Review Guide for Exam 4

Note: This study guide is NOT A COMPREHENSIVE list of topics on the exam. This guide is meant to frame your studying for Exam 4. As you are reviewing the lectures, practice problems, and chapter readings, be sure that you are comfortable with these topics.

Chapter 15 – Introduction to ANOVA

- **Define sampling distribution of F and specify its characteristics**
  - Allows us to make one overall comparison that tells us whether there is a significant difference between the means of groups
  - Avoids the problem of increased Type 1 error
  - Can be used with both independent/repeated measures designs
  - Can be used when there are one or more independent variables in the same experiment
  - Uses variance. Ratio of two independent variance estimates of the same population variance of o2
  - Sampling distribution: gives all possible F values along with probability of obtaining these values assuming that sampling is random
  - Degrees of freedom for numerator and denominator
- **Specify null and alternative hypotheses for one-way, independent groups ANOVA**
  - Alternative hypothesis is always non directional
- **Solve problems using one-way ANOVA**
- **Make appropriate conclusions about group differences**
  - Larger effects of IV: more differences between sample means, larger SSb, larger sb2
- **Understand derivation of MS_{within} and $MS_{between}$**
  - Total variability → between groups/within groups Sum of Squares → between/within groups Variance estimate → F ratio
- **Specify assumptions underlying one-way ANOVA**
  - Only the mean is affected by the independent variable, not the variance
  - F increases with the effect of the independent variable
  - The populations from which the samples were taken are normally distributed
  - The samples are drawn from populations of equal variance → homogeneity of variance
- **Explain why H_1 in one-way ANOVA is always nondirectional and why we evaluate it with a one-tailed evaluation**
  - The deviation of each individual score from the grand mean is made up of: the deviation from the individual score to the group mean and the deviation of the group mean to the grand mean
- **Calculate size of effect for a one-way ANOVA using eta squared and omega squared, and explain the difference between the values obtained by each**
  - Eta squared: estimate of proportion of variability in Y accounted for by X. Similar to omega squared. Provides biased estimate that overestimates the true size of effect because it underestimates population variance

    - Omega squared: corrects for bias. Accounted for by the independent variable. 0.01-0.05 is small effect, 0.06-0.13 is medium effect, larger than 0.14 is large effect

- **Specify how power using one-way ANOVA varies with changes in N, size of the real effect, and sample variability**
    - Power varies directly with N
    - Power varies directly with size of real effect of independent variable
    - Power varies inversely with sample variability
- **Specify the difference between planned and post hoc comparisons; specify which is more powerful and why**
    - Planned: do not correct for high probability of Type 1 error. Can use the t test for independent groups.
    - Post hoc: must correct for higher probability of Type 1 error
- **Do multiple comparisons using planned comparisons**
- **Do multiple comparisons using the Tukey HSD**

Chapter 16 – Introduction to Two-Way ANOVA

- **Define factorial experiment, main effect, and interaction effect**
    - Factorial experiment: experiment in which the effect of two or more factors are tested
    - Main effect: effect of one factor independent from the effect of the other
    - Interaction effect: effect of one factor different at different levels of the other factor
- **Correctly interpret graphs showing no effect, and various combinations of main and interaction effects**
    - Parallel lines mean no interaction effect
- **Understand the partitioning of SS_{total} into its 4 components, the formation of variance estimates, and the formation of the three F ratios**
    - Sw2: within cells variance estimate. Not sensitive to the effects of the IV's
    - Sr2: row variance estimate. Sensitive to the effect of variable A
    - Sc2: column variance estimate. Sensitive to the effect of variable B
    - Src2: row x column variance estimate. Sensitive to effects of variables A and B
- **Solve problems involving two-way ANOVA**
- **Specify assumptions underlying two-way ANOVA**
    - The populations from which the samples are taken are normally distributed
    - The population variances for each of the cells are equal (homogeneity of variance)
- **Make appropriate conclusions about main effects and interaction effect**

Chapter 17 – Chi-Square and Other Non-Parametric Tests

- **Specify the distinction between parametric and nonparametric tests, and when to use each**
    - Parametric: depends on characteristics of population. Use whenever possible
    - Nonparametric: minimally depends on characteristics of population. Use when assumption of parametric test is extremely violated.

- **Specify the level of variable scaling that chi-square requires for its use; understand that chi-square uses sample frequencies and predicts to population proportions**
    - Nominal data, determine whether two categorical variables are independent or related, can be used with nominal, ordinal, interval, or ratio data.
    - Family of curves that vary with degrees of freedom, which are determined by the number of fo scores that are free to vary
- **Define and create a contingency table**
- **Specify the H_1 and H_0 for chi-square and Wilcoxon match-pairs signed ranks analyses**
    - Null: proportions are equal
- **Understand that chi-square basically computes the difference between expected vs. obtained frequencies, and the larger this difference, the more likely we can reject H_0**
- **Solve problems using chi-square, and specify the assumptions underlying this test**
    - There is independence between each observation in the contingency table
    - The sample size must be large enough so that the expected frequency for each cell is at least 5
    - X2 can be used with nominal, ordinal, interval, or ratio data
- **Solve problems using the Wilcoxon match-pairs signed ranks test, and specify the assumptions underlying this test**
    - Used with correlated groups design
    - Data should be at least in ordinal scaling
    - More powerful than the sign test, less powerful than t test for correlated groups
    - If t test for correlated groups cannot be used due to an assumption violation, use this test
    - The magnitude of the difference scores must be at least ordinal so that the difference scores can be rank-ordered
- **Specify the parametric test that is substituted for by each respective non-parametric test (chi-square, Wilcoxon match-pairs signed ranks, Mann-Whitney U test, and Kruskal-Wallis test)**
    - Chi-square: t test
    - Wilcoxon match-pairs: t test for correlated groups
    - Mann-Whitney U test: t test for independent groups
    - Kruskal- Wallis test: one way ANOVA

(Chapter 18 – Review of Inferential Statistics)