Comparing Two Race Cars
Racer Lab: Part B

Step 3: Designing an Experiment

This lab is a continuation of the Racer Lab Activity using the game at https://www.stat2games.sites.grinnell.edu/games/racer20.htm.

Individual/Small Group Work: Work with your nearest neighbor, and **design an experiment** that outlines the data collection strategy that you will implement to determine **whether the Bayes car or the Gauss car is faster on the oval track.** Each person in your class will play the game to collect this data. Your data collection strategy should allow you to conduct a hypothesis test.

State the null and alternative hypotheses, in words or symbols. Before stating the hypotheses think carefully how you plan to analyze the data that will be collected.

What is the explanatory variable?

What is the response variable?

What are the units for the data?

What data specifically needs to be recorded with each race?

What is the sample size?

Explain whether you should use a two-sample t-test or a paired t-test for this experiment.

Confounding Variable Information: In order to evaluate whether the car speeds are truly different, we should take into account possible **confounding variables** (variables that the researcher did not include in the study but that might be connected to both the independent variable and the dependent variable). For example, some racetracks are longer than others. We want to hold the track constant for everyone in your experiment to ensure that the type of track does not bias our results. Are there any other potential confounding variables that might get in the way of determining which car is faster?

As a class, decide on the exact protocol (instructions) for the experiment to generate the data. You need clear instructions so you can run the experiment the same every time. Write down the final instructions to collect data for this study. Specifically discuss how you will control for the potential confounding variables. If collecting data outside of class, clearly identify the timeframe for collecting data.

Step 4: Collect the data

Go to https://www.stat2games.sites.grinnell.edu/games/racer20.htm.

Ensure that you have the correct
Player ID: _____ **Group ID**: _____.

Follow the protocol decided upon for the class.

- Click the **Paired Test** button on the main menu.
- Use the **pull down menu to select which car you will race first**.
- Then select **which car you will race second.**
- Then select the **Track**. Select the **Continue** button.
- Use the arrow keys to race the car.

Record your own results:

1st Race: Car Type _____ Finishing Time _____

2nd Race: Car Type _____ Finishing Time _____

Calculate the difference in times: Bayes Time – Gauss Time: _____

Step 5: Examine and Analyze the Data

Go back to http://shiny.grinnell.edu/RacerTTests/ . You may want to watch following video on data cleaning again: https://www.youtube.com/watch?v=isWnFFORQVE&t=294s.

Examine the data. Were there any people who did not play the game the correct number of times? Can their data be included? Were there people who played the game using the same car? What do you do with their data? ***Decide as a class, with your teacher taking notes, which data to use and what variables you will analyze.***

Submit the final sample size, mean, and standard deviation for your class data (with the players you identified removed). ***Explain why N should be identical for both the Bayes and Nightingale cars***.

	N	Mean	SD
Bayes			
Nightingale			

List the assumptions required to conduct a t-test and describe how you evaluated whether these conditions were met. If the sample size is small, it is particularly important to verify that the assumptions are satisfied.

What should you do if the needed assumption is not met?

Data Analysis:

If the data collection was conducted properly, you can use the app to analyze your data. However, if your data was not properly collected, your instructor will provide a cleaned dataset for you. Use the data to conduct a test and make a decision about if there is a difference in the population average finishing time of the Bayes and Gauss cars.

Provide the test statistic and corresponding p-value:

Give the 95% confidence interval and provide an interpretation:

What conclusions can you draw about this experiment? Clearly state your **overall** recommendation to someone wanting to win a race on the oval track.

Step 6: Making Connections:

Discussion Question 1) Watch the video entitled Deception at Duke: https://www.youtube.com/watch?v=eV9dcAGaVU8. Discuss how this Racer Lab is related to the errors discussed in this video.

Discussion Question 2) Read the brief article discussing the ASA's statement on statistical significance and p-values, https://amstat.tandfonline.com/doi/pdf/10.1080/00031305.2016.1154108?needAccess=true. Pick one of the six principles and write one to two paragraphs discussing how this principle relates to this Racer Lab activity. More than one of the principles can apply to this lab.

Discussion Question 3) Read the article discussing Amy Cuddy's research, https://www.nytimes.com/2017/10/18/magazine/when-the-revolution-came-for-amy-cuddy.html. Discuss how this Racer Lab is related to the errors discussed in this article.

To receive credit for this lab, you must complete the evaluation at:
https://grinnell.co1.qualtrics.com/jfe/form/SV_0p4Cz8T1dveoAdf.