Stat 242 Final Exam Dec 02

For questions #1 - #4: (a) Present the schema for each design and (b) write the Sources of Variance (SV) and numerical df. In addition, (c) write the Expected Mean Squares (EMS)for each SV, indicating the appropriate error term for each SV. Note that each question also has a part (d), which is described below.

1. Thirty-one school children are tested. Their reading ability is measured a total of six times: 3 times in the child's first year of reading instruction (Grade 1) and 3 times in the same child's second year (Grade 2). (d) When you apply Mauchly's test, what data in this design are relevant? (That is, how is the sphericity assumption for this particular design tested?) If the assumption is not supported, what course of action is recommended?

2. After drawing the general schema showing subjects and items together in the same diagram, analyze the following design once as a subjects-analysis and once as an items-analysis: The same children are tested for their arithmetic ability in Addition, Subtraction, Multiplication, and Division (AI, A2, A3, A4). In each of the 4 areas, there are 21 different age-appropriate arithmetic problems (i.e., 21 Addition problems, 21, Subtraction, etc.). Sixty-one children are tested. Test for a main effect of A (Type of Arithmetic). (d) Assume that the effect of Type of Arithmetic is significant. What specific information could a follow-up post-hoc test give you about the results? (Consider separate post-hoc tests for subjects and for items and specify whether the error terms in each would be global, local, or pooled.)

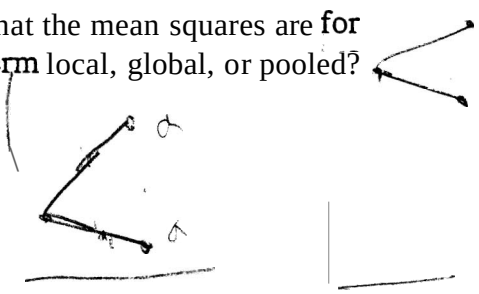
3. Three arthritis drugs are tested (AI, A2, A3). Twenty-one subjects are measured for pain-relief in each group. Before the study begins, a covariate control measure (pre-experiment pain) is taken for each subject, before subjects are randomly assigned to a drug group. (d) Draw a graph illustrating an apparently significant drug effect together with a satisfactory homogeneity of regression outcome for this study. (Only one graph required). How would you test for homogeneity of regression? What is the purpose of getting the covariate measure?

4. The following study of music preference asked participants to rate their liking for Music Types AI, A2, A3, A4. It was designed as a Latin Square (in order to counterbalance the presentation order of Type of Music) but analyzed as a Mixed Factorial (in which the order of presentation - first, second, third, fourth - was ignored). The DV is a preference rating from 1 - 10. There were 44 participants. In groups of 11 each, they were randomly assigned to one of four different sequences of presentation order for A1 - A4. Present two schemas: one for the Latin Square (which includes presentation order) and one for the factorial (which ignores presentation order). However, present the SV, df, and EMS for the factorial only. (For extra credit, present the SV of the Latin Square). (d) Draw a graph of the outcome of the study (showing all IVs) in which the only significant result is Music Type.

5. a. Draw a graph of a 2 x 2 x 2 factorial design outcome in which the only significant IVs are A, C, and AB.

b. Assume that the factorial design in the first part of this question (5.a) is a mixed design in which B and Care within-Ss IVs. If you do a simple main effect test (e.g., post-hoc) on the significant AB interaction, specifically on the effect of Bat Al ' indicate symbolically what the mean squares are for the F-tests. That is, what is the numerator of the F-test and is the error term local, global, or pooled?

no B
no BC
no AC
no ABC.



For all questions: (a) Present the schema (layollt) for each design, write (b) the Sources of Variance, SV, (c) numerical df, and (d) the appropriate error term for each SV (e.g., $MS_A/MS_{S/A}$). Note that each question also has an additional part, (e), which is described below.

1. Concern over student alcohol abuse at a university led to the introduction of an intensive alcohol-information campaign. In order to see if the campaign had any effect on students' behavior, 21 students were randomly sampled from each combination of Gender (MIF) and Year (Freshman/Senior) for a total of 84. Each student:s alcohol use, was assessed on two occasions (Time): before the campaign began and after the campaign had run for three months. (e) Draw a graph of the results of this 2 x 2 x 2 factorial experiment such that there is: 1. a significant three-way interaction, 2. *no* significant Gender main effect and a *significant* Time effect, and 3. *any* other pattern of significances you wish. Briefly interpret your graph.

2. Thirty-one school children are tested. Each child's reading ability is measured a total of six times: 3 times in the child's first year of reading instruction (Grade 1) and 3 times in the same child-'s second year (Grade 2). (e) Specifically for this example, what data in this design are relevant for assessing the sphericity assumption? How would you know if the sphericity assumption was acc·eptable? If the assumption is not supported, what course of action is recommended?

