Building Bridges

Instructor Key

Building bridges

Access the bridge data here: google sheet

You'll work with a .csv data file from multiple lab sections. The first part of the assignment will involve analyzing data from *only your lab section.*

Who else was in your group?

your response here

Start by reading in your data:

```
# Read in your data
df <- read.csv("filename") # Replace filename with the name of your file

# Subset to get the data from your lab section
# IN OUR SPREADSHEET, THAT COLUMN WAS day_time
# Replace labsection with the name of your section (day_time)
df_lab <- subset(df, day_time == "labsection")
```

Prediction 1: Fitness varies among individuals

Prediction 2: Average fitness increases from one generation to the next

Prediction 3: There is a trade-off beween bridge length and load score

Prediction 4: Structural complexity increases from one generation to the next

Let's visualize these data in a way that lets us track how each group's bridge changed across generations (like ancestors & decendants!):

```
# Plot generation time by fitness
plot(df_lab$generation, df_lab$fitness)

# Subset the lab data to isolate the bridges for each group
# replace teamname with one of the team names from your section
team1 <- subset(df_lab, team_name == "teamname")
# repeat with the other teams in your section (e.g. team2, team3)
team2 <- subset(df_lab, team_name == "teamname2")
team3 <- subset(df_lab, team_name == "teamname3")
team4 <- subset(df_lab, team_name == "teamname4")

# Plot each team individually on the same graph
plot(df_lab$generation, df_lab$fitness, type="n")
lines(team1$generation, team1$fitness, col="blue")

# repeat with the other teams in your section (e.g. team2, team3)
lines(team2$generation, team2$fitness, col="red")
```

```r
lines(team3$generation, team3$fitness, col="black")
lines(team4$generation, team4$fitness, col="green")
```

Interpret this figure - is there variation in fitness among bridges? Does fitness seem to increase across generations?

your response here

It may be easier to see overall trends by creating a boxplot to show changes in fitness across generations. Boxplots are great because they show us more about the data's distribution (i.e., median and quartiles) than we can see with a scatterplot.

Evaluate Prediction 1 AND Prediction 2 using your lab section's Building Bridges data:

```r
# Plot fitness for each generation as a boxplot
boxplot(df_lab$fitness ~ df_lab$generation, xlab="Generation", ylab="Fitness")
```

Prediction 1: Was your intial prediction supported?

your figure results and evidence-based claim here

Prediction 2: Was your intial prediction supported?

your figure results and evidence-based claim here

Create a scatterplot to determine whether a tradeoff exists between load score and length and overlay a linear regression line:

```r
# Run a linear model
bridge_mod <- lm(score ~ length_cm, data=df_lab)

# Find the slope of the line
summary(bridge_mod)

# Add linear regression line to the plot
plot(length_cm ~ score, data=df_lab)
abline(bridge_mod)
```

Interpret this figure and evaluate prediction 3: Was your intial prediction supported?

your response here

Calculate structural complexity of bridges and compare across generations

The Shannon Index of diversity considers how many different resources were used to build each bridge AND how evenly they were used (e.g., if 90% of the resources used were paper cups, that would not represent an even use of resources). Before running the code below, install the package vegan (install.packages("vegan")) in the R console.

Calculate the Shannon Index for the building bridges data:

```r
# Modify the code below as needed to exactly match the data sheet
materials_lab <- subset(df_lab, select = c("paper", "paper_clips", "sticky_pads",
                                           "rubber_bands","straws", "cups","bowls",
                                           "plates","labels","knife"))

# Load the vegan package
library("vegan")
```

```r
# Calculate the shannon index using the diversity function
shannon <- diversity(materials_lab, index="shannon")

# Add the results from the shannon index as a new column in df_lab
df_lab$shannon
```

Great! Now you've got Shannon diversity for each bridge in your lab section. Visualize how this changes across generations using a boxplot, like above:

```r
# Plot shannon index for each generation
boxplot(df_lab$shannon ~ df_lab$generation,
        xlab="Generation", ylab="Shannon Index")
```

Interpret this figure and evaluate prediction 4: Does complexity increase or decrease across time?

your response here

Self-assessment of group collaboration

Assess whether everyone played a role or whether the contributions were very unbalanced. Give your overall impression of your individual ability to contribute in positive ways towards your group's bridge.

your response here

Bonus section! Evolution is not uniform across populations…explore this for yourself by comparing results from your lab section to other lab sections.

```r
# Subset data to get another lab section's data
# Replace labsection with the name of another section
df_lab2 <- subset(df, day_time == "labsection")

# Use a boxplot to look at how fitness changed across generations in that lab,
boxplot(df_lab2$fitness ~ df_lab2$generation, xlab="Generation", ylab="Fitness")

# or see if they saw a trade-off in length vs. load of the bridges.
# Compare their results to your results from this lab section!

bridge_mod2 <- lm(score ~ length_cm, data=df_lab2)
summary(bridge_mod2)
plot(length_cm ~ score, data=df_lab2)
abline(bridge_mod2)
```

Your comparison of results across lab sections here