

## Q SCI 482 Assignment 6 (100 points)

### Q1: Pain management through music (65 points)

A recent study examined the ability of music and audiobooks to reduce pain in children undergoing major surgical procedures (Sunith Suresh et al. 2015). In brief, children recovering from surgery were chosen randomly to receive one of three treatments: (1) listen to music, (2) listen to audiobooks, and (3) sat with noise-cancelling earphones. After 30 minutes, researchers asked the children to rate their pain using the 10 point FACES scale below:



1a) The resulting data from 30 children is contained in the file "6 ReducingPain.csv". Convert the data into long format data any way you wish, and upload the resulting long format data file

"6 ReducingPainLong.csv" to the assignment hand in page. (5 points)

1b) Using either the original data file or the long format data file, read the data into R and conduct a one-way ANOVA, the long way around, to determine if there are significant differences among the means of the three groups of children. Note the null and alternate hypotheses. Calculate and report the Groups SS, Total SS, and Error SS, and their corresponding degrees of freedom and mean squares; the test statistic; and the resulting  $p$ -value. (20 points)

1c) Run the ANOVA using the `aoV()` function, and report the groups MS, error MS, and  $p$ -value. (5 points)

1d) What do you conclude from running this test? (5 points)

1e) Run a Tukey multiple comparison test the long way around to determine which groups are significantly different. Report the difference in means, error MS, error DF, SE,  $q$  values, and  $p$  values. Use underlining and letters (a,b,c) to clearly outline which groups can be combined or separated. (20 points)

1f) Run a Tukey multiple comparison test the short way around. (5 points)

1g) What would you advise for hospitals taking care of children after surgery? (5 points)

### Q2: sample size required for desired power in ANOVA (35 points)

You are designing an experiment to test whether the travel time of salmon from an ocean fishery to each of four spawning streams differs. The idea is to catch salmon in the ocean fishery, implant acoustic tags in them, and release them. The acoustic tags will trigger a detector within each stream, giving the travel time. The location of the tagging event (which will happen on one day) is in a place where salmon from each stream are in equal abundance, so you can assume that the sample sizes will be equal for the four streams. Thus, the resulting data will consist of an equal number of travel time data points to each of four streams. You want to be able to detect a difference in travel time as small as 0.5 days from the longest travel time to the shortest

travel time, with a power of 0.9 at a significance level of 0.05. A previous study has estimated that the within-group variability in travel time (error MS) is 6.5 days.

2a) What is the total number of salmon that you need to tag with acoustic tags? Explain your workings, and do this the long way around. (30 points)

2b) Your total budget is \$100,000 for acoustic tags, and each tag costs \$25. Will you be able to complete the experiment with the desired power? (5 points).

### **References**

Sunitha Suresh, BS et al. (2015) The effect of audio therapy to treat postoperative pain in children undergoing major surgery: a randomized controlled trial. *Pediatrics Surgery International* 32(2): 197-201.