PSYC278 – Final Assignment

April 1, 2023

Instructions

- Use R to perform all data organization, manipulation, visualization, and statistical computations required to answer the questions below
- Where applicable, include your code in the document and format it so that if it is copied into RStudio, your answers to the questions can be reproduced (do not use screenshots)
- Only include the output from your code if it directly addresses the question being asked
- Text-based responses, where required, do not need to be generated from code
- Unless instructed otherwise, round your answers to two decimal places, with the exception of p-values, which should be reported to three decimal places. If the rounded p-value is equal to zero, report $p < .001$.

Part I (14 pts.)

Unless explicitly instructed otherwise, assume $\alpha = 0.05$.

Q1. A researcher wants to know if social stress can influence one's accuracy in perceiving others' actions. The researcher recruited 150 participants, randomly assigned them to 3 different stress conditions (low stress = 1, high stress = 2, neutral = 3), and asked them to report their *subjective feeling of social stress* on a 1-7 point likert-type scale after they had experienced the social stress manipulation. Participants then completed a task which assessed their *accuracy* in recognizing different actions. Please find the data in the attached file ***Final_Q1.txt*** on Canvas.

a) Report the median and variance of *accuracy* for participants who were in the high stress condition and whose ratings of *social stress* were greater than 1. (**1 pt.**)

b) Based on the distribution of the self-reported ratings of *social stress*, the researchers judged that it was reasonable to represent this variable on a nominal scale. Specifically, they wanted to assign participants with a *social-stress* rating equal to 1 to a category of **"low social stress"**, and participants whose ratings of *social stress* were greater than 1 to a category of **"high social stress"**. Re-code the *social stress* data according to this scheme. Then, create a clustered bar chart to represent the mean *accuracy* of each experimental condition subsetted by the low and high social stress categories. (**2 pt.**)

c) Assuming a linear relationship between *accuracy* and *social stress*, conduct an unstandardized ordinary least-squares regression analysis to predict *accuracy* from *social stress* (in its original scale). 1) Please report the regression results in APA format and interpret the coefficient estimates within the context of the study (i.e. what do the two values mean?). 2) Does the value of the intercept offer you any useful information? Why or why not? (**3 pt.**)

d) What is the correlation between *social stress* and *accuracy* of action perception? Is this value the same as the slope you obtained in question c) ? Why are they the same/not the same? (**1 pt.**)

Q2. An addictions research group has obtained access to the player records of a popular online gambling website. The spending data in dollars is normally distributed with μ=1000 and σ = 437. Given this information, determine the percentage of players that spent greater than $1800. (**1 pt.**)

Q3. An ecologist has been tracking the weight of a population of Canadian geese. A population level survey conducted twenty years prior showed that the average weight of the population was $\mu = 6.50$ kg ($\sigma = 1.30$). The ecologist has reason to believe the weight of this population of geese has decreased by around 0.90 kg. He wants to collect a random sample of Canadian geese to test whether his belief is correct.

a) Given the previous population level information, what is the sample size required to achieve a power of 90% given a real mean weight decrease of 0.90 kg? (**1 pt.**)

b) To test his hypothesis that the weight of this population of geese has declined, the ecologist collects a random sample of 20 geese. The ecologist finds that average weight of his sample of geese is 5.80 kg. Using $\alpha = 0.05_{\text{1-tailed}}$, state your conclusion, while reporting the obtained Z-score and associated p-value. (**1 pt.**)

Q4. A clinical psychologist is running a study where she predicts a single session of psilocybin-assisted therapy will significantly decrease levels of depression. She does not believe there is any possibility that the intervention could worsen depression. Participants ($n = 20$) first filled out the Beck Depression Inventory (BDI), which provided a baseline measure of their depression severity (the higher score, the more severe the depression). Each participant then received a single session of psilocybin-assisted therapy tailored specifically for depression. One week later, participants filled out the BDI a second time for comparison to their baseline scores. The data collected from the study are given below.

BDI pre-treatment: 55, 16, 24, 41, 53, 60, 53, 60, 12, 8, 61, 30, 38, 12, 36, 3, 62, 61, 54, 26
BDI post-treatment: 48, 28, 19, 39, 20, 31, 16, 57, 62, 46, 4, 28, 35, 27, 57, 3, 17, 58, 24, 32

a) State the null hypothesis given the clinical psychologist's prediction. (**1 pt.**)

b) Conduct an appropriate statistical test to evaluate the clinical psychologist's prediction and report the results in APA format. Ensure that the test you use is sensitive to the magnitude of how pre- and post-treatment BDI scores compare. (**2 pt.**)

c) Based on the obtained data, what is the effect size? (**1 pt.**)

Part II (10 pts.)

Coldness can be a highly potent stimulus that activates the sympathetic nervous system and brings about various physiological changes. Anecdotal reports of increased motivation and attention following deliberate cold exposure prompted a group of researchers to investigate how immersion in water of different temperatures affected plasma concentrations of dopamine (DA) – a neurotransmitter which has been implicated in motivation and cognitive performance. Participants (75 males) were recruited and randomly assigned to three four-minute, up-to-neck water immersion protocols with temperatures of 32°C ('*lukewarm*'), 14°C ('*moderately cold*'), and 4°C ('*very cold*'). There were 25 participants in each of the three groups. The researchers collected a baseline blood sample from participants prior to informing them which condition they were assigned to. They collected another blood sample immediately after the four-minute exposure period was completed. The dependent variable of interest was the amount by which plasma DA concentration (measured in picomoles/mL) changed from baseline following the exposure period. The data from this experiment are available in a file named `cold.csv` located on Canvas. Unfortunately, the research assistant who managed data collection and entry for this experiment was inexperienced. Additional details on the data's organizational issues and what the variables represent are provided in `cold-info.txt`. Assume $\alpha = 0.05$ for all questions below and report p to three decimal places.

a) Keeping in mind what has been noted as the dependent variable of interest, use R to import and prepare the data for a one-way between groups ANOVA analysis. All data cleaning, organization,

and processing must be done programmatically using R. Show all steps of your code. Once you have finished tidying and processing the data, print the first ten observations (i.e. rows). Do not include the output of any intermediate steps. (**2 pt.**)

b) Conduct a one-way ANOVA to examine if changes in plasma dopamine concentration differ between the three different conditions. Include the output of the ANOVA summary table. Report your results in APA format, while providing a brief interpretive statement. (**2 pt.**)

c) Compute and report the overall effect size ($\hat{\eta}^2$). Provide an explanation of what this represents conceptually. (**1 pt.**)

d) Create a bar chart to represent the group means of the change in plasma DA. For the error bars, *use 95% confidence intervals based on the group-level standard errors and degrees of freedom*: not the model-based standard error and degrees of freedom which is used to construct the 95% CIs given in the output summary of an `emmeans` object. (**2 pt.**)

e) Use Tukey's Honestly Significant Difference test to perform all possible pairwise comparisons of the change in plasma DA concentration. Organize your results in a table that includes the headers, 'Comparison', 'Q' (for the studentized range statistic), and 'p' (for the p-value). (**2 pt.**)

f) Interpret the pattern of results given by Tukey's HSD in the context of this experiment and the anecdotal reports that prompted researchers to conduct the study. **(1 pt.)**