

Practice Assignment: ANOVA

- 1) We want to see if there is a difference in the mean number of sleep hours per night between freshmen, sophomores, juniors, and seniors.¹ Assume all assumptions of ANOVA are satisfied.

Part A: How many groups do we have?

Part B: Define what each parameter of interest represents. Make sure to use words and symbols.

$$\mu_1 =$$

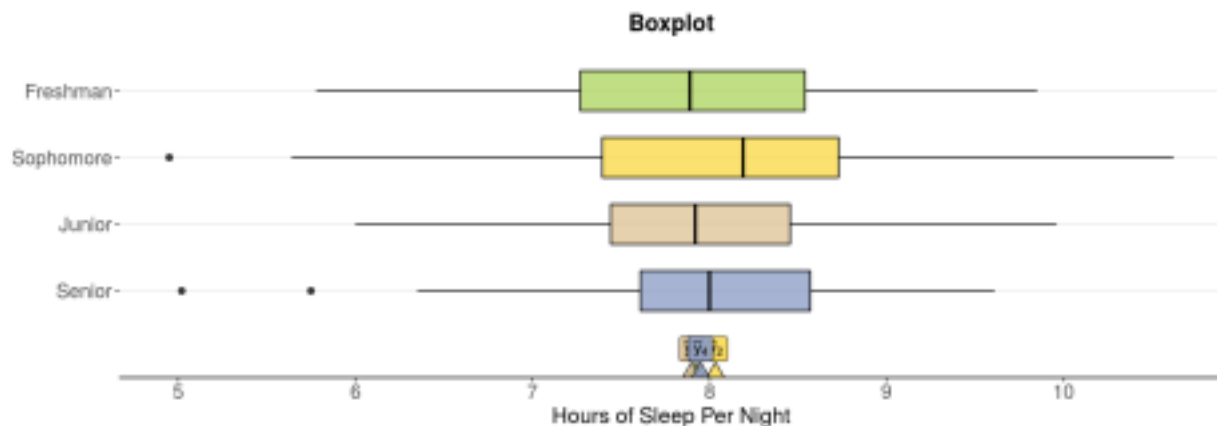
$$\mu_2 =$$

$$\mu_3 =$$

$$\mu_4 =$$

Part C: State the null and alternative hypotheses.

- 2) Look at the following boxplots and sample means. Do you see any differences or similarities in sleep hours between the class years? Explain.



[Continued on the next page.]

¹ Onyper, S. V., Thacher, P. V., Gilbert, J. W., & Gradess, S. G. (2012). Class start times, sleep, and Module 14: Getting Stronger Practice Assignment. **Provided by:** The Charles A. Dana Center at The University of Texas at Austin. **Modified by:** Lumen Learning. **License:** [CC-BY-SA 4.0](https://creativecommons.org/licenses/by-sa/4.0/).

academic performance in college: A path analysis. *Chronobiology International*, 29(3), 318–335.

3) The following is the output for the ANOVA for the scenario in Questions 1 and 2.

ANOVA Table:

Source	df	Sum of Squares	Mean Square	F Statistic	P-value
Group	3	0.7708	0.2569	0.2736	0.8444
Error	249	233.8	0.939		
Total	252	234.5708			

Part A: State the F-statistic and P-value.

Part B: Based on your answer to Part A, what is your decision for the test? Use a significance level of 5%.

- a) Reject the null hypothesis.
- b) Fail to reject the null hypothesis.
- c) Accept the null hypothesis.

Part C: Interpret your results from Part B in the context of the problem.

4) Does the container ramen comes in contribute to people’s perceptions of the taste? Three independent samples of ramen in different containers (a cup, a pack, and a bowl) were taken. Each ramen sample was rated on a scale from 0–5, where 5 was the best-tasting ramen. We want to test to see if there is a difference in the mean ramen rating between ramen in cups, packs, and bowls.^{2,3} Assume all assumptions of ANOVA are satisfied.

Part A: How many groups do we have?

Part B: Define what each parameter represents. Make sure to use words and symbols.

Part C: State the null and alternative hypotheses.

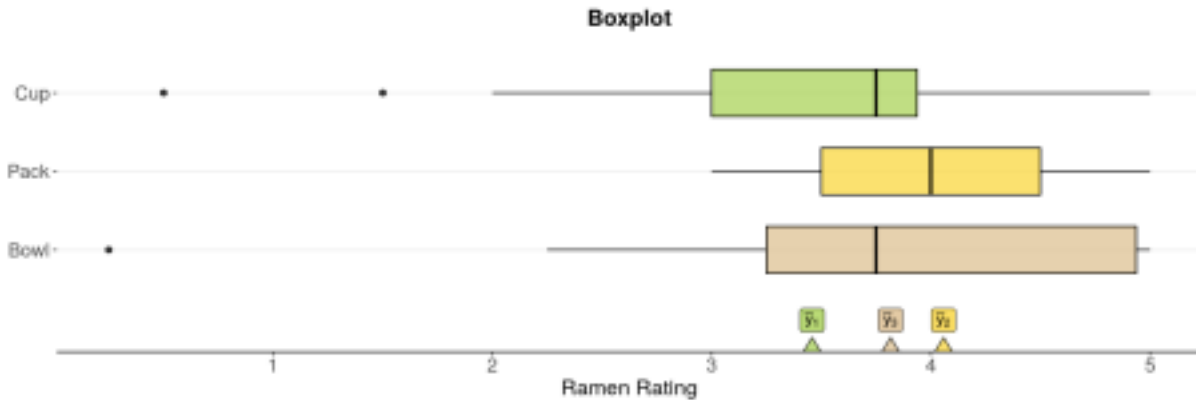
² *Ramen ratings*. (2019, June 3). GitHub.

<https://github.com/rfordatascience/tidyuesday/tree/master/data/2019/2019-06-0>

⁴ ³ Lienesch, H. (2021, January 18). *The Big List*. The Ramen Rater.

<https://www.theramenrater.com/resources-2/the-list/>

5) Look at the following boxplots and sample means. Do you see any differences or similarities in the ramen ratings for the three types of containers? Explain.



6) The following is the output for the ANOVA for the scenario in Questions 4 and 5.

ANOVA Table:

Source	df	Sum of Squares	Mean Square	F Statistic	P-value
Group	2	5.468	2.734	3.2	0.0456
Error	87	74.34	0.8545		
Total	89	79.808			

Part A: State the F-statistic and P-value.

Part B: Based on your answer from Part A, what is your decision for the test? Use a significance level of 5%.

- a) Reject the null hypothesis.
- b) Fail to reject the null hypothesis.
- c) Accept the null hypothesis.

Part C: Interpret your results from Part B in the context of the problem.

Part D: Suppose your friend interpreted the results as, “All three types of ramen packaging have significantly different ratings.” Would this be the correct interpretation based on the ANOVA results? Explain.

7) In the previous in-class activity (14.A), we looked at the ANOVA table for the average number of alcoholic drinks consumed per week for the groups who

identified as Morning Larks, Night Owls, and Neither. We got the following results:

Source	df	Sum of Squares	Mean Square	F-Statistic	P-value
Group	2	73.04	36.52	2.198	0.11
Error	250	4154.00	16.62		
Total	252	4227.00			

Suppose we wanted to see if there was a difference between the average number of alcoholic drinks per week among the groups Morning Larks, Night Owls, and Neither group. Use $\alpha = 0.05$. Assume all assumptions of ANOVA are satisfied.

Part A: Write the null and alternative hypotheses.

Part B: Define what each parameter represents. Make sure to use words and symbols.

Part C: Interpret the results from the ANOVA table in the context of the problem.