

STA302H1 – Final Project Descriptive Statistics

Danny Chen

August 10, 2021

Import STA302H1 Study Time and COVID Contemplation Time vs. Quiz Performance Dataset

Data Cleaning

First, I'll clean my data.

```
cleaned_sta302_performance_data <- sta302_performance_data %>%  
  # Create a new "country" column, which is just "Country" but whose entries are factors.  
  mutate(country = as.factor(Country)) %>%  
  
  # Remove the "X" column: it's simply the row number, which isn't very useful.  
  # Remove the "Country" column: column "country" already exists  
  select(-X, -Country) %>%  
  
  # Rearrange similar columns side-by-side.  
  relocate(country,  
            COVID.hours..W1., COVID.hours..W2.,  
            COVID.hours..W3., COVID.hours..W4.,  
            STA302.hours..W1., STA302.hours..W2.,  
            STA302.hours..W3., STA302.hours..W4.,  
            Quiz_1_score, Quiz_2_score,  
            Quiz_3_score, Quiz_4_score)  
  
  # Identify rows with no quiz 4.  
  # These indicate students who have dropped STA302H1, and who  
  # should be excluded from the final data.
```

Identifying Anomalous Data

Rows with at least one NA deserve closer examination.

Some of the rows might only have 1 - 2 NAs and are therefore salvageable, which is OK.

Other rows may contain 3 or more NAs, and might indicate students who have dropped STA302H1. We'd like to exclude them from our analysis.

```
at_least_one_NA = function(data) {  
  return (rowSums(is.na(cleaned_sta302_performance_data)) >= 1)  
}  
  
rows_with_some_NAs = cleaned_sta302_performance_data[  
  at_least_one_NA(cleaned_sta302_performance_data),  
]
```

Rows with Mistyped Columns

Rows whose columns are mis-typed may need to be corrected via imputation.

```
rows_with_mistyped_columns = cleaned_sta302_performance_data[c(38, 83, 84, 117),]
# TODO: You're allowed to change entries manually though.

# row 83: Country -> "canada" -- DONE
# row 84: Country -> "canada" -- DONE

# row 117: COVID.hours..W4. -> 0.5 hours -- DONE

# row 38: STA302.hours..W3. -> 5.5<U+00A0> -- DONE
# row 117: STA302.hours..W4. -> 7.5 hours -- DONE

# library(janitor)
# use it to clean up data.
```

Find Significance Predictor Variables, Select Predictor Variables Based on Criterion

```
# use week 5b slides -- choose model selection criterion to pick predictor variables.
```

```
# use lm() on a bunch of predictor variables to determine significant  
# predictor variables.
```

Histograms

```
# TODO: See Demo 1 to figure out how to add histograms in a matrix format.
```

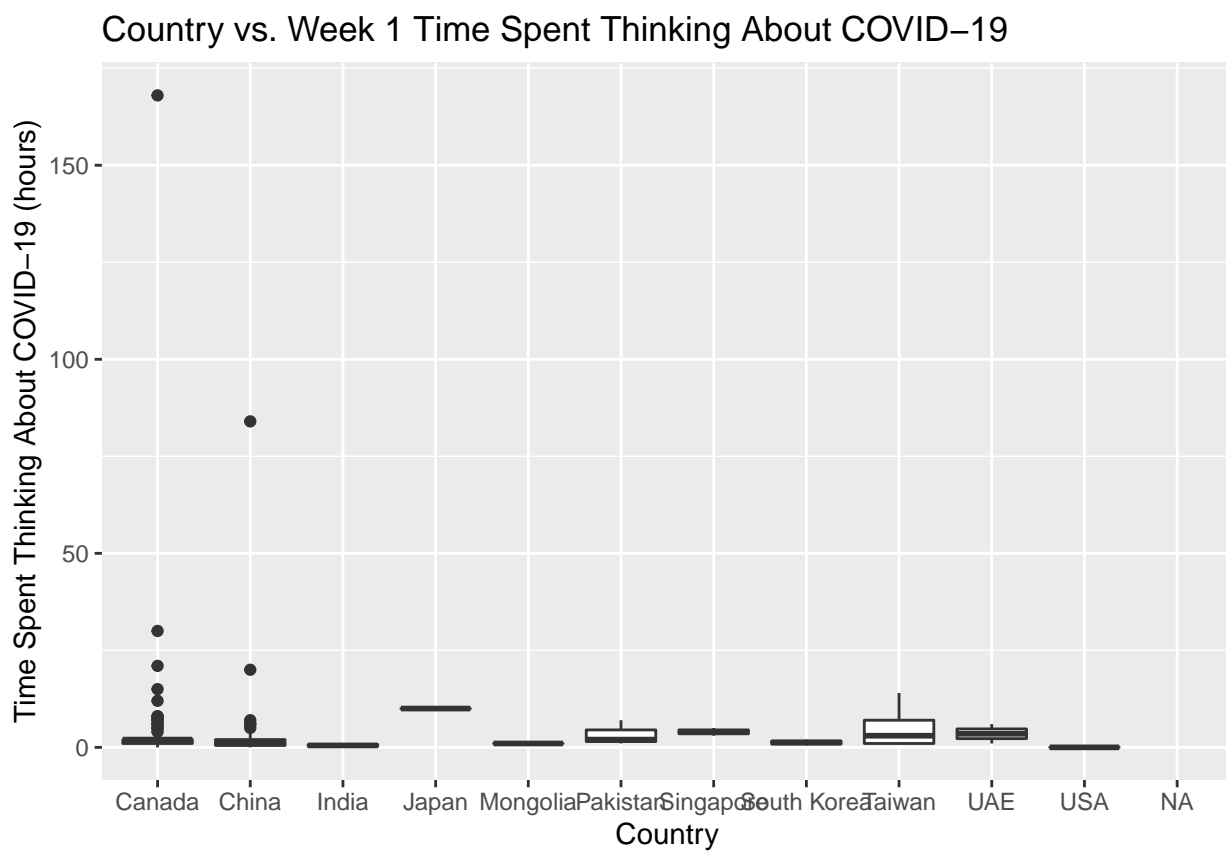
```
# TODO: create histograms with ggplot, and then grid.arrange them together.
```

Boxplots

```
# TODO: See STA248H1 notes to figure out how to create boxplots. -- DONE
# TODO: See toy program of boxplots to see how to color them by factor
```

