170s HW6

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Problem 1

```r
difference <- 8.15 - 6.50
c(difference - qnorm(0.995)*sqrt(1.2^2/40 + 0.98^2/49),
  difference + qnorm(0.995)*sqrt(1.2^2/40 + 0.98^2/49))
```

```
## [1] 1.042628 2.257372
```

From the above confidence interval, which only consists of positive values, we can conclude that the price of a large cup of coffee in the small town is likely to be more expensive than the price of coffee in the big city.

Problem 2

```r
### since the standard error is the standard deviation divided by sqrt(sample size)...

difference <- 7.6 - 8.2
c(difference - qnorm(0.975)*sqrt(1.68^2 + 1.5^2),
  difference + qnorm(0.975)*sqrt(1.68^2 + 1.5^2))
```

```
## [1] -5.014229  3.814229
```

Problem 3

```r
difference <- 5.11 - 4.21
c(difference - qnorm(0.975)*sqrt(0.95^2 + 0.8^2),
  difference + qnorm(0.975)*sqrt(0.95^2 + 0.8^2))
```

```
## [1] -1.534225  3.334225
```

From the values above, we can conclude that the price of coffee in the small town is likely to be more expensive as our 95% confidence interval has more values within the positive. Of course, we cannot state this with certainty as our interval dives into the negative as well (indicating a case where the price in the big city is greater).

Problem 4

```r
p <- 323/600
c(p - qnorm(0.975)*sqrt(p*(1-p)/600),
  p + qnorm(0.975)*sqrt(p*(1-p)/600))
```

```
## [1] 0.4984435 0.5782232
```

With 95% confidence, we estimate that the percent of accounts receivable that are more than 30 days overdue is in between 49.8% and 57.8%.

Problem 5

```r
### part a)

p <- 480/600
c(p - qnorm(0.95)*sqrt(p*(1-p)/600),
  p + qnorm(0.95)*sqrt(p*(1-p)/600))
```

```
## [1] 0.7731397 0.8268603
```

With 90% confidence, we estimate that the true percent of students who are against the new legislation is in between 77.3% and 82.7%.

```r
### part b)

p <- 0.68
c(p - qnorm(0.985)*sqrt(p*(1-p)/300),
  p + qnorm(0.985)*sqrt(p*(1-p)/300))
```

```
## [1] 0.6215551 0.7384449
```

With 97% confidence, we estimate that the true percent of students who own an iPod and a smartphone is in between 62.2% and 73.8%.

Problem 6

```r
### since our confidence interval is [0.12, 0.18],
### we have our sample proportion is (0.12+0.18)/2 = 0.15
p = 0.15

### so we have qnorm(x)*sqrt(0.15*0.85/144) = 0.03,
### where we are trying to find x to determine our level of confidence
Z <- 0.03/sqrt(0.15*0.85/144)
pnorm(Z)
```

```
## [1] 0.8433212
```

```r
### now we use this value and solve 1-((1-q)/2) = pnorm(Z)
q = 2*pnorm(Z) - 1
q
```

```
## [1] 0.6866423
```

So, the level of confidence used to construct the interval of the population proportion of dogs that compete in professional events is about 68.7%.

Problem 7

```r
p <- 98/250
c(p - qnorm(0.975)*sqrt(p*(1-p)/250),
  p + qnorm(0.975)*sqrt(p*(1-p)/250))
```

```
## [1] 0.3314836 0.4525164
```

Problem 8

```r
### defining a 99% confidence interval function for a sample

conf_99 <- function(sample) {
  lower = mean(sample) - qnorm(0.995)*sd(sample)/sqrt(length(sample))
  upper = mean(sample) + qnorm(0.995)*sd(sample)/sqrt(length(sample))
  c(lower, upper)
}

### part a)
sample1 <- c(23.5, 21.8, 20, 22.5, 28.3, 29.4, 29.3, 26.5, 25.6, 24.5, 23.8,
             27.7, 21.9, 20.5, 26.6, 28.2)
conf_99(sample1)
```

```
## [1] 22.9922 27.0203
```

```r
### part b)
sample2 <- c(33.2, 29.5, 30.1, 39.2, 40.6, 25.6, 31.8, 33.7, 38.3, 37.7, 36.6,
             30.2, 31.8, 32.9, 33.4, 34.4, 34.5, 36.4, 37.7, 39.6)
conf_99(sample2)
```

```
## [1] 32.10743 36.61257
```

```r
### part c)
sample3 <- c(220, 201, 229, 265,276, 288, 298, 256, 255, 234, 229, 245, 267, 289,
             299, 288, 278, 267, 259, 244, 239, 239, 266, 298)
conf_99(sample3)
```

```
## [1] 245.4009 273.6824
```

```r
### part d)
sample4 <- c(189, 119, 122, 127, 143, 132, 156, 198, 188, 187, 183, 176, 193, 145,
             144, 134, 129, 165, 156, 134, 187, 134, 198, 145, 132, 178)
conf_99(sample4)
```

```
## [1] 143.9729 170.9502
```

```r
### part e)
sample5 <- c(13,11,12,13,13,14,14,16,17,8,8,9,9,9,2,3,11,12,34,12,34,29,27,28,27,
             31,15,16,17,12,18,16,19)
conf_99(sample5)
```

```
## [1] 12.28466 19.77595
```