SPSS Test Practice Problem 1 **2 way Mixed ANOVA** **ANSWER KEY**

Which factor is within subjects? ____stress management technique_____

Which factor is between subjects? __personality____

PART A Assumptions

Explain why Mauchly's test of sphericity was tested in this example.

___because the within-subjects factor had 3 levels_____

W value	prob	signif (y/n)	assumption holds true (y/n)
1.00	.965	n	y

To test for HOV, look at the Levene's test results:

	F value	prob	signif (y/n)	assumption holds true (y/n)
meditation	1.35	.260	n	y
PMR	.034	.856	n	y
kickboxing	1.04	.322	n	y

PART B Inferential Statistics

Effect tested	df , df	F value	Sig value	Partial eta sq	Signif? y/n
main effect personality	1, 18	.56	.464	.030	n
main effect of technique	2, 36	.11	.895	.006	n
personality x technique	2, 36	23.48	<.001	.566	y

Write down all 3 effects using correct APA statistical notation format.

main effect of personality	$F(1,18) = .56$, $p > .05$, $\eta_p^2 = .030$
main effect of technique	$F(2,36) = .11$, $p >. 05$, $\eta_p^2 = .006$
personality X technique	$F(2,36) = 23.48$, $p < .001$, $\eta_p^2 = .566$

PART C Post hoc tests

Was a post hoc test on the within-subjects factor necessary? Explain why or why not.

A post hoc test was NOT necessary because although the within-subjects factor (technique) had more than two levels, the main effect was not significant.

Was a post hoc test necessary for the between-subjects factor? Explain your answer.

A post hoc test for the between-subjects factor (personality) was not necessary because it has only two levels (It needed to have at least three) and the main effect was not significant.

PART D Understanding the Interaction Effect

Simple main effect of stress management technique within personality

Describe the effect of technique for the extraverted participants and indicate whether it is significant.

SC for meditation was 2.4 points higher than PMR (which is not sig), and 11.3 points higher than kickboxing. (which is sig); SC for PMR was 8.9 points higher than kickboxing (which is sig).

Describe the effect of technique for the introverted participants and indicate whether it is significant.

SC for Meditation was .9 points lower than PMR (which is not sig), and 10.1 points lower than kickboxing. (which is sig); SC for PMR was 9.2 points lower than kickboxing (which is sig).

Is the effect of the technique the same for extraverts and introverts? To look for a pattern change, calculate the difference between the means for the three techniques for extraverts. Then calculate the difference between the means for the three techniques introverts**. Note: the differences between the means do not have to appear here, as long as they appear somewhere.**

No. The effect of technique on SC is *probably* different for extraverts and introverts. Extraverts' SC was highest to meditation, and lowest to kickboxing. Introverts' SC was highest to kickboxing, and lowest to meditation. For both extraverts and introverts, SC to PMR was in the middle.

Simple main effect of personality within stress management technique

Describe the effect of personality when meditating and indicate whether it is significant.

Extraverts' SC was 9.3 points higher than introverts – which is sig

Describe the effect of personality when using PMR and indicate whether it is significant.

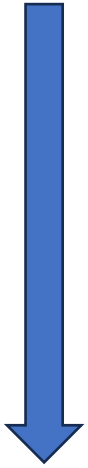
Extraverts' SC was 6.0 points higher than introverts – which is sig

Describe the effect of personality when kickboxing and indicate whether it is significant.

Introverts' SC was 12.1 points higher than extraverts - which is sig

Is the effect of personality the same for meditating, PMR, and kickboxing? To look for a pattern change, calculate the difference between the means for extraverts and introverts when meditating. Next, calculate the difference between the means for extraverts and introverts when using PMR**.** Finally, calculate the difference between the means for extraverts and introverts when kickboxing. **Note: the differences between the means do not have to appear here, as long as they appear somewhere.**

No. The effect of personality on SC is *probably* different for the three techniques. Introverts' SC was much higher for kickboxing compared to extraverts' SC. Extraverts' SC was much higher to meditation compared to introverts' SC. PMR was is the middle, but extraverts' SC was higher than introverts' SC.



Mauchly's Test of Sphericity[a]

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b] Greenhouse-Geisser	Epsilon[b] Huynh-Feldt	Epsilon[b] Lower-bound
technique	.996	.072	2	.965	.996	1.000	.500

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept + personality
Within Subjects Design: technique

