Repeated Measures ANOVA and Correlation

Directions: Answer each question synthesizing the information from the notes, readings, and other resources. When appropriate, insert statistical output (and input if need be) to justify each of your answers. Answers to the questions must be word-processed using Word or other program like LaTeX or an Equation Editor (an object to be inserted within Word) for statistical/mathematical notation. Answers to the homework questions should appear on 8.5" x 11" paper (not computer output) and must be legible and free of grammatical errors. Students with clarifying questions about the homework should contact Dr. Harring directly. A point total for each question is provided at the end of each question. The total number of points for assignment 4 is 40.

Part I: RM-ANOVA

Jemmott et al. (1983) report a study investigating the effect of academic stress on immune function. Immune function was measured five times during the academic year: an initial low-stress period, three high-stress periods coinciding with major exams, a finally a low-stress period. Forty-seven first-year dental students served as participants. Each was identified as belonging to one of three personality types on the basis of responses to the Thematic Apperception Test, which was administered prior to the assessment of immune function. The three groups were an inhibited power syndrome (IPS) group, a relaxed affiliative syndrome (RAS) group, and a residual or control group (C) group. The dependent measure was the rate of secretion of salivary secretory immunoglobulin A (s-IgA), obtained at each of the five time points. Higher values of s-IgA secretion rate reflect stronger functioning of the immune system. The three major research hypotheses were to see if there was a time effect, a group effect, and a time by group interaction. If statistically significant results exist, post-hoc testing is advisable. Find the data in dataset **Immune.csv**. Initial tasks to complete…

(**Insert graphs and output from items a-c below at the beginning of your assignment**)

a. Graph the repeated measures with a spaghetti plot by personality type. This can be accomplished on the same graph (using a legend and different line type and point character to delineate between the groups) OR on three separate side-by-side graphs—one for each group.

b. Graph the means at each time point for each group on the same plot. If you have done this correctly, you should have three line graphs connecting the five means for that particular group.

c. Provide a covariance and correlation matrix among the 5 repeated measures by group.

Questions to answer…

1. What does the spaghetti plot(s) convey about the mean differences across time across the groups? From a visual inspection, do the variances at each time point seem approximately the same? Explain. Discuss what kind of trajectory would seem appropriate to describe the repeated measures? Is this trajectory the same for each group? Explain. (**5 pts**)

2. Based on the bivariate correlations between the time points, do you think the assumption of compound symmetry is plausible? Explain why or why not and be specific. Is the heuristic epsilon level discussed in the notes consistent with the pattern of correlations? Explain why or why not. (**3 pts**)

3. Write the specific statistical hypotheses for the three omnibus research questions of interest. (**3 pts**)

4. No matter how you answered 3, perform a RM-ANOVA (no correction) to test the omnibus hypotheses. What decision do you make about the omnibus null hypothesis for time and why do you make this decision (be careful to use the recommended method in reporting your results – see the notes)? Do the results of the omnibus null hypothesis for time leave any ambiguity? Explain why or why not. (**5 pts**)

5. What decision do you make about the omnibus null hypothesis for time-by-group interaction and why do you make this decision? Based on the between-subjects results, what decision do you make concerning the omnibus null hypothesis for group and why do you make this decision? (**6 pts**)

6. Perform a set of post-hoc orthogonal polynomial contrasts for time AND the time-by-group interaction. Which contrasts are statistically significant for each effect? Use the recommended reporting template to report the results. Use the interaction plot generated above to interpret both of these effects (use variable names in your description). (**8 pts**)

Part II: Correlation

Sir Cyril Burt (1883–1971) studied heredity by fitting statistical models to predict IQs of identical twins raised in foster homes (FostIQ) and IQs of siblings raised in the biological parent's homes (OwnIQ). Over a 20-year period, he accrued data from 53 pairs of separated twins. This data set is available in IQdata.csv.

1. Produce a scatterplot of the two IQ scores with meaningful axes labels. Describe the bivariate relation in words. (**1 pts**)

2. Use the software to compute the Pearson's correlation between the two IQ scores. Interpret this value. (**1 pt**)

3. At the $\alpha = 0.01$ significance level, test whether the correlation is significantly different from 0 using the t-test. Write out the statistical null and alternative hypotheses; report your test statistic, p-value, and write a conclusion in the context of the problem. (**3 pts**)

4. We might consider $\rho = 0.7$ as an indication of strong positive association between two variables. Conduct a statistical test using the *z*-test (based on Fisher's r-to-z transform) at $\alpha = 0.01$ to determine if the correlation between the two IQ scores is strong. (**3 pts**)

5. Using the set-up in question 4, construct a 99% confidence interval for the true value of ρ and interpret this interval. (**2 pts**)