**Part I: Basic Concepts (10 points)**

Match the following 10 items with the best options. Each option can be used more than once and multiple options may be correct. Fill the letters in the parentheses.

(A, G) 1. Type I error

(A, B) 2. Effect coding

(C) 3. Effect size for the *t*-test for two independent samples

(E) 4. Assumption of ANCOVA

(L, F) 5. Within-subjects design

(I) 6. Sobel test

(L) 7. A priori power analysis

(O) 8. Interaction Effect

(N) 9. Random Effect

(O) 10. Compound Symmetry

Options:

(A) Erroneously retaining the null hypothesis.

(B) Assuming that covariances decrease with increasing distance between measurement occasions.

(C) Computes the sample size given the significance level, desired power, and effect size.

(D) The combined occurrence of an effect.

(E) 𝑓2 computed as the multiple 𝑅2 coefficient divided by the unexplained variability (1 – 𝑅2).

(F) Used to ensure that the model intercept reflects the grand mean of all groups.

(G) Erroneously rejecting the null hypothesis.

(H) Assuming constant covariances across measurement occasions.

(I) A procedure to evaluate the presence of a mediation effect.

(J) Assuming constant variance across measurement occasions.

(K) Cohen’s *d* computed as the mean difference divided by the pooled standard deviation.

(L) Homogeneity of regression slopes.

(M) An example for repeated measurements over time.

(N) A variable where factor levels constitute a random sample of a larger pool of possible levels.

(O) Tests the presence of moderation.

**Part II: Applications in R and G\*Power (20 points)**

Use the dataset yourname.csv from the second assignment to answer the questions below. You can compute the depression sum scores for each measurement point (i.e., the variables depr\_t1, depr\_t2, and depr\_t3) using the following R code

mydata$depr\_t1 <- rowSums(mydata[c("v1\_t1", "v2\_t1", "v3\_t1", "v4\_t1", "v5\_t1")])

mydata$depr\_t2 <- rowSums(mydata[c("v1\_t2", "v2\_t2", "v3\_t2", "v4\_t2", "v5\_t2")])

mydata$depr\_t3 <- rowSums(mydata[c("v1\_t3", "v2\_t3", "v3\_t3", "v4\_t3", "v5\_t3")])

When answering the questions, show the relevant R code and the R output.

1. Reshape the dataset from wide into long format and run a repeated measurement ANOVA assuming compound symmetry and a second ANOVA assuming an autoregressive structure of the variance-covariance matrix. Select an appropriate model using the AIC and the BIC. Which model is superior? (4 points)

Answer: Preferred model is wide format.

2. Run a repeated measurement ANOVA assuming an unstructured variance-covariance matrix and compare this model with the one selected in Question 1 using both, AIC and BIC and the likelihood-ratio test. Which model is preferred? (2 points)

Answer: AIC is recommended, because **AIC** chooses a larger model than **BIC.**

3. Plot the individual trajectories of depressive symptomology across measurement occasions using a scatterplot. Use two separate plots for the control and the treatment group. Please use the following specifications for the two scatterplots: The *x*-axis should give the three measurement occasions labeled with “Baseline”, “6 Months”, and “12 Months”. The *y*-axis should give the sum scores labeled with “Depression Score”. The title of the plot should specify the study group (“Control Group”, “Treatment Group”). (4 points)

4. Extend the model found in Question 2 including the variable treat and evaluate whether depressive symptomology develops differently for the two study groups. Are there significant effects? (2 points)

5. Evaluate whether a mediation effect exists for the stress management training and the observed change in depressive symptoms. That is, use the variable treat as the predictor, 6 months depression (depr\_t2) as mediator, and 12 months depression (depr\_t3) as outcome. Use a 95% bootstrap confidence interval (with 500 re-samples) for the indirect effect to test the presence of a significant mediation effect (4 points).

6. Assume that you want to design an empirical study in which means of two groups should be compared using a *t*-test for independent samples. Further, assume that prior research suggested a (according to Cohen’s effect size convention) medium effect size between the two groups. Calculate the necessary sample size (assuming a sample size ratio N2/N1 = 1) for a one-sided test, α = 0.05, and a power of 0.8 using G\*Power. Repeat the calculation for small and large effect sizes. Which relation between necessary sample sizes per group and hypothesized effect sizes do you observe? (4 points).