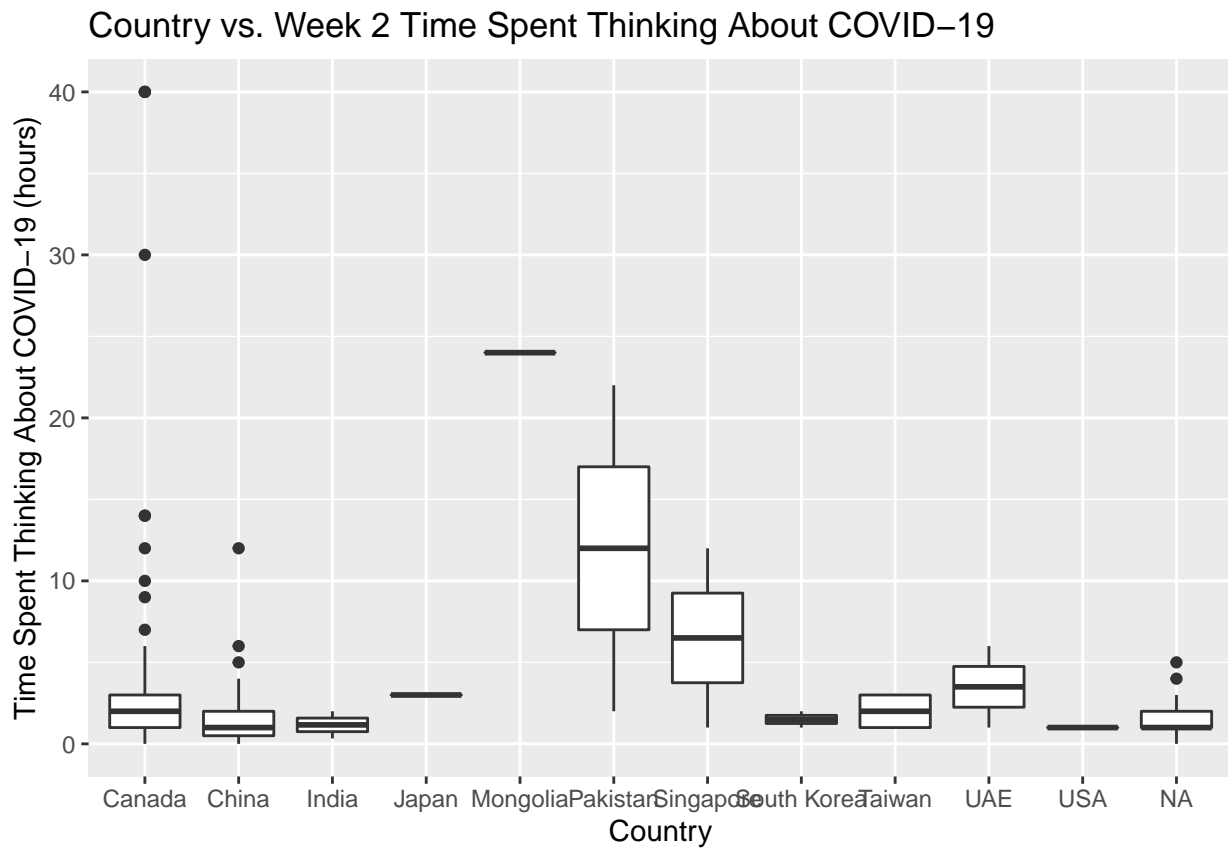
```
ggplot(data = cleaned_sta302_performance_data) +
  geom_boxplot(mapping = aes(x = Country, y = COVID.hours..W1.)) +
  labs(title = "Country vs. Week 1 Time Spent Thinking About COVID-19",
       x = "Country",
       y = "Time Spent Thinking About COVID-19 (hours)")
```

```
## Warning: Removed 26 rows containing non-finite values (stat_boxplot).
```



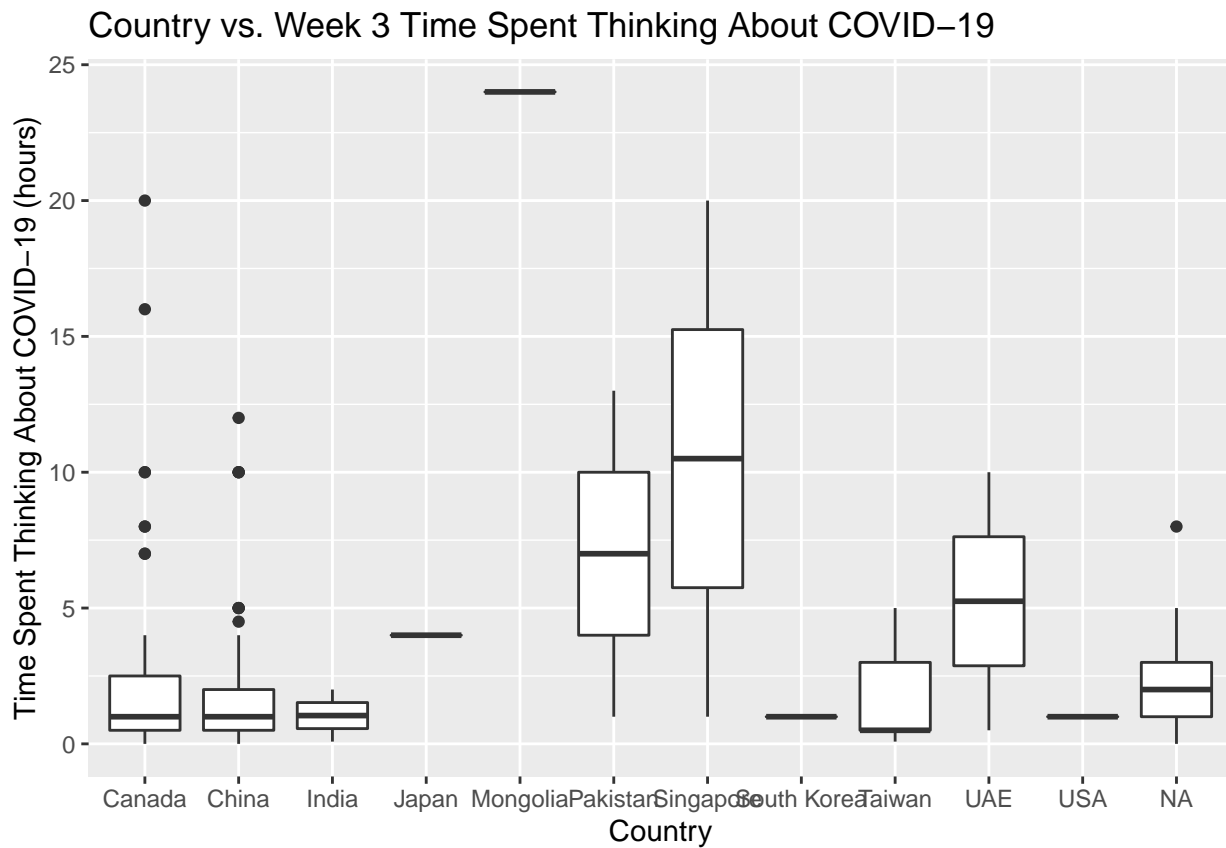
```
ggplot(data = cleaned_sta302_performance_data) +
  geom_boxplot(mapping = aes(x = Country, y = COVID.hours..W2.)) +
  labs(title = "Country vs. Week 2 Time Spent Thinking About COVID-19",
       x = "Country",
       y = "Time Spent Thinking About COVID-19 (hours)")
```

Warning: Removed 22 rows containing non-finite values (stat_boxplot).



