PH245
Introduction to Multivariate Statistics
Homework Set 1

Due date: October 2, Monday

Problems: For each problem, please choose an appropriate test, state *why* you choose this test, then carry out the test, and state your conclusion. The significance level to use is 0.05. Ignore all other questions asked in the problems.

1. (6-17) The data "Data-HW1-Cognition.dat" were collected to test two psychological models of numerical cognition. Does the processing of numbers depend on the way the numbers are presented (words, Arabic digits)? Thirty-two subjects were required to make a series of quick numerical judgments about two numbers presented as either two number words ("two," "four") or two single Arabic digits ("2," "4"). The subjects were asked to respond "same" if the two numbers had the same numerical parity (both even or both odd) and "different" if the two numbers had a different parity (one even, one odd). Half of the subjects were assigned a block of Arabic digit trials, followed by a block of number word trials, and half of the subjects received the blocks of trials in the reverse order. Within each block, the order of "same" and "different" parity trials was randomized for each subject. For each of the four combinations of parity and format, the median reaction times for correct responses were recorded for each subject. Here

   X_1 = median reaction time for word format-different parity combination

   X_2 = median reaction time for word format-same parity combination

   X_3 = median reaction time for Arabic format-different parity combination

   X_4 = median reaction time for Arabic format-same parity combination

   Test for treatment effects.

2. (6-19) In the first phase of a study of the cost of transporting milk from farms to dairy plants, a survey was taken of firms engaged in milk transportation. Cost data on X_1 = fuel, X_2 = repair, and X_3 = capital, all measured on a per-mile basis, are presented in the data "Data-HW1-Transportation.dat" for $n_1 = 36$ gasoline and $n_2 = 23$ diesel trucks. Test for differences in the mean costs between the gasoline and diesel trucks.

3. (6-24) Researchers have suggested that a change in skull size over time is evidence of the interbreeding of a resident population with immigrant populations.

Four measurements were made of male Egyptian skulls for three different time periods: period 1 is 4000 B.C., period 2 is 3300 B.C., and period 3 is 1850 B.C. The data are recorded in "Data-HW1-Skull.dat". The measured variables are

X_1 = maximum breadth of skull (mm)

X_2 = base height of skull (mm)

X_3 = base length of skull (mm)

X_4 = nasal height of skull (mm)

Test for differences in skull size over different time periods.

4. (6-33) In one experiment involving remote sensing, the data "Data-HW1-Sensing.dat" record measurements on the variables

   X_1 = percent spectral reflectance at wavelength 560 nm (green)

   X_2 = percent spectral reflectance at wavelength no nm (near infrared)

   for three species (sitka spruce [SS], Japanese larch [JL), and lodgepole pine [LP]) of 1-year-old seedlings taken at three different times (Julian day 150 [1], Julian day 235 [2], and Julian day 320 [3]) during the growing season. The seedlings were all grown with the optimal level of nutrient. Test for a species effect, a time effect, and species-time interaction.

Policy: You must do the homework **on your own**. Please ask the Instructor or the GSI if you have any question.