Homework 4

Psychology 311

1. Suppose that, in a 5 group experiment in a 1-Way ANOVA design, the actual population means $\mu_1, \mu_2, \ldots \mu_5$ are $5, 6, 13, 14, 22$. The analysis of variance model posits a grand mean μ and treatment effects $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5$.

   (a) (10 points). List the actual values for μ and the 5 α's for this situation.

   (b) (10 points) Suppose that $\sigma = 10$. What is the sum of squared standardized effects, i.e.

   $$\sum_{j=1}^{a} \left(\frac{\alpha_j}{\sigma}\right)^2$$

   (c) (10 points). Using your result from part (a), derive the value of the noncentrality parameter λ assuming $n = 5$ per group.

   (d) (10 points). Using that value of λ, calculate the power in your design if $\alpha = 0.05$.

   (e) (10 points). All other things being equal, what sample size n per group would you need to employ to guarantee power of at least 0.90?

2. Suppose you perform a 1-Way ANOVA on 4 independent groups with $n = 13$ per group.

   (a) (5 points). What are the degrees of freedom for the F-test?

   (b) (15 points). Suppose that, in this design, you gather data and observe an F of 3.75. Construct a 90% confidence interval for λ, the noncentrality parameter of the noncentral F distribution.

   (c) (10 points). Equation 8 in the lecture slides on 1-Way Fixed Effects ANOVA gives the relationship between the $RMSSE$ (Root Mean Square Standardized Effect) and the the noncentrality parameter λ. This can be written

   $$RMSSE = \sqrt{\frac{\lambda}{n(a-1)}}$$

   where a is the number of groups in the design, and n is the sample size *per group*. Convert the confidence interval for λ from part (b) above into a confidence interval on the $RMSSE$.