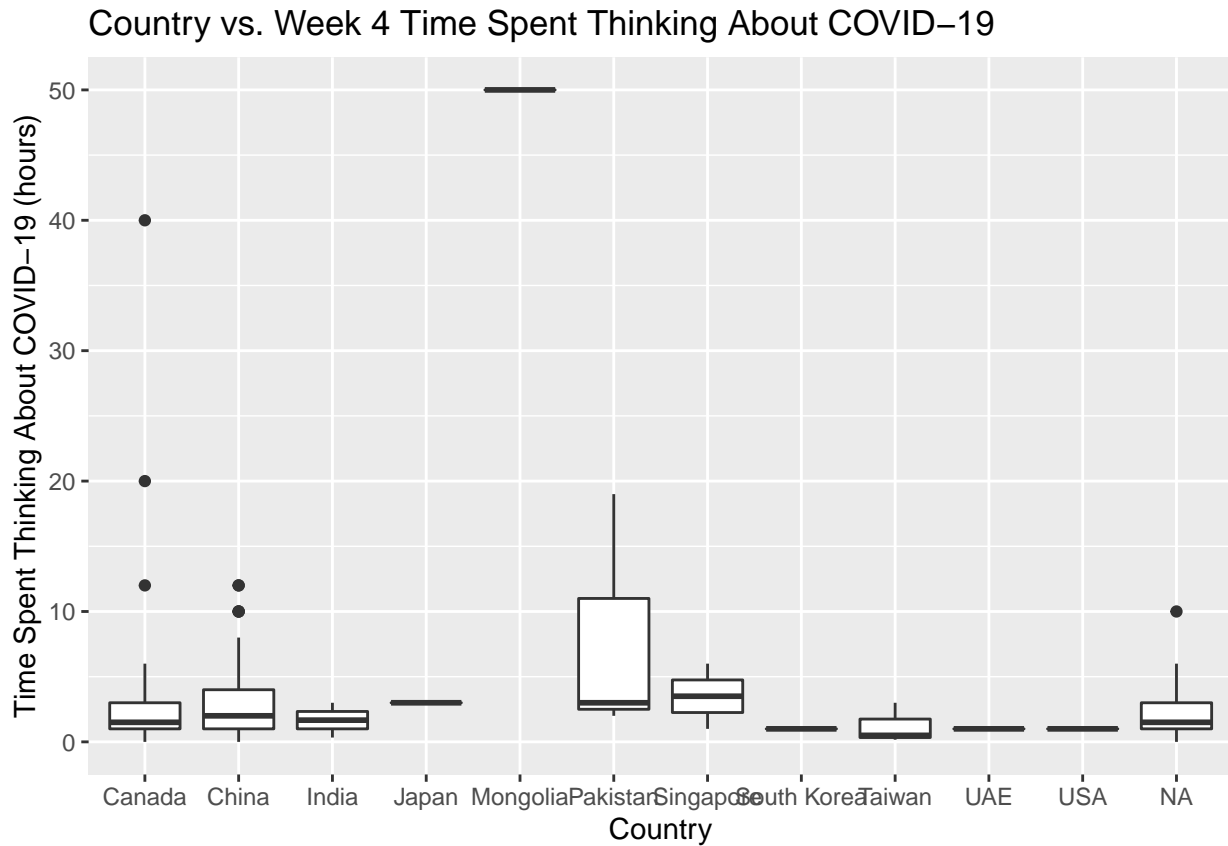
```
ggplot(data = cleaned_sta302_performance_data) +
  geom_boxplot(mapping = aes(x = Country, y = COVID.hours..W3.)) +
  labs(title = "Country vs. Week 3 Time Spent Thinking About COVID-19",
       x = "Country",
       y = "Time Spent Thinking About COVID-19 (hours)")
```

Warning: Removed 21 rows containing non-finite values (stat_boxplot).



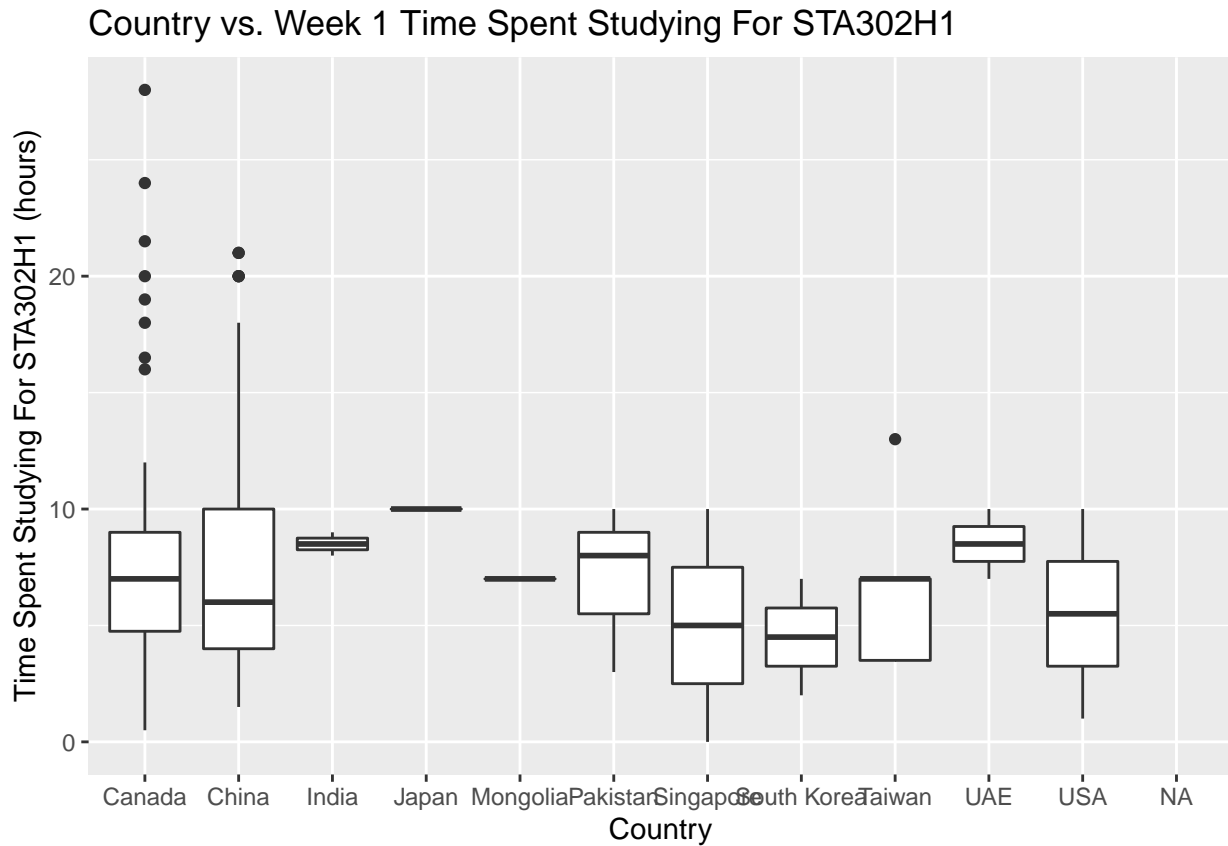

```
ggplot(data = cleaned_sta302_performance_data) +
  geom_boxplot(mapping = aes(x = Country, y = COVID.hours..W4.)) +
  labs(title = "Country vs. Week 4 Time Spent Thinking About COVID-19",
       x = "Country",
       y = "Time Spent Thinking About COVID-19 (hours)")
```

Warning: Removed 40 rows containing non-finite values (stat_boxplot).



