Homework 08

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STAT 641-720

1) Type I Error: $P(z > \frac{\sqrt{10}500}{1000}) = P(z > \frac{\sqrt{10}}{2}) = .056$

Type II Error: $P(z \leq \frac{-200\sqrt{(10)}}{1000}) = P(z \leq \frac{-\sqrt{10}}{5}) = .263$

2) a) Decision Rule $Z = \frac{\sqrt{n}(\bar{Y}-\mu_0)}{\sigma} > Z_{1-\alpha} = \frac{\sqrt{10}(\bar{Y}-10500)}{1000} > 2.326$
We reject the null hypothesis when $\bar{Y} > 11235.65$>

b)

```
alpha = qnorm(.99)
mu = 10500 + alpha * 1000/sqrt(10)
x = c(10600, 10800, 11000, 11500)
pnorm((sqrt(10) * (x - mu))/1000)
```

```
[1] 0.02220924 0.08415344 0.22807268 0.79840280
```

3) a) p-value: 0.0059106, we conclude that there is sufficient evidence to reject the null hypothesis because the pvalue is less than .01

$$H_o : \mu \geq 10, H_1 : \mu < 10$$
$$\text{reject } H_o : \text{when } \bar{y} < 10 - Z_{.01}\frac{2}{\sqrt{15}} = 8.79$$
$$\bar{Y} = 8.7$$

b)$H_o : \mu > 8.5, H_1 : \mu \leq 8.5$

```
alpha = -qt(.99, 14)
delta = (sqrt(15)*(.2))/2
pt(alpha, 14, delta)
```

```
[1] 0.003692709
```

c)

4)

```
dt = c(125,123,117,123,115,112,128,118,124,
       111,116,109,125,120,113,123,112,118,
       121,118,122,115,105,118,131)

# a)
(t = 5 * (10 - sd(dt)) / 10); pnorm(t)
```

```
[1] 1.9039
```

```
[1] 0.9715384
```

```
# b)
sigma = c(5, 6, 7, 8, 9, 10)
pnorm(qnorm(.9) + (5 * (sigma - sd(dt)) / sigma))
```

```
[1] 0.5355990 0.8689381 0.9684547 0.9920549 0.9977545 0.9992774
```

```
# c) This is consistent with the results from a), we will reject the null
(T = qt(.9, 24))
```

```
[1] 1.317836
```

5)

```
# a) There sufficient evidence to support the alternative hypothesis that the median is less t
alpha = .05
n = 21
Splus = qbinom(alpha, n, .5)
pbinom(Splus, n, .5)
```

```
[1] 0.09462357
```

```
# b) There is not significant evidence that the true median is less than 120
wilcox.test(x = dt, y = rep(120, 25), paired = TRUE,
            alternative = "less", conf.level = .95)
```

```
Warning in wilcox.test.default(x = dt, y = rep(120, 25), paired = TRUE, :
cannot compute exact p-value with ties
```

```
Warning in wilcox.test.default(x = dt, y = rep(120, 25), paired = TRUE, :
cannot compute exact p-value with zeroes
```

```
    Wilcoxon signed rank test with continuity correction

data:  dt and rep(120, 25)
V = 112.5, p-value = 0.1447
alternative hypothesis: true location shift is less than 0
```

```
# c) lower bound with alpha = .05
qbinom(.05, 21, .5)
```

```
[1] 7
```

6)

```
# a)
binom.test(46, 50, p = .8, alternative = "greater", conf.level = .95)
```

```
    Exact binomial test

data:  46 and 50
number of successes = 46, number of trials = 50, p-value = 0.0185
alternative hypothesis: true probability of success is greater than 0.8
95 percent confidence interval:
 0.8262088 1.0000000
sample estimates:
probability of success
                  0.92
```

```
# b) There is substantial evidence that the improved method has increased the accuracy over th

# c) The accuracy is 90%
Y = qbinom(.95, 50, .8)
1 - pbinom(Y-1, 50, .92)
```

```
[1] 0.8981282
```

```
# d) n = 49 would result in a power of 80%
```

MC1) C

MC2) C

```
n = c(140, 100, 98, 35)
pnorm(sqrt(n)*(1.5)/9)
```

```
[1] 0.9756967 0.9522096 0.9505199 0.8379367
```

MC3) A

```
# sigma can be any number
sigma = 3; delta = 17 + .5*sigma
((sigma * (qnorm(.05) + qnorm(.1)))/(17 - delta))^2
```

```
[1] 34.25539
```

MC4) C

MC5) A

```
1 - pt(qt(.95, 9), 9, 0)
```

```
[1] 0.05
```

MC6) C

MC7) C

MC8) B

MC9) B

MC10) C