R wizardry Homework 3, 2017

Question 1a (1 point)

Four volunteers assited Willy Wonka and Chuck Norris with the methane measurements: "Tom", "Jerry", "Sylvester", and "Tweety" alternated sampling each sample number in the "compounds_triplicates_long.csv" dataset. Create a new data column that reflects this.

```
##    compound salinity      group day mean_methane sd_methane        Staff
## 1 unamended brackish media_only   1           NA         NA  Willy_Wonka
## 2 unamended    fresh media_only   1           NA         NA Chuck_Norris
## 3 unamended   saline media_only   1           NA         NA  Willy_Wonka
## 4   benzene brackish    sterile   1           NA         NA Chuck_Norris
## 5    hexane brackish    sterile   1           NA         NA  Willy_Wonka
## 6   toluene brackish    sterile   1           NA         NA Chuck_Norris
##   Volunteer
## 1       Tom
## 2     Jerry
## 3 Sylvester
## 4    Tweety
## 5       Tom
## 6     Jerry
```

Question 1b (2 points)

Upon reviewing your notes from this experiment, you discover that the volunteer "Tom" was confused about the procedure measuring all brackish and saline experimental groups on day 10, 86, and 116. Using 1 line of code, change the methane and standard deviation data for these measurements to NA. Then proceed to chastise Tom.

```
##      compound salinity      group day mean_methane sd_methane       Staff
## 25  unamended brackish media_only  10           NA         NA Willy_Wonka
## 29     hexane brackish    sterile  10           NA         NA Willy_Wonka
## 37    benzene brackish  treatment  10           NA         NA Willy_Wonka
## 45    toluene   saline  treatment  10           NA         NA Willy_Wonka
## 97  unamended brackish media_only  86           NA         NA Willy_Wonka
## 101    hexane brackish    sterile  86           NA         NA Willy_Wonka
## 109   benzene brackish  treatment  86           NA         NA Willy_Wonka
## 117   toluene   saline  treatment  86           NA         NA Willy_Wonka
## 145 unamended brackish media_only 116           NA         NA Willy_Wonka
## 149    hexane brackish    sterile 116           NA         NA Willy_Wonka
##     Volunteer
## 25        Tom
## 29        Tom
## 37        Tom
## 45        Tom
## 97        Tom
## 101       Tom
## 109       Tom
## 117       Tom
## 145       Tom
```

```
## 149       Tom
```

```
##    compound salinity      group day mean_methane sd_methane        Staff
## 1 unamended brackish media_only   1           NA         NA  Willy_Wonka
## 2 unamended    fresh media_only   1           NA         NA Chuck_Norris
## 3 unamended   saline media_only   1           NA         NA  Willy_Wonka
## 4   benzene brackish    sterile   1           NA         NA Chuck_Norris
## 5    hexane brackish    sterile   1           NA         NA  Willy_Wonka
## 6   toluene brackish    sterile   1           NA         NA Chuck_Norris
##   Volunteer
## 1       Tom
## 2     Jerry
## 3 Sylvester
## 4    Tweety
## 5       Tom
## 6     Jerry
```

```
##      compound salinity      group day mean_methane sd_methane       Staff
## 25  unamended brackish media_only  10           NA         NA Willy_Wonka
## 29     hexane brackish    sterile  10           NA         NA Willy_Wonka
## 37    benzene brackish  treatment  10           NA         NA Willy_Wonka
## 45    toluene   saline  treatment  10           NA         NA Willy_Wonka
## 97  unamended brackish media_only  86           NA         NA Willy_Wonka
## 101    hexane brackish    sterile  86           NA         NA Willy_Wonka
## 109   benzene brackish  treatment  86           NA         NA Willy_Wonka
## 117   toluene   saline  treatment  86           NA         NA Willy_Wonka
## 145 unamended brackish media_only 116           NA         NA Willy_Wonka
## 149    hexane brackish    sterile 116           NA         NA Willy_Wonka
## 157   benzene brackish  treatment 116           NA         NA Willy_Wonka
## 165   toluene   saline  treatment 116           NA         NA Willy_Wonka
##     Volunteer
## 25        Tom
## 29        Tom
## 37        Tom
## 45        Tom
## 97        Tom
## 101       Tom
## 109       Tom
## 117       Tom
## 145       Tom
## 149       Tom
## 157       Tom
## 165       Tom
```

Question 2 (2 points)