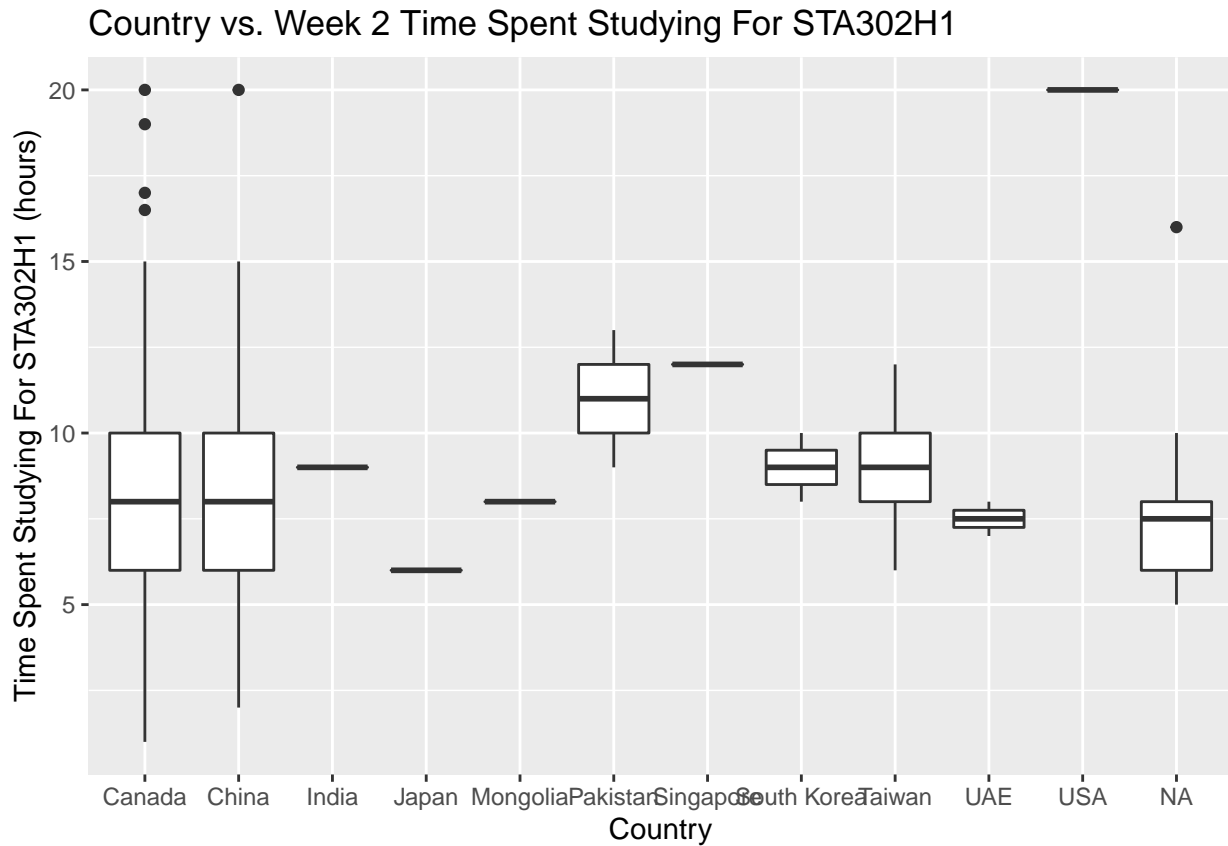
```
ggplot(data = cleaned_sta302_performance_data) +
  geom_boxplot(mapping = aes(x = Country, y = STA302.hours..W1.)) +
  labs(title = "Country vs. Week 1 Time Spent Studying For STA302H1",
       x = "Country",
       y = "Time Spent Studying For STA302H1 (hours)")
```

Warning: Removed 26 rows containing non-finite values (stat_boxplot).



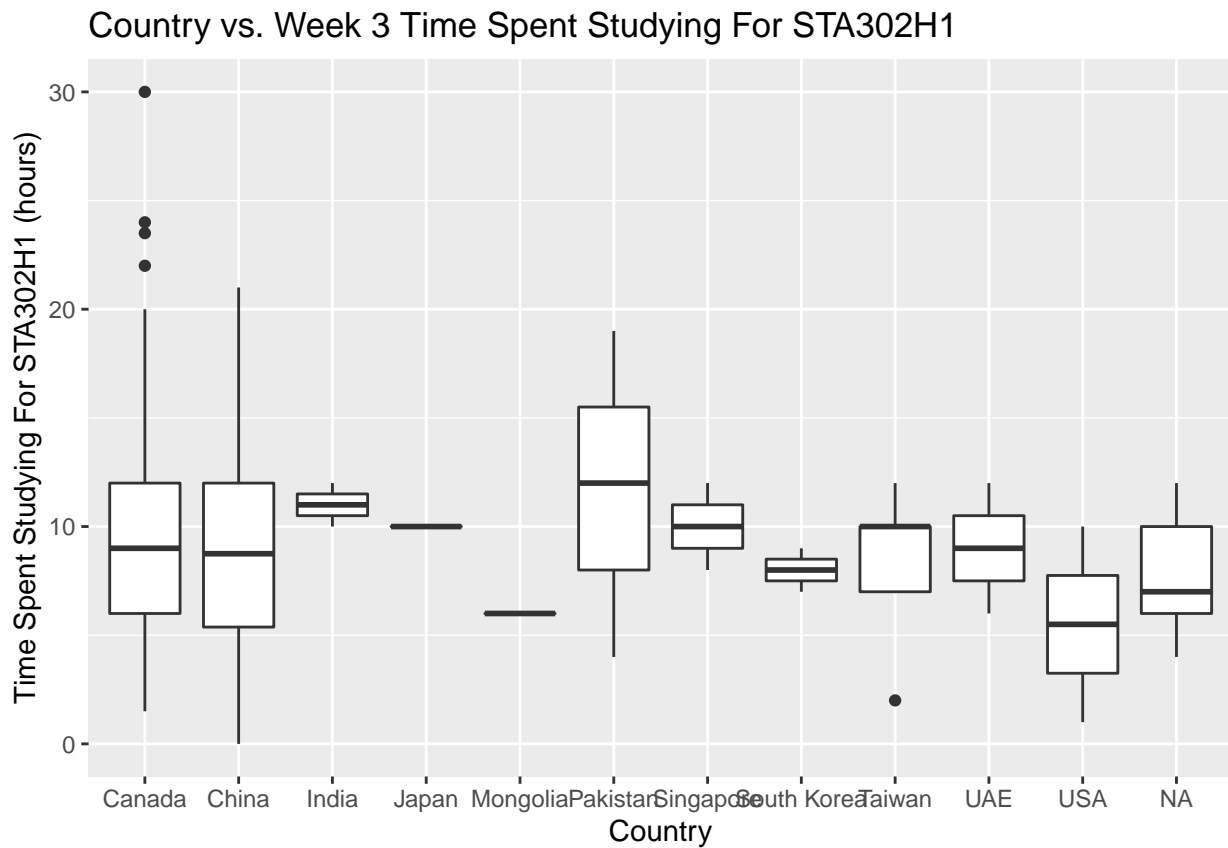
```
ggplot(data = cleaned_sta302_performance_data) +
  geom_boxplot(mapping = aes(x = Country, y = STA302.hours..W2.)) +
  labs(title = "Country vs. Week 2 Time Spent Studying For STA302H1",
       x = "Country",
       y = "Time Spent Studying For STA302H1 (hours)")
```

