Assignment 1

STAT3373

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Question 1

a)

```
data <- c(14.2, 16.1, 15.8, 17.2, 14.5, 15.3, 16.8, 15.9, 14.7, 16.4, 15.1, 17.5, 15.6, 16.2, 14.9, 15.
```

$$H_0 : \mu = 15, H_\alpha : \mu \neq 15$$

$$n = 20, \alpha = 0.05, \bar{x} = 15.8$$

```
(mean(data) - 15)/(sd(data)/sqrt(20)) # t-value
```

```
## [1] 3.910959
```

```
qt(1 - (0.05/2), 20-1) # critical t-value
```

```
## [1] 2.093024
```

Because t is greater than the critical t, $3.910959 > 2.093024$, we can reject the null hypothesis. The medicine does not take effect in 15 minutes

b)

```
(interval <- qt(1 - (0.05/2), 20-1) * (sd(data)/sqrt(20))) # Interval from mean
```

```
## [1] 0.4281352
```

```
mean(data) - interval
```

```
## [1] 15.37186
```

```
mean(data) + interval
```

```
## [1] 16.22814
```

The confidence interval with 95% confidence is [15.37186, 16.22814]

Question 2

a)

```r
before <- c(72, 68, 75, 81, 69, 73, 77, 70, 74, 79)
after <- c(78, 71, 80, 85, 76, 75, 82, 76, 79, 84)
diff <- after - before
```

$$H_0 : \mu \leq 0, H_\alpha : \mu > 0$$
$$n = 10, \alpha = 0.01, \bar{d} = 4.8$$

```r
mean(diff)/(sd(diff)/sqrt(10)) # t-value
```

```
## [1] 10.28571
```

```r
qt(1 - (0.01/2), 10 - 1) # critical t-value
```

```
## [1] 3.249836
```

Because t is greater than critical t, $10.28571 > 3.249836$, we can reject the null hypothesis. The method does improve test scores

b)

```r
(interval <- qt(1 - (0.01/2), 10-1) * (sd(diff)/sqrt(10))) # Interval from mean
```

```
## [1] 1.51659
```

```r
mean(diff) - interval
```

```
## [1] 3.28341
```

```r
mean(diff) + interval
```

```
## [1] 6.31659
```

The confidence interval with 99% confidence is [3.28341, 6.31659]