3. Three arthritis drugs are tested (AI, A2, A3). Twenty-one subjects are measured for pain-relief in each group. Before the study begins, a covariate control measure (pre-experiment pain) is taken for each subject, before subjects are randomly assigned to a drug group. (e) Draw a graph illustrating an apparently significant drug effect together with satisfactory homogeneity of regression for this study. (Only one graph required).

4. The same children are tested for their arithmetic ability in 4 types of arithmetic: Addition, Subtraction, Multiplication, and Division (i.e., AI, A2, A3, A4). [The order of treatments A1 - A4 was *not* counterbalanced; counterbalancing is not of interest in this question]. For each of the 4 types of arithmetic, there are 10 different arithmetic items (i.e., 10 Addition items, 10, Subtraction, etc.). The independent variable Problems (i.e., Items), is a random-effect independent variable. Thirty-one children are tested. Test for a main effect of A (Type of Arithmetic). First draw the general layout for this design showing both subjects and items in the same layout. Then draw two separate layouts, one for a subjects-analysis and another for an items-analysis. Then answer parts (b), (c), and (d) for each of the two analyses, separately - once for the subjects-analysis and once for the items analysis. (e) Assume that the effect of Type of Arithmetic is significant. What kind of follow-up post-hoc test is most appropriate? What information could it provide?

5. The following study of music preference asked participants to rate their liking for each of the four Music Types B1, B2, B3, B4. It was designed as a Latin Square (in order to counterbalance the presentation order of Type of Music) but analyzed as a Mixed Factorial (in which the order of presentation - first, second, third, fourth - was ignored and Sequence was treated as a Between-Ss IV: factor A). The DV is a music-preference rating from 1-10. There were 44 participants. In' groups of 11 each, they were randomly assigned to one of four different Sequences of presentation order for the treatment levels B1 - B4. Present two schemas [part (a)]: one for the Latin Square design (which includes presentation order and sequence as well as factor B) and one for the factorial design (which ignores presentation order). However, present the SV, df, and F-tests [parts (b), (c), (d)] *only* for the factorial design. (e) Draw a graph of the outcome of the factorial design (showing Sequence and Music Type) in which the only significant result is Music Type.

For all questions: (a) Present the tree (schema) for each design, write (b) the Sources of Variance, SV, (c) numerical df, (d) the expected mean squares (EMS) and (e) the appropriate error term for each SV (e.g., MSA/MS$_{S/A}$). Note that each question also has an additional unique part, (f).

1. Three programs for treating mentally ill children are compared on the cost for their treatment. Children were randomly assigned to programs (one program per child). For each program, you randomly assigned 31 boys and 31 girls because you wanted to study the effect of Gender on cost, as well as Program. Three types of costs are recorded for each child: psychiatric, medical (non-psychiatric), and social services. (f) What data would you use to assess compound symmetry? Speculate (briefly) on the likelihood of achieving satisfactory compound symmetry with these DVs.
2. You want to compare the effectiveness of two programs of instruction in arithmetic. Twenty-one boys and 21 girls are randomly assigned to each program. (Only one program per child). Each child's math ability is measured a total of six times: 3 times in the child's fITst year of arithmetic instruction (Grade 1) and 3 times in the same child's second year (Grade 2).Thus, you want to assess the four factors of Program-of-Instruction, Gender, Grade, and Time-of-Test (Le., 3 test times during the school year) **NOTE**: Provide EMS **only** for all those SV that contain Time-of-Test (Le., the main effect of Time-of-Test and its crossings and nestings). (f) The results showed significant effects only for the main effects of Gender, Grade and Time-of-Test, and the interaction of Gr,ade x Time-of-Test. Show *plausible* results for these significant SV by drawing one or two graphs. Important: because no significant effects were found that involved Program, you may completely ignore that factor in the graphs; consider the graphs to involve only the three factors that had some effect: Gender, Grade, and Time-of-Test.
3. Two medications for treating chronic pain and a no-drug control group are compared to each other. Thirty-one patients are randomly assigned to one of the medications or to the control group (93 patients in total). After taking the medication, patients rate their amount of pain on a scale of 0 (no pain) to 7 (severe pain). Before the medication is given, a covariate control me.asure (pre-medication pain) is also taken for each subject, before subjects were randomly assigned. (f) Draw a graph that illustrates an apparently significant effect of medication together with satisfactory homogeneity of regression for this study. (Only one graph required).
4. Men and women at a large New England university are compared on how certain types of music appeal to them. Three music genres are studied: Rap, Country, and Rock. Within each of these types of music, 6 examples of each are played for all subjects. (Each example is a single recording by a different prominent musician in that genre). Each subject rates each of the 18 recordings on a scale of 0 to 7. You want to detennine if there are different preferences for the three types of music and if the pattern of preference differs for men and women. 51 men and 51 women are studied. NOTE: Do *not* be concerned about counterbalancing; this is not a Latin square design. (fa) Now present the design tree and its Sources of Variance for an analysis that ignores recordings (i.e., that averages over recordings to produce a Subjects-analysis) and (fb) present the design tree and its Sources of Variance for an Items-analysis that ignores subjects. NOTE: Only the design tree and SV are needed for part (f).
5. You wish to test the reading ability of 30 children in the second grade. Each child reads three books of equal length: a book about sports (AI), a book about friendship (A2), and a book about pets (A3). You measure the amount of time it takes each child to complete each book. The sequence of books is counterbalanced across children; your analysis needs to take that into account. (Of course, each child reads each book only once). (d) No EMS are required in your answer. Instead discuss the experimental reasons for needing to counterbalance. (f) Reanalyze this using a factorial design in which you ignore the effect of the order of reading a book (first, second, third) on reading time. Only a tree and SV are needed for this answer.