Warning: Removed 22 rows containing non-finite values (stat_boxplot).



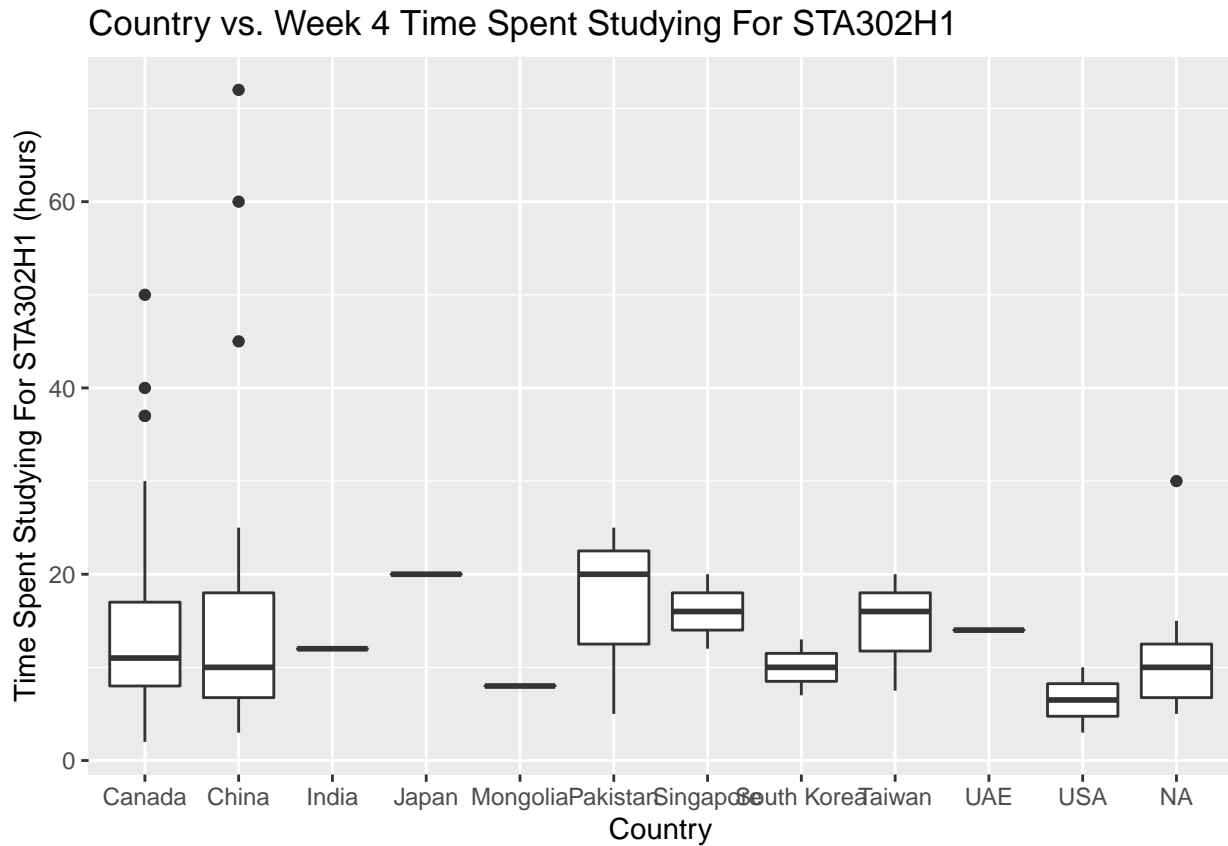
```
ggplot(data = cleaned_sta302_performance_data) +
  geom_boxplot(mapping = aes(x = Country, y = STA302.hours..W3.)) +
  labs(title = "Country vs. Week 3 Time Spent Studying For STA302H1",
       x = "Country",
       y = "Time Spent Studying For STA302H1 (hours)")
```

Warning: Removed 20 rows containing non-finite values (stat_boxplot).



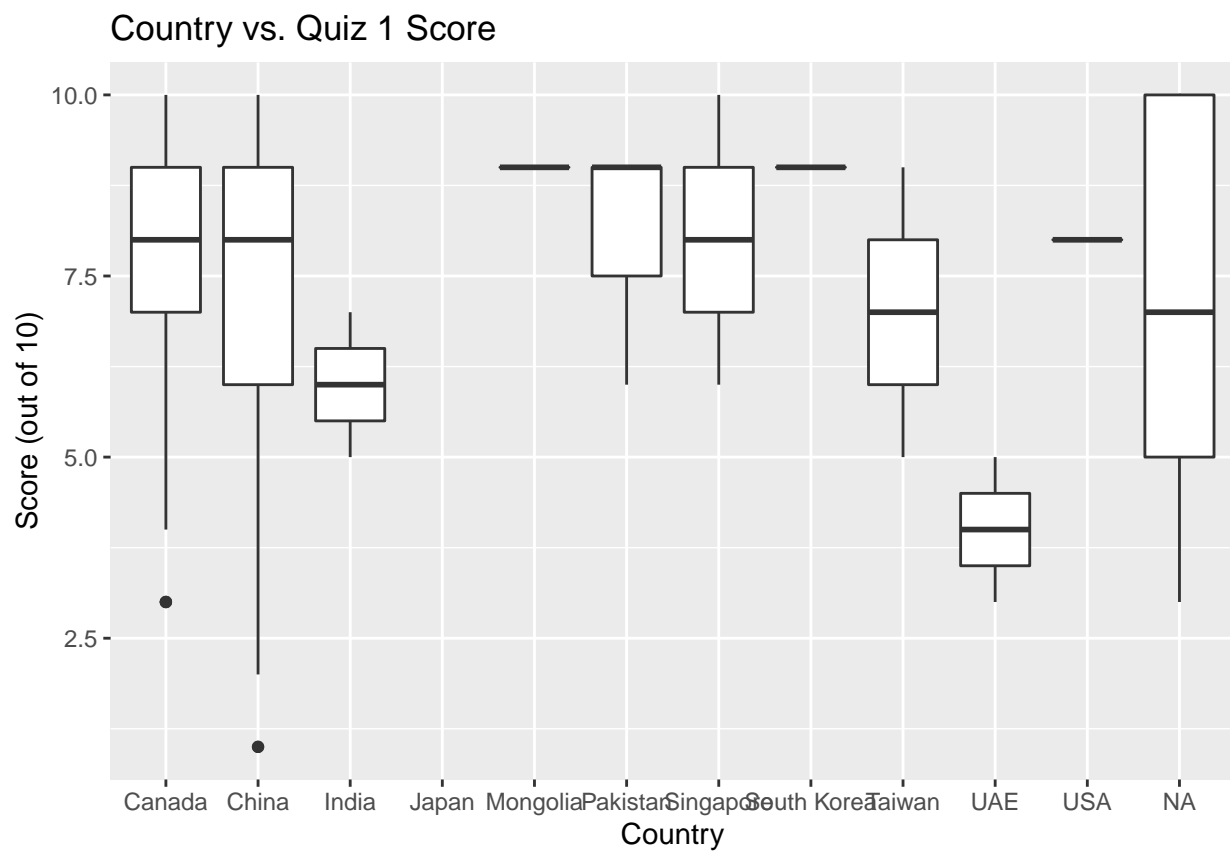
```
ggplot(data = cleaned_sta302_performance_data) +
  geom_boxplot(mapping = aes(x = Country, y = STA302.hours..W4.)) +
  labs(title = "Country vs. Week 4 Time Spent Studying For STA302H1",
       x = "Country",
       y = "Time Spent Studying For STA302H1 (hours)")
```

