525
sampleMean = 520
criticalValue = qnorm(1 - (alpha/2))
newB = 0.04
B = qnorm(1 - newB)

findN = ((criticalValue + B) * stdDev / (newMu - mu))^2
findN = ceiling(findN)
cat("Required Sample Size to achieve Beta <= 0.04:", findN, "\n")
```

```
Required Sample Size to achieve Beta <= 0.04: 169
```

2

a.

```r
n = 40
sampleMean = 47
mu = 41
StdDev = 35
alpha = 0.05

criticalValue = qnorm(1 - (alpha/2))
criticalValue
```

```
[1] 1.959964
```

```r
errorMargin = criticalValue * (StdDev/sqrt(n))
errorMargin
```

```
[1] 10.84641
```

```
lowerErrorMargin = sampleMean - errorMargin
upperErrorMargin = sampleMean + errorMargin



cat("95% Confidence Interval: (", lowerErrorMargin, ",", upperErrorMargin, ")\n")
```

```
95% Confidence Interval: ( 36.15359 , 57.84641 )
```

b.

```
n = 40
sampleMean = 47
mu = 41
StdDev = 35
alpha = 0.05

z = (sampleMean - mu) / (StdDev/sqrt(n))
z
```

```
[1] 1.084209
```

```
criticalValue = qnorm(1 - (alpha))
criticalValue
```

```
[1] 1.644854
```

```
p = 1 - pnorm(z)
p
```

```
[1] 0.139136
```

```
reject = z > criticalValue
reject
```

```
[1] FALSE
```

3

```r
coli = read.csv("/Users/alexb/Downloads/377-coli.txt")
attach(coli)

t = t.test(coli$housing,
           coli$groceries,
           alternative = "greater",
           paired = T,
           conf.level = 0.95)
t
```

```
    Paired t-test

data:  coli$housing and coli$groceries
t = 1.8824, df = 35, p-value = 0.03406
alternative hypothesis: true mean difference is greater than 0
95 percent confidence interval:
 0.4381479       Inf
sample estimates:
mean difference
       4.277778
```

```r
differences = coli$housing - coli$groceries
differences
```

```
 [1]  24   5 -17  -2  22  -2  13  11  -3   8  -9  -8   3   7 -11 -10  17  28  29
[20]   1  -3  15   9  24  13 -10  -6  15  -2 -26  13  -1  19  12  -9 -15
```

```r
n = 36

sdDiff = sd(differences)
sdDiff
```

```
[1] 13.63527
```

```r
criticalValue = qt(0.95, 35)
criticalValue
```

```
[1] 1.689572
```

```
errorMargin = criticalValue * (sdDiff/sqrt(n))
errorMargin
```

```
[1] 3.83963
```

```
lower =  4.277778 - errorMargin
upper =  4.277778 + errorMargin

lower
```

```
[1] 0.4381481
```

```
upper
```

```
[1] 8.117408
```

4

```
# Given data
field_A = c(8.1, 8.5, 8.4, 7.3, 8.0, 7.1, 13.9, 12.2, 13.4, 11.3, 12.6, 12.6, 12.7, 12.4, 11
field_B = c(10.2, 10.7, 15.5, 10.4, 9.9, 10.0, 16.6, 15.1, 15.2, 13.8, 14.1, 11.4, 11.5, 11.

t_test = t.test(field_A, field_B, alternative = "less", conf.level = 0.95)
t_test
```

```
    Welch Two Sample t-test

data:  field_A and field_B
t = -2.0059, df = 27.495, p-value = 0.0274
alternative hypothesis: true difference in means is less than 0
95 percent confidence interval:
       -Inf -0.2664399
sample estimates:
mean of x mean of y
 10.76875  12.52857
```

```r
nA = length(field_A)
nB = length(field_B)

meanA = mean(field_A)
meanB = mean(field_B)

sdA = sd(field_A)
sdB = sd(field_B)


pooledSD = sqrt(((nA - 1) * sdA^2 + (nB - 1) * sdB^2) / (nA + nB - 2))

t = (meanA - meanB) / (pooledSD * sqrt(1/nA + 1/nB))
t
```

```
[1] -2.005493
```

```r
df = nA + nB - 2
df
```

```
[1] 28
```

```r
alpha = 0.05
criticalValue = qt(1 - alpha, df)
criticalValue
```

```
[1] 1.701131
```

```r
p = pt(t, df)
p
```

```
[1] 0.0273309
```

```r
reject = t < criticalValue
reject
```

```
[1] TRUE
```

5

```r
dynamic <- c(370, 360, 510, 445, 295, 315, 490, 345, 450, 505, 335, 280, 325, 500)
static <- c(430, 445, 455, 455, 490, 535)
alpha = 0.01
df = 17.832

t_test <- t.test(dynamic,
                 static,
                 alternative = "less",
                 conf.level = 0.99)
t_test
```

```
	Welch Two Sample t-test

data:  dynamic and static
t = -2.6804, df = 17.832, p-value = 0.007679
alternative hypothesis: true difference in means is less than 0
99 percent confidence interval:
      -Inf -3.456423
sample estimates:
mean of x mean of y 
 394.6429  468.3333 
```

```r
n_dynamic <- length(dynamic)
n_static <- length(static)
n_dynamic
```

```
[1] 14
```

```r
n_static
```

```
[1] 6
```

```r
mean_dynamic <- mean(dynamic)
mean_static <- mean(static)
mean_dynamic
```

```
[1] 394.6429
```

```
mean_static
```

```
[1] 468.3333
```

```
sd_dynamic <- sd(dynamic)
sd_static <- sd(static)
sd_dynamic
```

```
[1] 84.74996
```

```
sd_static
```

```
[1] 38.1663
```

```
criticalValue = qt(alpha, df)
criticalValue
```

```
[1] -2.554701
```

```
poolSd = sqrt(((n_dynamic - 1) * sd_dynamic^2 + (n_static - 1) * sd_static^2) / (n_dynamic +
poolSd
```

```
[1] 74.77988
```

```
errorMargin = criticalValue * poolSd * sqrt(1/n_dynamic + 1/n_static)

ci = (mean_dynamic - mean_static) + c(-errorMargin, errorMargin)
ci
```

```
[1]   19.5276 -166.9086
```