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
technique	Sphericity Assumed	6.300	2	3.150	.111	.895	.006	.223	.066
	Greenhouse-Geisser	6.300	1.992	3.163	.111	.894	.006	.222	.066
	Huynh-Feldt	6.300	2.000	3.150	.111	.895	.006	.223	.066
	Lower-bound	6.300	1.000	6.300	.111	.742	.006	.111	.062
technique * personality	Sphericity Assumed	1327.433	2	663.717	23.481	<.001	.566	46.961	1.000
	Greenhouse-Geisser	1327.433	1.992	666.518	23.481	<.001	.566	46.764	1.000
	Huynh-Feldt	1327.433	2.000	663.717	23.481	<.001	.566	46.961	1.000
	Lower-bound	1327.433	1.000	1327.433	23.481	<.001	.566	23.481	.996
Error(technique)	Sphericity Assumed	1017.600	36	28.267					
	Greenhouse-Geisser	1017.600	35.849	28.386					
	Huynh-Feldt	1017.600	36.000	28.267					
	Lower-bound	1017.600	18.000	56.533					

a. Computed using alpha = .05

Levene's Test of Equality of Error Variances[a]

		Levene Statistic	df1	df2	Sig.[b]
meditation	Based on Mean	1.352	1	18	.260
	Based on Median	.758	1	18	.396
	Based on Median and with adjusted df	.758	1	12.320	.401
	Based on trimmed mean	1.268	1	18	.275
PMR	Based on Mean	.034	1	18	.856
	Based on Median	.025	1	18	.875
	Based on Median and with adjusted df	.025	1	17.756	.876
	Based on trimmed mean	.031	1	18	.862
kickboxing	Based on Mean	1.037	1	18	.322
	Based on Median	.971	1	18	.337
	Based on Median and with adjusted df	.971	1	14.661	.340
	Based on trimmed mean	1.019	1	18	.326

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + personality
Within Subjects Design: technique

b. Confidence Interval: 0%

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Intercept	13862.400	1	13862.400	454.339	<.001	.962	454.339	1.000
personality	17.067	1	17.067	.559	.464	.030	.559	.109
Error	549.200	18	30.511					

a. Computed using alpha = .05

1. technique Main Effect of Technique

Estimates

Measure: MEASURE_1

technique	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	15.650	1.278	12.965	18.335
2	14.900	1.159	12.464	17.336
3	15.050	1.172	12.587	17.513

Pairwise Comparisons

Measure: MEASURE_1

(I) technique	(J) technique	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	.750	1.661	.657	-2.740	4.240
	3	.600	1.734	.733	-3.044	4.244
2	1	-.750	1.661	.657	-4.240	2.740
	3	-.150	1.647	.928	-3.610	3.310
3	1	-.600	1.734	.733	-4.244	3.044
	2	.150	1.647	.928	-3.310	3.610

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

2. personality * technique SME of personality within technique

Estimates

Measure: MEASURE_1

personality	technique	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
extravert	1	20.300	1.808	16.502	24.098
	2	17.900	1.639	14.456	21.344
	3	9.000	1.658	5.516	12.484
introvert	1	11.000	1.808	7.202	14.798
	2	11.900	1.639	8.456	15.344
	3	21.100	1.658	17.616	24.584

Pairwise Comparisons

Measure: MEASURE_1

technique	(I) personality	(J) personality	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b] Lower Bound	95% Confidence Interval for Difference[b] Upper Bound
1	extravert	introvert	9.300*	2.556	.002	3.930	14.670
	introvert	extravert	-9.300*	2.556	.002	-14.670	-3.930
2	extravert	introvert	6.000*	2.319	.019	1.129	10.871
	introvert	extravert	-6.000*	2.319	.019	-10.871	-1.129
3	extravert	introvert	-12.100*	2.345	<.001	-17.027	-7.173
	introvert	extravert	12.100*	2.345	<.001	7.173	17.027

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

3. personality * technique SME of technique within personality

Estimates

Measure: MEASURE_1

personality	technique	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
extravert	1	20.300	1.808	16.502	24.098
	2	17.900	1.639	14.456	21.344
	3	9.000	1.658	5.516	12.484
introvert	1	11.000	1.808	7.202	14.798
	2	11.900	1.639	8.456	15.344
	3	21.100	1.658	17.616	24.584

Pairwise Comparisons

Measure: MEASURE_1

personality	(I) technique	(J) technique	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b] Lower Bound	95% Confidence Interval for Difference[b] Upper Bound
extravert	1	2	2.400	2.349	.320	-2.535	7.335
		3	11.300*	2.453	<.001	6.147	16.453
	2	1	-2.400	2.349	.320	-7.335	2.535
		3	8.900*	2.329	.001	4.007	13.793
	3	1	-11.300*	2.453	<.001	-16.453	-6.147
		2	-8.900*	2.329	.001	-13.793	-4.007
introvert	1	2	-.900	2.349	.706	-5.835	4.035
		3	-10.100*	2.453	<.001	-15.253	-4.947
	2	1	.900	2.349	.706	-4.035	5.835
		3	-9.200*	2.329	<.001	-14.093	-4.307
	3	1	10.100*	2.453	<.001	4.947	15.253
		2	9.200*	2.329	<.001	4.307	14.093

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Profile Plots