Warning: Removed 40 rows containing non-finite values (stat_boxplot).



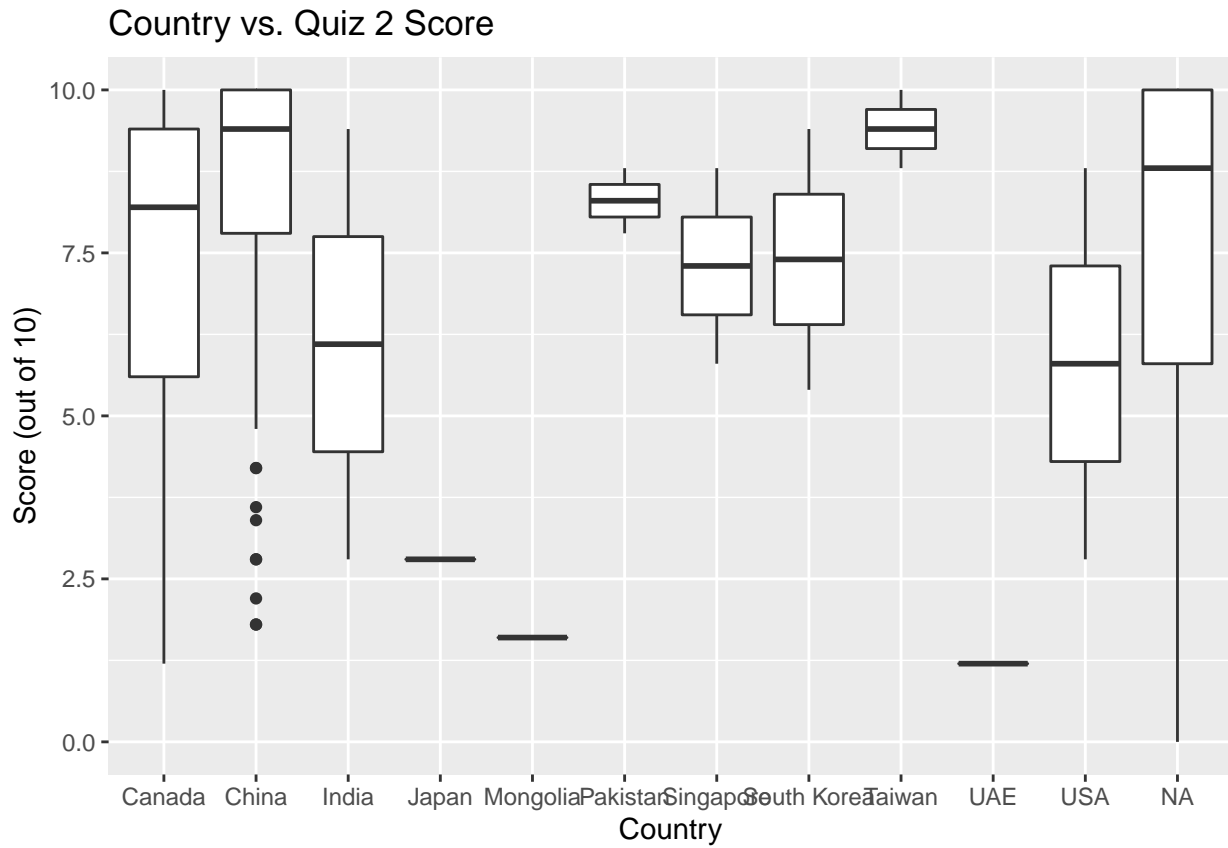
```
ggplot(data = cleaned_sta302_performance_data) +
  geom_boxplot(mapping = aes(x = Country, y = Quiz_1_score)) +
  labs(title = "Country vs. Quiz 1 Score",
       x = "Country",
       y = "Score (out of 10)")
```

Warning: Removed 13 rows containing non-finite values (stat_boxplot).



