PSYC 2317: Statistical Methods for Psychology

1. An experimental psychologist records the time (in seconds) that a sample of seven rats requires to complete a standardized maze task. The recorded times are 20, 28, 23, 22, 18, 22, 21. Compute the mean, median, variance, and standard deviation for these data.

2. A set of exam scores has a mean of 64 and a standard deviation of 14. The instructor would like to transform the scores into a *standardized* distribution with a new mean of 75 and new standard deviation of 10. Find the *transformed* value for each of the following scores from the original population: 47, 54, 68, 85.

3. A normal distribution has a mean of $\mu = 52$ with $\sigma = 14$. What proportion of scores in this distribution are:

   (a) above 63?
   (b) below 70?
   (c) within 10 points of 52?
   (d) at least 10 points away from 52?

4. Data indicates that adolescent girls tend to experience a drop in self-esteem. To evaluate this result, a researcher obtains a sample of $N = 16$ adolescent girls, all 13 years old. A self-esteem measure is administered to each participant and the average score for the sample is $\overline{X} = 68$ with $SS = 2385$. It is known that the mean self-esteem score for the population of pre-teen girls is 75.

   (a) Compute a 95% confidence interval for μ, the population mean self-esteem score for 13-year old girls.
   (b) Compute Cohen's d to estimate the size of the described effect.
   (c) Perform a hypothesis test to decide whether the mean self-esteem score for adolescent girls is significantly different from the mean self-esteem score for pre-teen girls. Be sure to define $\mathcal{H}_0$ and $\mathcal{H}_1$, report the t-score and p-value, and state your decision about $\mathcal{H}_0$.
   (d) Compute and interpret a Bayes factor for the model (either $\mathcal{H}_0$ or $\mathcal{H}_1$) with the best predictive adequacy.
   (e) Compute and interpret the posterior model probability for the winning model chosen in part (d).

5. A sample of $N = 15$ individuals is selected from a population with a mean of 82. A treatment is administered to the individuals in the sample and, after treatment, the sample has a mean of $\overline{X} = 85$ and $SS = 154$.

   (a) Compute a 95% confidence interval for μ, the population mean for the treatment group.

   (b) Compute Cohen's d to estimate the size of the described effect.

   (c) Perform a hypothesis test to decide whether the population mean of the treatment group is significantly larger than the mean of the general population. Be sure to define $\mathcal{H}_0$ and $\mathcal{H}_1$, report the t-score and p-value, and state your decision about $\mathcal{H}_0$.

   (d) Compute and interpret a Bayes factor for the model (either $\mathcal{H}_0$ or $\mathcal{H}_1$) with the best predictive adequacy.

   (e) Compute and interpret the posterior model probability for the winning model chosen in part (d).

6. A researcher is investigating the effect of background noise on classroom performance for children aged 10 to 12. One class of $N = 15$ students who listens to calming music each day while working on arithmetic problems is chosen as the experimental group. Another class of $N = 15$ students serves as a control group with no music. Accuracy scores are measured for each child, and the average for students in the music condition is $\overline{X} = 86.4$ with $SS = 1550$. For the no-music condition, the average is $\overline{X} = 78.8$ with $SS = 1235$.

   (a) Compute a 95% confidence interval for $\mu_1 - \mu_2$, the population mean difference in accuracy scores.

   (b) Compute Cohen's d to estimate the size of the described effect.

   (c) Perform a hypothesis test to decide whether the population mean accuracy is significantly increased for students who listen to calming music during study compared to those who do not listen to music. Be sure to define $\mathcal{H}_0$ and $\mathcal{H}_1$, report the t-score and p-value, and state your decision about $\mathcal{H}_0$.

   (d) Compute and interpret a Bayes factor for the model (either $\mathcal{H}_0$ or $\mathcal{H}_1$) with the best predictive adequacy.

   (e) Compute and interpret the posterior model probability for the winning model chosen in part (d).