PSYC 5301: Research Methods

For each of the hypothesis testing problems below, you need to do the following: (1) explicitly define your null hypothesis $\mathcal{H}_0$ and alternative hypothesis $\mathcal{H}_1$; (2) calculate and report the observed t-score; (3) calculate and report the resulting Bayes factor; and (4) calculate and report the posterior probability of the "winning" model (i.e., the model which receives more support from the data).

1. A random sample of $N = 35$ individuals is selected from a population with a mean of 60, and a treatment is administered to each individual in the sample. After treatment, the sample mean is found to be $\overline{X} = 60.2$ with $SS = 296$. Based on the sample data, can we conclude that the treatment results in a meaningful score change?

2. To evaluate the effect of a treatment, a sample is obtained from a population with a mean of 20 and the treatment is administered to the individuals in the sample. After treatment, the sample mean is found to be $\overline{X} = 17.7$ with a standard deviation of $\hat{\sigma} = 3$.

   (a) If the sample consists of $N = 16$ individuals, are the data sufficient to conclude that the treatment decreases scores?

   (b) If the sample consists of $N = 36$ individuals, are the data sufficient to conclude that the treatment decreases scores?

   (c) Comparing your answers for parts (a) and (b), how does the size of the sample influence the size of the obtained Bayes factor?

3. A sample of $N = 9$ individuals participates in a repeated measures study that produces a sample mean difference of $\overline{X} = 4.25$ with $SS = 128$ for the difference scores. Is this mean difference large enough to be considered a real positive effect?

4. Two separate samples receive two different treatments. The first treatment group ($N = 15$) has a mean of 50 with $SS = 210$. The second treatment group ($N = 9$) has a mean of 56 with $SS = 190$. Does the second treatment result in larger scores than the first treatment?