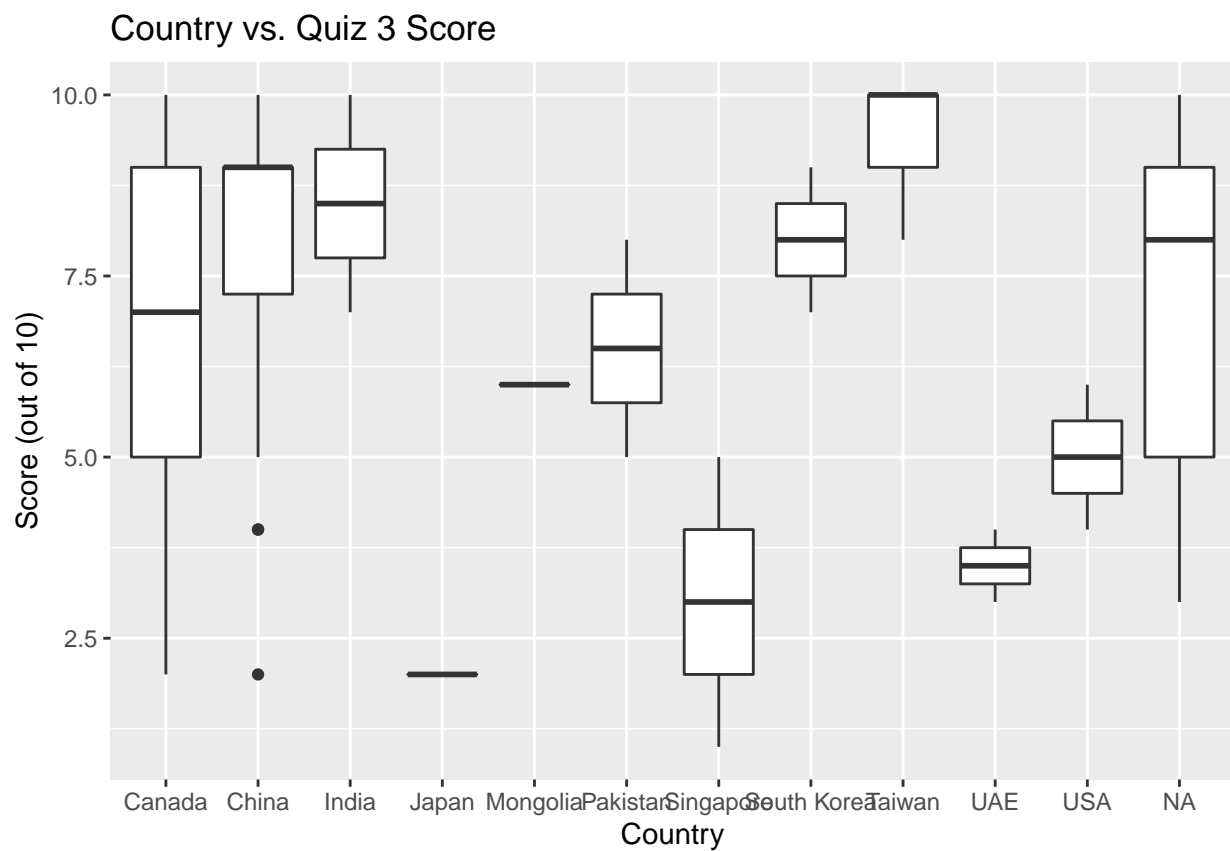
```
ggplot(data = cleaned_sta302_performance_data) +
  geom_boxplot(mapping = aes(x = Country, y = Quiz_2_score)) +
  labs(title = "Country vs. Quiz 2 Score",
       x = "Country",
       y = "Score (out of 10)")
```

Warning: Removed 36 rows containing non-finite values (stat_boxplot).



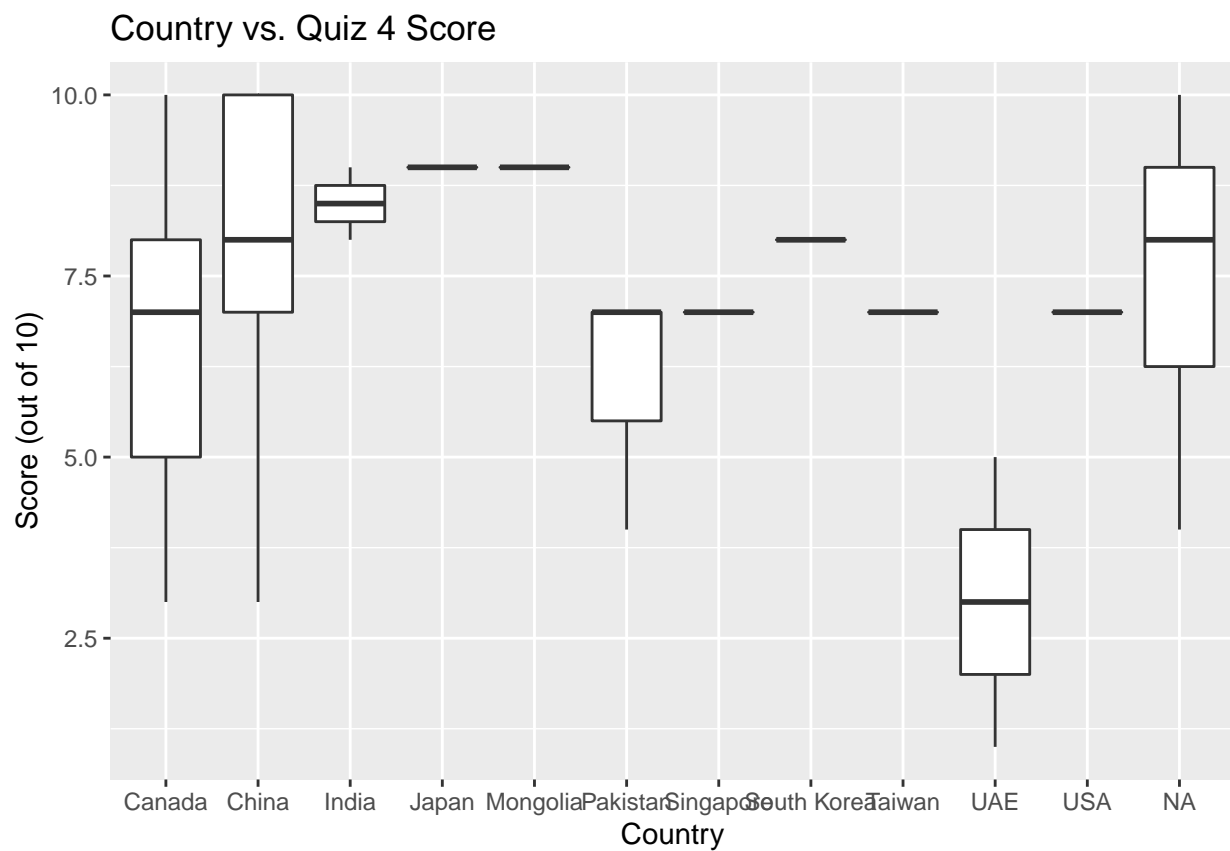
```
ggplot(data = cleaned_sta302_performance_data) +
  geom_boxplot(mapping = aes(x = Country, y = Quiz_3_score)) +
  labs(title = "Country vs. Quiz 3 Score",
       x = "Country",
       y = "Score (out of 10)")
```

Warning: Removed 31 rows containing non-finite values (stat_boxplot).



