Gov 2001: Problem Set 2
Assessment Problem

Due Wednesday, February 10 by 6pm

Instructions

You should submit your answers and R code to the problems below using the Quizzes section on Canvas.

Remember that you should treat this assessment problem as you would treat a final exam.

You are not allowed to discuss the problem with classmates, the teaching staff, or any other people. You also may not post questions about the assessment problem to the Canvas discussion boards.

You may consult any readings, notes, or R code from the class, and you can also use the internet as a resource, but remember that all answers and code must be entirely your own.

Also don't forget that you only have one opportunity to submit your answers to the assessment problem on Canvas. Be sure you check your work before you click the submit button.

Remember that the purpose of these assessment problems is for you to get an honest sense of how well you understand the content from the class. If you struggle with an assessment problem one week, you should spend the following week being sure that you catch up on the topics you didn't understand.

Happy Hour

"Our constitution protects aliens, drunks, and U.S. Senators" - Will Rogers

Imagine that you're a member of the United States Senate. The US Capitol building has one bar inside that exclusively serves to US Senators. It's the hip place to be on a Friday night, and all of your distinguished colleagues want to be there. The problem is that the bar is very small inside, and it's very miserable to be there when there's a filibuster proof majority inside (more than 60 people inside). On the other hand, it's very boring to be at the bar when there are fewer than 10 noted gentlemen or gentlewomen there.

In this problem, we're going to use simulation to help you to decide whether you'll be happier going out to the bar or whether you should stay home.

A

You decide that you're going to go to the bar no matter what. The other 99 Senators independently decide whether to go to the bar, and each has a 50% probability of going to the bar. First, set the seed to 12345 and simulate the total number of Senators in the bar on 10,000 Friday nights. Plot a histogram of the PMF.

Hint: The `rbinom()` *function should be helpful.*

B

Now, in R, simulate 10,000 possible Friday nights to determine the probability that you have a good time at the bar. In other words, what is the probability that between 9 and 59 of the other 99 Senators join you at the bar? Again set the seed to 12345.

C

Briefly discuss and critique one of the assumptions that underlies this model. Do you think that assumption is a reasonable one to make?

D

Now let's assume that you're a member of the US House of Representatives, instead of the Senate, and that their bar is a little bit bigger in size. Continue to assume that each of your colleagues has a 50% probability of going to the bar and that the House bar also requires a minimum of 10 people to be fun. Write a function in R that takes, as arguments, the total number of Representatives (or Senators) and the maximum number of people who can comfortably fit into the bar. This function should return the probability that you would have fun on on any single Friday night.

E

Use your function from part D to estimate the probability that you have a fun time at the bar, given that the House has 435 members[1] (instead of 100) and the their bar's capacity is 225 (instead of 60). Set the seed to 54321.

Note: We will still give full credit for this problem to students who could not solve Part D, but correctly calculate the probability of having a good time at the House bar using an alternative approach (not a function).

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[1] The Constitution says that only the 435 voting members of the House are allowed into the bar. Sorry Eleanor Holmes Norton.

F

Assume again that you're in the Senate (with 99 colleagues and a bar that fits 60 people). Alter your function so that it also takes as an argument the probability that the other Senators go to the bar. Vary this parameter (which was originally 50%) at 5% intervals from 5% to 95% (i.e 5%, 10%, 15%...95%) and store the results. Set the seed to 1776. Create a graph showing the probability of having a fun Friday night at each level of the parameter that you varied.

Note: We will still give full credit for this problem to students who could not solve Part D, but still produced the correct plot using an alternative approach.

G

The Constitution is changed so that members of the House of Representatives and Senators are allowed to go to either of the two bars inside the Capitol building. Assume that all the other 534 elected representatives (435 House members plus 99 Senators other than you) go to the Senate bar with probability 0.15, the House bar with probability 0.4, and stay home with probability 0.45. Also assume that you will definitely go to either the Senate bar or the House bar, each with equal probability. Set the seed to 429.

What is the probability that you have a fun Friday night?

Hint: The `rmultinom()` *function will be useful. Also, this question is meant to be challenging to code, so don't worry too much if you struggle to get the right answer.*

R code

Please submit all your code for this assessment problem as a .R file. Your code should be clean, commented, and executable without error.