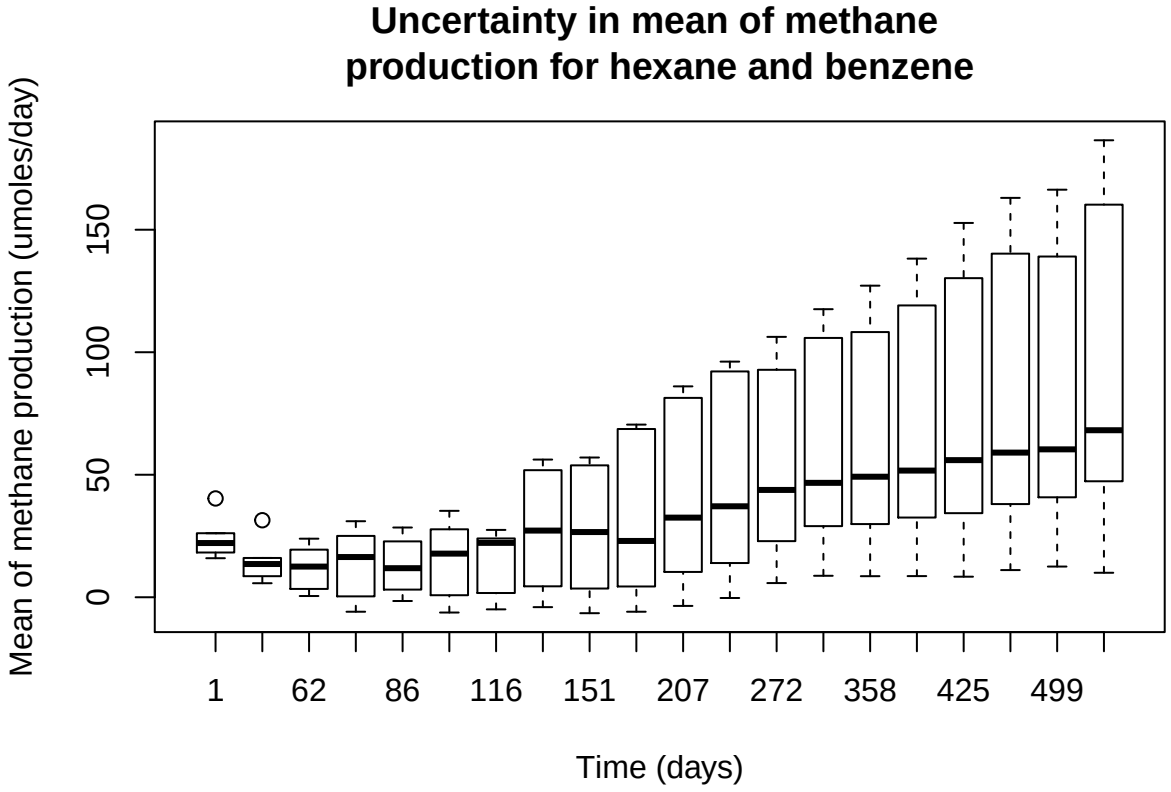
You have collected data for the methane production for each day for multiple compounds, treatment types, and saline treatments. Calculate and create two new columns in your dataset for the upper and lower 95% confidence intervals for each sample. The 95% confidence intervals are the methane production +/- 1.96 times the standard deviation for that sample.

```
##     compound salinity      group day mean_methane sd_methane        Staff
## 1  unamended brackish media_only   1           NA         NA  Willy_Wonka
## 2  unamended    fresh media_only   1           NA         NA Chuck_Norris
```

```
## 3  unamended   saline media_only   1           NA         NA  Willy_Wonka
## 4    benzene brackish    sterile   1           NA         NA Chuck_Norris
## 5     hexane brackish    sterile   1           NA         NA  Willy_Wonka
## 6    toluene brackish    sterile   1           NA         NA Chuck_Norris
## 7    benzene    fresh    sterile   1           NA         NA  Willy_Wonka
## 8     hexane    fresh    sterile   1           NA         NA Chuck_Norris
## 9    toluene    fresh    sterile   1           NA         NA  Willy_Wonka
## 10   benzene   saline    sterile   1           NA         NA Chuck_Norris
## 11    hexane   saline    sterile   1           NA         NA  Willy_Wonka
## 12   toluene   saline    sterile   1           NA         NA Chuck_Norris
## 13   benzene brackish  treatment   1     23.60000   8.006872  Willy_Wonka
## 14    hexane brackish  treatment   1     20.66667   1.450287 Chuck_Norris
## 15   toluene brackish  treatment   1     25.30000   2.193171  Willy_Wonka
##    Volunteer    Upper     Lower
## 1        Tom       NA        NA
## 2      Jerry       NA        NA
## 3  Sylvester       NA        NA
## 4     Tweety       NA        NA
## 5        Tom       NA        NA
## 6      Jerry       NA        NA
## 7  Sylvester       NA        NA
## 8     Tweety       NA        NA
## 9        Tom       NA        NA
## 10     Jerry       NA        NA
## 11 Sylvester       NA        NA
## 12    Tweety       NA        NA
## 13       Tom 39.29347  7.906531
## 14     Jerry 23.50923 17.824104
## 15 Sylvester 29.59862 21.001384
```

Question 3 (3 points)

Create a boxplot showing the uncertainty in mean methane production per day for the hexane and benzene compounds (i.e., combine the methane production for both compounds).



Question 4 (2 points)

Find the indices for where in the data methane production was greater than 3.5 but the standard deviation was less than or equal to 2 on day 1. Whoever ran the unamendend saline water part of this experiment did so perfectly and will merit coauthorship, but which one of your volunteers deserves this honor?

```
##     compound salinity     group day mean_methane sd_methane        Staff
## 24 unamended   saline unamended   1     13.13333   1.266228 Chuck_Norris
##    Volunteer    Upper    Lower
## 24    Tweety 15.61514 10.65153
```