

PRIFYSGOL BANGOR  
BANGOR UNIVERSITY

Arholiadau Diwedd Semester II 2012/2013  
End of Semester II Examinations 2012/2013

Amser a ganiateir : 1.5 awr  
Time allowed : 1.5 hours

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**PHP4006**

**ADVANCED STATISTICS**

Please answer **THREE** questions

Questions are each worth 25 marks.

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(Answer **THREE** questions. Spend approximately **30 minutes** on each question)

1. You are planning a study of the effectiveness of two therapies for treating Post-Traumatic Stress Disorder (PTSD). Group A will receive the typical psychotherapy along with a placebo pill. Those in Group B will receive the drug MDMA alongside the typical psychotherapy. Participants are randomly assigned to one of the therapy groups. A measure of PTSD symptoms is collected at baseline and following the treatment. You are trying to decide if the new MDMA-assisted psychotherapy is more effective than the current approach.
  - a) State the **name and** design of the statistical test you intend to use. (3 marks)
  - b) Justify the use of the chosen test in (a). (5 marks)
  - c) State the null hypotheses of your test chosen in (a). (3 marks)
  - d) Explain what the statistical power of the chosen test is. (4 marks)
  - e) State the assumptions that the chosen test requires to hold (4 marks)
  - f) State one other statistical test you would consider using in this situation and explain its design. (6 marks)
  
2. Although it is well-established that there is a strong biological factor underlying Anorexia Nervosa, you are interested in psychological factors that relate to this condition. You have collected data from adolescent girls assessed at an Eating Disorder Clinic along with an age-matched control sample. The data includes the following: whether or not the girls were diagnosed with Anorexia; whether or not there is a family history of depression; and a questionnaire that measures feelings of Ineffectiveness. While the Ineffectiveness scale potentially ranges from 0-50, you are undecided whether to use a median split to define two discrete groups (i.e., High vs. Low Ineffectiveness).
  - (a) Determine the form of the ineffectiveness variable, and state the name of the statistical test you intend to use. (3 marks)
  - (b) Justify the use of the chosen test in (a). (6 marks)
  - (c) Explain the basic inferences which can be derived from this data using your chosen test. (8 marks)
  - (d) State the assumptions that the chosen test requires to hold. (5 marks)
  - (e) State the name statistical test you would intend to use for the alternative form of the Ineffectiveness variable. (3 marks)

3. You have studied the impact of physiological arousal on problem-solving ability. You measured problem-solving using a task where a higher score represents better problem-solving. 60 participants were allocated to one of three conditions: a control condition and two conditions inducing physiological arousal (Mild or High). After the treatment, participants completed the problem-solving task. The output for the One-way independent ANOVA is below (assumptions were met).

- Calculate the Eta-squared effect size for the differences in problem-solving across conditions from the information below. (2 marks)
- Calculate the Pearson's  $r$  effect size for ONE contrast using the information below. (4 marks)
- Explain some advantages of using effect sizes in addition to measures of statistical significance. (4 marks)
- Briefly summarise the main findings of the data below. (7 marks)
- Explain why a trend analysis would be informative for this design and, given the data, what would you expect it to show? (5 marks)
- If the assumptions were not met for ANOVA, which statistical test would you consider using to examine these data? (3 marks)

#### Descriptives

Problem Solving								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
Control	20	84.05	10.31	2.31	79.22	88.88	63.00	101.00
Mid	20	96.80	12.12	2.71	91.13	102.47	72.00	114.00
High	20	88.00	11.84	2.65	82.46	93.54	65.00	102.00
Total	60	89.62	12.47	1.61	86.39	92.84	63.00	114.00

#### ANOVA

Problem Solving					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1704.033	2	852.017	6.496	.003
Within Groups	7476.150	57	131.161		
Total	9180.183	59			

Contrast Coefficients			
Arousal Condition			
Contrast	Control	Mid	High
1	-2	1	1
2	0	-1	1

Contrast Tests							
		Contrast	Value of Contrast	Std. Error	t	df	Sig. (2-tailed)
Problem Solving	Assume equal variances	1	16.70	6.27	2.662	57	.010
		2	-8.80	3.62	-2.430	57	.018
	Does not assume equal variances	1	16.70	5.97	2.798	43.41	.008
		2	-8.80	3.79	-2.323	37.98	.026

4. The data analysis provided on the following pages relates to subjective (Self-report) and objective (Skin Conductance Response) emotional responses to social stimuli. High emotional reactivity is measured by higher scores on each of the variables. Data was collected from two groups of participants: Psychopaths and Non-Psychopaths.

