HW 1 - due 04/14 at 11:59 pm.

Math 181B, Spring 23, Rava

Follow closely the 'Hw guide' under Files in the folder 'Course Contents' on how to write, scan and submit your homework.
On any problem involving R, you should include your code and output as part of your answer. You may take a screenshot of the code/output, or write it by hand.
Be careful with notation, remember to define the parameters and the random variables you intend to use.

1 Exercise 1

[10 points] Let $X_1, X_2, \ldots, X_n$ and $Y_1, Y_2, \ldots, Y_m$ be independent random samples drawn from normal distributions with means μ_X and μ_Y, respectively, and with the same unknown variance σ^2. Use the generalized likelihood ratio criterion to derive a test procedure to test $H_0 : \mu_X = \mu_Y$ against $H_1 : \mu_X \neq \mu_Y$. Show that it is equivalent to the two-sample t-test described in class.

2 Exercise 2

We want to determine whether cell phones slow the reaction time of drivers. Thirty-two subjects used a machine that simulated driving situations and were asked to press a break button when they saw a red light. Each subject did this once when talking on a cell phone and once when not talking on the phone, and their reaction times (in milliseconds) were recorded. On Canvas you can find two files that contain the recorded times 'Phone.csv' and 'NoPhone.csv'.

a) [6 points] Conduct an HT with significance level 0.05. You can use R to find the quantities needed (as mean and sd) but you cannot just use a built-in function that performs the test for you. Make sure to report all the lines of code needed, including the ones used to import the two files. Make sure to define parameters, hypotheses, comment on assumptions and write a meaningful conclusion.

b) [4 points] Construct a 99% (two-sided) CI for the difference in the average reaction time between drivers on the phone and drivers not on the phone. As before, don't just use a built-in function that constructs the CI for you. Remember to include a sentence that interprets the meaning of the confidence interval. Do you think that this CI is in contrast with the conclusion of the test performed in part a)? Briefly explain.

c) [2 points] Verify your result of part a), b) using the R built-in function that performs the test and constructs the CI for you.

3 Exercise 3

Your friend ripped his wetsuit and you are trying to advice him on a special glue to fix it. A company markets two brands of glue - regular and a more expensive one that claims to dry faster. Your friend decide to test this claim. On a big piece of neoprene, they perform 20 equal tears. They then apply the regular glue on 10 of them, chosen at random, and the fast glue on the others. They record the drying times. They then performs an hypothesis test with $\alpha = 0.01$ and they claim that it does not seem that the more expensive glue dries statistically significantly faster than the regular one. They write down for you the summarized data, in hours, they collected but they forget to give you all the information.

	Regular	More expensive
Average	5	?
sd	1	1.5

a) [5 points] What are all the different values we could assign to ? on the basis of their claim? Here don't just guess and check but arrive at the solution with a mathematical argument. You can assume equal variances.