ST 516 - Homework 4
student Paul ReFalo 10/19/17

1. The column motheriq contains the mother's IQ for 36 gifted children. We are interested in whether the mothers of gifted children have an IQ higher than the population at large, which is 100.

   . (a) State the null and alternative hypothesis in statistical notation, and in words.

$$H_0 : \mu = 100$$

$$H_A : \mu > 100$$

The null hypothesis is that the mothers of gifted children have average IQ's equal to that of the population average of 100.

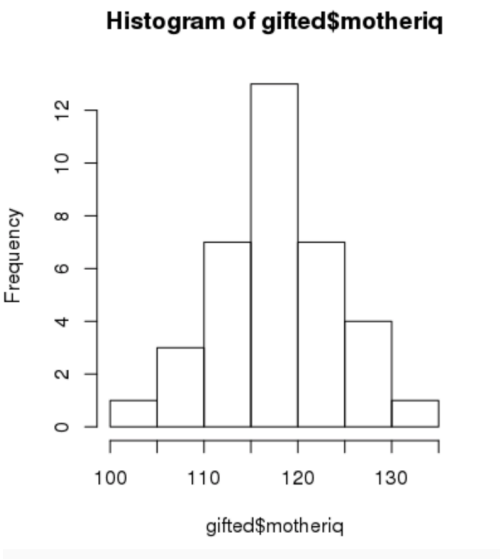
The alternative hypothesis is that the mothers of gifted children have average IQ's greater than the population average of 100.

Continued on next page

. (b) Give the formula for the test statistic you will use, and calculate it.

I will use the sample mean to estimate the population mean. The formula for the sample mean is:

$$\bar{x} = \frac{x_1 + x_2 + \ldots + x_n}{n} = \frac{1}{n}\sum_{i=1}^{n} x_i$$



We can use the sample mean since the motheriq data has no outliers and shows no indication of strong skew and has n = 36.

```
> hist(gifted$motheriq)

> mean(gifted$motheriq)

[1] 118.1667
```

The sample mean is an estimate for the population mean and is unbiased.

Continued on next page

(c) Give the p-value for the test, and the line of code you used to calculate it.

See part d for the calculate of the Z value

> pval <- 1 - pnorm(16.82) # Z value, one-sided or upper tail

```
> pval # practically I would report this as pval < 0.000001
[1] 0
```

. (d) Calculate a point estimate and a 95% confidence interval for the mean IQ of mothers of gifted children.

Our point estimate, $\bar{x} = 118.1667$

$$SE_{\bar{x}} = \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$$

point estimate ± 1.96×*SE*

> sd(gifted$motheriq)

```
[1] 6.504943
```

SE = 6.504943 / sqrt(36)

SE = 1.084157

point estimate ± 1.96 x 1.084157 at 95% Confidence Interval

118.1667 ± 2.12 → (116.05, 120.29) at 95% Confidence Interval

$Z = \bar{x} - \mu_0 / (s2 / n)^{1/2} = 118.17 - 100 / (6.5^2 / 36)^{1/2} = 18.17 / 1.08$

$Z = 16.82$ and since $|Z| > 1.96$ we reject H_0

(e) Give a summary of your findings.

We are 95% confident that the population mean of mothers of gifted children is between an IQ of 116.05 and 120.29. Because the average IQ of 100 is not inside of this range we reject the null hypothesis in favor of the alternative hypothesis. Since the 95% confidence interval is well above 100 we can conclude that the average, or mean, IQ of mothers of gifted children is greater than 100.