Outcome	SR	Self-reported emotional response
Predictors	SCR	Skin Conductance Response
	Group	0: Non-Psychopath 1: Psychopath

The output on the following pages is taken from a series of analyses attempting to understand the relationships between these variables:

- (a) What percentage of variability in Self-report does Skin Conductance Response explain in each of the two models in Regression 1  
(2 marks)
- (b) From the data presented in Regression 1, state the basic linear model equation and predict the Self-report emotional response for BOTH a Psychopath and Non-Psychopath with an SCR score of 13.  
(5 marks)

- (c) Explain why the best predictors chosen by a Forward regression does not have to be the same as that suggested by the Forced entry regression. (4 marks)
- (d) Sketch two plots you would find if the regression assumptions hold for these analyses. (3 marks)
- (e) State the specific style of analysis and regression method performed in Regression 2. (3 marks)
- (f) Summarise the overall findings of the data presented in Regression analyses 1 and 2. Sketch an appropriate scatterplot with lines of best fit which illustrate the basic findings. (8 marks)

### Regression 1

Variables Entered/Removed <sup>a</sup>				
Group	Model	Variables Entered	Variables Removed	Method
Non-Psychopath	1	SCR <sup>b</sup>	.	Enter
Psychopath	1	SCR <sup>b</sup>	.	Enter

a. Dependent Variable: SR

b. All requested variables entered.

Model Summary					
Group	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Non-Psychopath	1	.484 <sup>a</sup>	.234	.207	5.868
Psychopath	1	.446 <sup>a</sup>	.199	.170	5.683

a. Predictors: (Constant), SCR

ANOVA <sup>a</sup>						
Group	Model		Sum of Squares	df	Mean Square	F Sig.
Non-Psychopath	1	Regression	294.450	1	294.450	8.550 .007 <sup>b</sup>
		Residual	964.250	28	34.437	
		Total	1258.700	29		
Psychopath	1	Regression	224.249	1	224.249	6.942 .014 <sup>b</sup>
		Residual	904.551	28	32.305	
		Total	1128.800	29		

a. Dependent Variable: SR

b. Predictors: (Constant), SCR

Coefficients <sup>a</sup>						
Group	Model		Unstandardized Coefficients		Standardized Coefficients	t Sig.
			B	Std. Error	Beta	
Non-Psychopath	1	(Constant)	19.334	1.950		9.913 .000
		SCR	.107	.036	.484	2.924 .007
Psychopath	1	(Constant)	17.742	2.012		8.817 .000
		SCR	-.118	.045	-.446	-2.635 .014

a. Dependent Variable: SR

## Regression 2

Variables Entered/Removed <sup>a</sup>			
Model	Variables Entered	Variables Removed	Method
1	Group, SCR <sup>b</sup>		. Enter
2	SCR_BY_Group <sup>b</sup>		. Enter

a. Dependent Variable: SR

b. All requested variables entered.

### Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.657 <sup>a</sup>	.432	.412	6.448
2	.743 <sup>b</sup>	.552	.528	5.776

a. Predictors: (Constant), Group, SCR

b. Predictors: (Constant), Group, SCR, SCR\_BY\_Group

### ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1799.630	2	899.815	21.641	.000 <sup>b</sup>
	Residual	2370.020	57	41.579		
	Total	4169.650	59			
2	Regression	2300.849	3	766.950	22.982	.000 <sup>c</sup>
	Residual	1868.801	56	33.371		
	Total	4169.650	59			

a. Dependent Variable: SR

b. Predictors: (Constant), Group, SCR

c. Predictors: (Constant), Group, SCR, SCR\_BY\_Group

### Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	23.189	1.833		12.649	.000
	SCR	.020	.031	.065	.648	.519
	Group	-10.775	1.676	-.646	-6.429	.000
2	(Constant)	19.334	1.920		10.070	.000
	SCR	.107	.036	.341	2.970	.004
	Group	-1.592	2.805	-.095	-.567	.573
	SCR_BY_Group	-.224	.058	-.682	-3.875	.000

a. Dependent Variable: SR