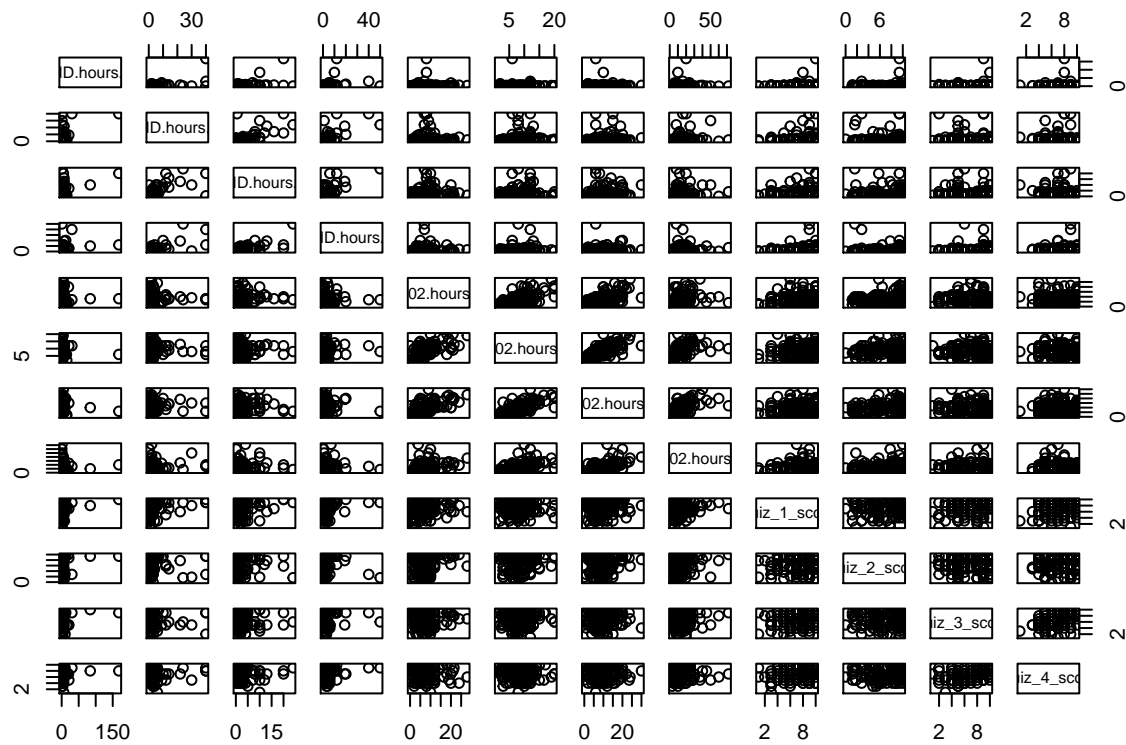

```
ggplot(data = cleaned_sta302_performance_data) +
  geom_boxplot(mapping = aes(x = Country, y = Quiz_4_score)) +
  labs(title = "Country vs. Quiz 4 Score",
       x = "Country",
       y = "Score (out of 10)")
```

Warning: Removed 34 rows containing non-finite values (stat_boxplot).



Scatterplots

```
# pairwise scatterplot
pairs(~COVID.hours..W1. + COVID.hours..W2. + COVID.hours..W3. + COVID.hours..W4. +
      STA302.hours..W1. + STA302.hours..W2. + STA302.hours..W3. + STA302.hours..W4. +
      Quiz_1_score + Quiz_2_score + Quiz_3_score + Quiz_4_score,
      data = cleaned_sta302_performance_data)
```



Correlation Matrix

```
# take out country column
# TODO: Or create separate correlation matrices for each country?
no_country = cleaned_sta302_performance_data %>%
  select(-country)

# Find correlation matrix to determine candidate significant predictor values.
# library(GGally)
colnames(no_country) <- c("W1COV", "W2COV", "W3COV", "W4COV",
                          "W1302", "W2302", "W3302", "W4302",
                          "Q1", "Q2", "Q3", "Q4")
# ggcorr(no_country, label = TRUE, label_round = 2)
round(cor(no_country, use = "complete.obs"), 2) # TODO: na.rm = true
```

```
##      W1COV W2COV W3COV W4COV W1302 W2302 W3302 W4302  Q1  Q2  Q3  Q4
## W1COV  1.00  0.66  0.46  0.20  0.02 -0.04 -0.02  0.06  0.10  0.07  0.05  0.01
## W2COV  0.66  1.00  0.82  0.60  0.06  0.05  0.13  0.21  0.11 -0.10 -0.08 -0.06
## W3COV  0.46  0.82  1.00  0.73  0.06  0.09  0.14  0.13  0.13 -0.10 -0.11 -0.06
## W4COV  0.20  0.60  0.73  1.00  0.02  0.04  0.09  0.07  0.10 -0.09 -0.03  0.01
## W1302  0.02  0.06  0.06  0.02  1.00  0.61  0.57  0.31  0.02  0.11  0.03 -0.07
## W2302 -0.04  0.05  0.09  0.04  0.61  1.00  0.70  0.49 -0.04  0.08 -0.09 -0.12
## W3302 -0.02  0.13  0.14  0.09  0.57  0.70  1.00  0.62 -0.07  0.08 -0.14 -0.09
## W4302  0.06  0.21  0.13  0.07  0.31  0.49  0.62  1.00 -0.07  0.02 -0.05 -0.11
## Q1     0.10  0.11  0.13  0.10  0.02 -0.04 -0.07 -0.07  1.00  0.22  0.33  0.21
## Q2     0.07 -0.10 -0.10 -0.09  0.11  0.08  0.08  0.02  0.22  1.00  0.22  0.16
## Q3     0.05 -0.08 -0.11 -0.03  0.03 -0.09 -0.14 -0.05  0.33  0.22  1.00  0.54
## Q4     0.01 -0.06 -0.06  0.01 -0.07 -0.12 -0.09 -0.11  0.21  0.16  0.54  1.00
```

5-Number Summary Statistics

STA302H1 Hours 5-Number Summary

```
summary(sta302_performance_data$STA302.hours..W1.)
```

##	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
##	0.000	4.000	7.000	7.458	9.000	28.000	26

```
summary(sta302_performance_data$STA302.hours..W2.)
```

##	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
##	1.000	6.000	8.000	8.298	10.000	20.000	22

```
summary(sta302_performance_data$STA302.hours..W3.)
```

##	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
##	0.000	6.000	9.000	9.225	11.500	30.000	20

```
summary(sta302_performance_data$STA302.hours..W4.)
```

##	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
##	2.00	7.00	11.00	13.42	16.00	72.00	40

COVID Hours 5-Number Summary

```
summary(sta302_performance_data$COVID.hours..W1.)
```

##	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
##	0.000	1.000	1.000	3.607	2.000	168.000	26

```
summary(sta302_performance_data$COVID.hours..W2.)
```

##	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
##	0.000	1.000	1.000	2.884	2.000	40.000	22

```
summary(sta302_performance_data$COVID.hours..W3.)
```

##	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
##	0.000	0.500	1.000	2.333	2.000	24.000	21

```
summary(sta302_performance_data$COVID.hours..W4.)
```

##	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
##	0.000	1.000	1.500	2.918	3.000	50.000	40

Quiz Scores 5-Number Summary

```
summary(sta302_performance_data$Quiz_1_score)
```

##	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
##	1.000	6.000	8.000	7.617	9.000	10.000	13

```
summary(sta302_performance_data$Quiz_2_score)
```

##	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
##	0.000	5.800	8.800	7.422	9.400	10.000	36

```
summary(sta302_performance_data$Quiz_3_score)
```

##	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
##	1.000	5.000	8.000	7.209	9.000	10.000	31

```
summary(sta302_performance_data$Quiz_4_score)
```

##	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
##	1.000	6.000	8.000	7.378	9.000	10.000	34