Stat414; **FALL 2024;** Assessment Instructions

INSTRUCTIONS

I. You are expected to work on the assessments without the help of the discussion threads. You are expected to work on the assessments by yourself without any outside human or internet help. You will be signing an honor code to this effect.

II. Each assessment is based on two or three modules. Questions are based on the material supplied in the module folders. You may consult these materials while answering the questions.

III. You may have to use R (Rstudio plus any other package needed). R output along with the screenshot of your R session should be included in your submission.

IV. Once you open the submission link, you will have one hour to complete the assessment. Unlimited attempts are enabled. Please submit after completing each question. Your last attempt uploaded, containing ALL your completed work will be graded. (Only one upload per student to be graded by the grader)

V. You need to submit

- .pdf of this document including the CHECKLIST and SCORE tables.
- .Rmd file showing all your codes
- .pdf file showing the report generated by your .Rmd file
- .RData file which saves all commands and clicks of your session
- a video log of your entire session. Here's are three short videos showing exactly how to do this, along with your own face showing in the corner throughout the session. Click on the Zoom support link below if you are looking for more techincal details on how to do this.
  `https://youtu.be/Le216n4lNhw`
  `https://youtu.be/LfQYZ_3gCb4`
  `https://youtu.be/MLyW0JVlT98`
  Zoom Support for Local Recording

Stat414; **FALL 2024;** Assessment 02(M04-M07); 100 Points;

CHECKLIST

Item	Points	Included?
.Rmd	Your Code	
.pdf	Your output	
.RData	Your R session	
.mp4	Your Assessment session	

SCORE

Question	Points	check
Q1a	20	
Q1b	20	
Q1c	20	
Q2a	20	
Q2b	20	
Total	100	

1. Let $X_1, ..., X_n$ denote a random sample from a normal population distribution with an unknown value of σ. Assume that the population is well-approximated by a normal distribution with mean μ and variance σ^2. A sample of size $25 (= n)$ yielded mean 102 $(=\bar{X})$ and standard deviation of 7 $(= s)$.

   (a) Test the null $H_0 : \mu = 100$ vs $H_a : \mu > 100$ at level $\alpha = 0.05$ and state your conclusions based on the above sample. Please clearly show all seven steps of the hypothesis testing procedure.

   (b) Use `tTestPower` function of `EnvStats`, and compute the power curve of the above test procedure assuming that the standard deviation of the population (σ is 8. Plot the power curve of this test procedure. Suppose the data had yielded a sample mean $\bar{X} = 103$, what would the power curve look like?

   (c) Plot the power curve of this test for values of μ ranging from 90 to 110 for sample sizes $n = 10, 20, 30, 40, 50$. Plot all these curves on the same plot. Add a legend to your plot.

2. Suppose the investigator had mistakenly thought that the population is Normal. In reality it is a Gamma, with shape α and scale β.

   (a) Use simulation and plot the sampling distribution of $\bar{X}$ (for $n = 10$) when the null hypothesis is true and the population standard deviation (σ) is 8.

   (b) Suppose the $\mu = 102$ and standard deviation (σ) is 8. Compute the true power of the test and compare it to the power under the [wrong] assumption of Normality as in #1.

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