STAT 3480 Homework 1

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Problem 1.

```
data.1 <- c(79, 74, 88, 80, 80, 66, 65, 86, 84, 80, 78, 72, 71, 74, 86, 96, 77, 81, 76, 80,
            76, 75, 78, 87, 87, 74, 85, 84, 76, 77, 76, 74, 85, 74, 76, 77, 76, 74, 81, 76)

b <- length(subset(data.1, data.1 > 70))
# [1] 38

z_b <- (38-20)/sqrt(.25*40)
# [1] 5.6921

p_val = pnorm(-z_b)
# [1] 6.274324e-09
```

With a p-value of 6.274324e-09 we can reject the null hypothesis at a significance level # of 95%. We can conclude that the median exam score has increased from the previous semester's # median of 70.

Problem 3.

Part a.

$\frac{a-.5n}{\sqrt{.25n}} = -z_{1-\alpha/2}, \frac{b-1-.5n}{\sqrt{.25n}} = z_{1-\alpha/2}$

$\frac{a-.5*.34}{\sqrt{.25*.34}} = -1.96, \frac{b-1-.5*34}{\sqrt{.25*34}} = 1.96$

```
data.3 <- c(21.3, 28.8, 17.6, 23.0, 27.2, 28.5, 32.8, 28.2, 25.9, 22.5,
            27.2, 33.1, 28.7, 24.8, 24.3, 27.1, 30.6, 26.8, 18.9, 36.3,
            28.0, 17.9, 25.0, 27.5, 27.7, 32.1, 28.0, 30.9, 20.0, 20.2,
            33.5, 26.4, 30.9, 33.2)

a <- (sqrt(.25*34)*-1.96)+(.5*34)
b <- (sqrt(.25*34)*1.96)+(.5*34)+1

data.3.sorted <- sort(data.3)
lower <- data.3.sorted[11]
upper <- data.3.sorted[24]
```

a = 11.28567

b = 23.71433

Interval is (25, 28.7)

Part b.

```
a <- -qnorm(.2)*sqrt(.25*34)+17
b <- qnorm(.2)*sqrt(.25*34)+18

upper <- data.3.sorted[19]
lower <- data.3.sorted[16]
```

a = 19.45373, b = 15.54627

Interval for 20th percentile is (19.45373, 27.7)

```
a <- -qnorm(.8)*sqrt(.25*34)+17
b <- qnorm(.8)*sqrt(.25*34)+18
lower <- data.3.sorted[15]
upper <- data.3.sorted[20]
```

a = 14.54627, b = 20.45373

Interval for 80th percentile is (27.1, 28)

Part c.

Rainfall is being averaged throughout the entire year for each observation. A record year or two could create a distribution that is more heavy-tailed than a normal distribution.

Problem 6.

Part a.

$1 - \Phi(1.645) = 0.04998491$

Part b.

As mu increases p also increases. This increases the power, and the chance # of tests to detect that mu is greater than 75.

Part c.

Increasing the sample size would lower the denominator of the right side of the # binomial test equation. As p-.5/(sqrt(1-p)/n) decreases the amount subtracted # from 0 also decreases, so the power would increase with sample size.