For all questions except #5: (a) Present the tree (schema) for each design, write (b) the Sources of Variance, SV, (c) numerical df, and (d) the appropriate error term for each SV (e.g., $MSAIMS_{S/A}$). Note that each question also has an additional unique part, (e).

1. Three different supplementary textbooks are randomly assigned to a large Introductory Psychology class. 31 students get Textbook1, 31 get Textbook2, and 31 get Textbook3. As a covariate control, you get a measure of each student's knowledge of psychology before taking this course by administering a quiz on the first day of class. At the end of the course, you compare the 3 groups on their final grade (e.g., the number of points out of 100), adjusting for the covariate. (f) Draw a graph that illustrates an apparently significant effect of Textbook together with satisfactory homogeneity of regression. (Only one graph required).
2. Forty-four elderly men and 44 elderly women who are suffering from arthritis pain are available for studying the effectiveness of 3 drugs. Subjects are first categorized by gender (as just described) and then are randomly assigned to one of four groups: No-Drug Control, Drug1, Drug2, or Drug3. Each subject's severity-of-symptom score is recorded three times: once before treatment, once the day after treatment, and finally, one week after treatment. (e) What do the data need to look like in order for sphericity to be assumed? (A brief verbal description of sphericity for these data is sufficient).
3. You compared the effectiveness of two management-training programs. Twenty-one people with a B.A. degree and 21 people with a M.S. degree were randomly assigned within each program. Each person was evaluated for "effectiveness" a total of six times. Evaluation scores were on a 7-point scale, high scores being better. The six evaluations occurred as follows: 3 times (Fall, Winter, Spring) in each person's first year after training (Year 1) and the same 3 times (Fall, Winter, Spring) in the person's second year (Year 2). Thus, you want to assess four factors: (A) Type-of-Management-Training Program, (B) University Degree, (C) Year-of-Test and (D) Time-of-Test. (e) The results showed significant effects only for the main effects of Program, Year, and Time-of-Test, and the interaction of Program x Year. Show *plausible* results for these significant SV by drawing one or two graphs. Important: because no significant effects were found that involved Degree, you may completely ignore that factor in the graphs (although not in the SV, etc.); consider the graphs to involve only the three factors that had some effect: Program, Year, and Time-of-Test.
4. Who is the funnier comedian to octogenarians: John Stewart or Chris Rock? You randomly select 5 John Stewart excerpts (each about 15-minutes in length) from his recorded performances and you do the same for Chris Rock. The 5 excerpts for each comedian are sampled from a much larger population of such excerpts and are intended to be representative of that larger population. Each elderly subject sees only one excerpt. After viewing the excerpt, the subject rates the comedian on a 7-point scale. In total, there are 110 subjects in the entire experiment. (e) How *might* you gain additional power for the F-test, if the outcome is felicitous enough to allow it?
5. Consider the design in the previous question. Change that design by requiring each subject to view and rate all 10 excerpts (i.e., all five for Stewart and all 5 for Rock). (a) Present the schema for the full design but do *not* present the SV for this tree. Instead, (questions b,c, d:) present the SV, df, and error terms for a **Subjects** analysis and then the SV, df, and error terms for an **Items** analysis. (e) Write the Expected Mean Squares (EMS) next to each SV in the Ss and Items analyses. Note: Do *not* be concerned about counterbalancing treatments in either the design or the analysis; ignore counterbalancing considerations. Also, you are *not* asked to calculate minF', merely to calculate F1 and F2, separately.