Psych 5741 / 5751: Data Analysis
University of Colorado @ Boulder
Gary McClelland & Charles Judd

PRACTICE PROBLEMS
One-Way ANOVA Contrast Code Problems

1. An advertising director tests the effectiveness of three types of ads: those with color pictures, those with black and white photos, and those with no pictures. Subjects rate each type of ad. Specify a contrast code to test picture vs. no picture and specify the other orthogonal contrast code. What does the other contrast code test?

2. A drug company wishes to test the side effects of a new drug. They used five groups: a control group which received no medication (C1), a control group which received an inert placebo (C2), a treatment group which received the regular formulation of Drug A (A1), another treatment group which received a buffered version of Drug A (A2), and a final treatment group which received a different Drug B which is presumed to have the same therapeutic effects as Drug A (B). Generate a set of contrast codes for groups C1, C2, A1, A2, and B to answer these questions:
   1. Do the drug groups differ from the control groups?
   2. Do the two control groups differ from each other?
   3. Do the Drug A groups differ from the Drug B group?
   4. Do the two formulations of Drug A differ from each other?

Verify that all of your contrast codes are orthogonal to each other.

3. Subjects are given some material to learn for 10 trials, with the independent variable intertrial interval (the interval between successive trials) being manipulated at intervals of 0 seconds (massed practice) and 20, 40, and 60 seconds (distributed or spaced practice). 80 subjects are randomly assigned to one of the four groups for a total of 20 subjects per group. Specify a code for testing the hypothesis that performance will steadily increase as the intertrial interval increases (linear trend). Specify another code that will test the hypothesis that performance will be better for the middle levels than for either extreme (quadratic trend). If you can, specify the third code that will complete the set of contrast codes (cubic trend), but you may need a table of orthogonal polynomials to find the third code.

4. Fifth-grade students representing five ethnic groups are compared in terms of school attitude. The five ethnic groups are Afro-Americans, Hispanics, Native Americans , Asian-Americans, and Whites. Generate any complete set of contrast codes which you believe would be appropriate for analyzing these data. Indicate the question asked by each code you generate.

5. Four different groups of subjects are asked to study a set of materials describing automobiles. One group (MEMORY) is told to prepare for a

memory test after the study period, another group (CHOOSE BEST) is told to prepare for choosing the best alternative after the study period, yet another group (CHOOSE WORST) is told to prepare for choosing the worst alternative, and a final group (RATE) is told to prepare for rating the desirability of each alternative. In fact, all groups are given a memory test after the study period. Generate an appropriate set of contrast codes for analyzing these data. Indicate the question asked by each code you generate.

6. No statistics course would be complete without an example from the field (pardon the pun) which generated so much of the early work on statistical methods. This example is from the classic textbook by Snedecor and Cochran. The field is agriculture....

An experiment on sugar beets compared times and methods of applying mixed artificial fertilizers. Yields were measured for the following conditions: no artificials; artificials applied in January by plowing; artificials applied in January with broadcast spreaders; and artificials applied in April with broadcast spreaders.

Generate contrast codes to test the following questions.

1. Do the artificials have an effect?
2. Are January applications better than April?
3. Given that fertilizer is applied in January, does method of application make a difference?

Show that the codes for these questions generate a complete set of orthogonal contrast codes.