HW3 KEY

34 points total, 2 points per problem part unless otherwise noted.

Q1 Hypothesis Test "By Hand"

```
ybar = 5.3
s = 0.5
n = 10
SE = s/sqrt(n)
ME = qt(0.975, df = 9)*SE
LB = ybar - ME
UB = ybar + ME
```

1A. SE = 0.16
95%ME = 0.36

1B. 95% CI = (4.94, 5.66)

1C. Fail to reject H0, since 5 is included in the CI.

1D. **(4 pts)**

```
mu0 = 5
RR = qt(0.975, df = 9)
TS = (ybar - mu0)/(s/sqrt(n))
```

RR: Reject H0 if $|t| > 2.26$.
TS: $t = 1.9$.
Conclusion: Fail to reject H0. We cannot conclude the population mean is different from 5.

1E. **(4 pts)**

```
RR = qt(0.95, df = 9)
TS = (ybar - mu0)/(s/sqrt(n))
```

RR: Reject H0 if $t > 1.83$.
TS: $t = 1.9$.
Conclusion: Reject H0. We can conclude the population mean is greater than 5.

1F. **(4 pts)**

```
n = 51
RR = qt(0.975, df = 50)
TS = (ybar - mu0)/(s/sqrt(n))
```

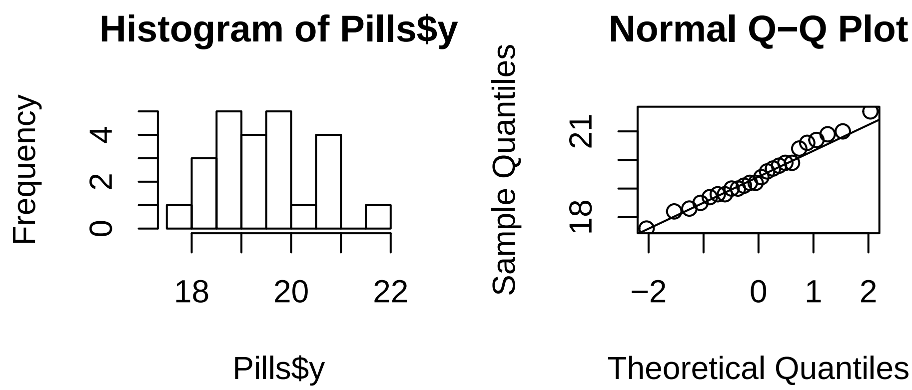
RR: Reject H0 if $|t| > 2.01$.
TS: $t = 4.28$.
Conclusion: Reject H0. We can conclude the population mean is different from 5.

1G. The test in part F (with $n = 51$) has higher power due to increased sample size. This can be seen by both (1) the larger magnitude test statistic and (2) smaller value defining the rejection region.

Q2 Pills

2A. **(4 pts)** Based on the SW test (large p-value supports normality), histogram (looks approximately normal) and qqplot (close to linear), the data appears to be normally distributed.

```
Pills <- read.csv("C:/hess/STAT511_FA11/HW_2019/HW3/Pills.csv")
par(mfrow = c(1,2))
hist(Pills$y)
qqnorm(Pills$y);qqline(Pills$y)
```




```
shapiro.test(Pills$y)
```

```
##
##  Shapiro-Wilk normality test
##
## data:  Pills$y
## W = 0.97988, p-value = 0.8936
```

```
TestOut <- t.test(Pills$y, mu = 20)
TestOut
```

```
##
##  One Sample t-test
##
## data:  Pills$y
## t = -2.44, df = 23, p-value = 0.02281
## alternative hypothesis: true mean is not equal to 20
## 95 percent confidence interval:
##  19.07609 19.92391
## sample estimates:
## mean of x
##      19.5
```

2B. mean = 19.5
95% CI = (19.08, 19.92)

2C. **(4 pts)**
H0: $\mu = 20$ vs HA: $\mu \neq 20$
TS: t = -2.44
p-value = 0.022811
Since p-value $<$ 0.05, we reject H0 and conclude that the mean amount is different from 20mg.

2D. **(4 pts)**

```
TestOut <- t.test(Pills$y, mu = 20, alternative = "less")
```

H0: $\mu \geq 20$ vs HA: $\mu < 20$
TS: t = -2.44
p-value = 0.0114055
Since p-value < 0.05, we reject H0 and conclude that the mean amount is less than 20mg.