UNIVERSITY OF JOHANNESBURG

DEPARTMENT INDUSTRIAL PSYCHOLOGY AND PEOPLE MANAGEMENT
DEPARTEMENT BEDRYFSIELKUNDE EN MENSBESTUUR

PROGRAMME IN INDUSTRIAL PSYCHOLOGY
PROGRAM IN BEDRYFSIELKUNDE

JUNE EXAM/JUNIE EKSAMEN 2014

MODULE: HONOURS IN INDUSTRIAL PSYCHOLOGY:
RESEARCH DESIGN & ANALYSIS: QUANTITATIVE RESEARCH

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EKSTERNE MODERATOR:

PAGES/*BLADSYE*: 8

INSTRUCTIONS TO CANDIDATES/*INSTRUKSIES AAN KANDIDATE:*

- Question papers **must** be handed in
- Read the questions carefully and answer only what is asked
- Plan your time carefully
- Number your answers clearly
- Write neat and legibly
- Structure your answers by using appropriate headings and sub-headings
- The general University of Johannesburg policies, procedures and rules pertaining to written assessments apply to this assessment
- *Vraestelle **moet** ingedien word*
- *Lees die vrae sorgvuldig deur en beantwoord net wat gevra word*
- *Beplan jou tyd versigtig*
- *Nommer jou antwoorde duidelik*
- *Skryf netjies en leesbaar*
- *Struktureer jou antwoorde deur toepaslike opskrifte en onderopskrifte te gebruik.*
- *Die algemene beleide, prosedures en reëls van die Universiteit van Johannesburg met betrekking tot skriftelike assessering is op hierdie assessering van toepassing*

QUESTION 1

Consider the following: $Y_i = \alpha + \beta X_i + u_i$

where Yi is individual i's happiness levels during depression

Xi is individual i's daily appropriate use of prescribed medication

1.1. Define α. (2)

1.2. What is the interpretation of α in this case? (2)

1.3. Do you expect α to be positive/high or negative/low? (1)

1.4. Why? (1)

1.5. Define β. (2)

1.6. What is the interpretation of β in this case? (2)

1.7. Do you expect β to be positive or negative? (1)

1.8. Why? (1)

1.9. Define u_i. (1)

1.10. What does the error term, u_i capture in this specific example? (1)

[Subtotal: 14]

QUESTION 2

Consider the following data set:

X_i	Y_i
7	1.25
7	2.05
5	3.50
1	8.25
5	2.75
4	6 80

Where: Y_i is individual i's level (units) of burnout on a scale of 1 (low) to 7 (high)

X_i is individual i's level (units) of job satisfaction on a scale of 0 (none) to 10 (very high)

2.1. Calculate the Ordinary Least Square (OLS) values for a and b. Include your calculations. (12)

2.2. Interpret your results. (2)

[Subtotal: 14]

QUESTION 3

Suppose we have the following model:

$$Y_i = \alpha + \beta X_i + u_i$$

Where: Y_i is a healthy 30 year old person's expected speed (km/h) when walking

X_i is the energy level of the person

Consider the following Excel output:

	Coefficients
Intercept	-0.012
Energy level	2.328

Discuss and interpret the estimated coefficients. (4)

[Subtotal: 4]

QUESTION 4

Suppose we have the following model:

$$Y_i = \alpha + \beta X_i + u_i$$

Where: Y_i is individual *i*'s level of Conscientiousness

(1 = very low; 5 = very high)

X_i is individual *i*'s Autonomy

(1 = very low; 6 = very high)

Population: General Managers at Makro stores across Gauteng

Consider the following SPSS output:

Descriptive Statistics

	Mean	Std. Deviation	N
Autonomy	5.3475	9.79882	207
CONSCIENTIOUSNESS	3.1449	6.75998	207

Correlations

		Autonomy	CONSCIENTIOUSNESS
Pearson Correlation	Autonomy	1.000	.191
	CONSCIENTIOUSNESS	.191	1.000
Sig. (1-tailed)	Autonomy	.	.003
	CONSCIENTIOUSNESS	.003	.
N	Autonomy	207	207
	CONSCIENTIOUSNESS	207	207

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	CONSCIENTIOUSNESS[b]	.	Enter

a. Dependent Variable: Autonomy

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.191[a]	.037	.032	9.64107	.037	7.796	1	205	.006

a. Predictors: (Constant), CONSCIENTIOUSNESS

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	724.684	1	724.684	7.796	.006[b]
	Residual	19054.803	205	92.950		
	Total	19779.487	206			

a. Dependent Variable: Autonomy

b. Predictors: (Constant), CONSCIENTIOUSNESS

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	48.712	4.929		9.882	.000
	CONSCIENTIOUSNESS	.277	.099	.191	2.792	.006

a. Dependent Variable: Autonomy

4.1. Interpret the mean of Conscientiousness for the population. (1)

4.2. Interpret the correlation table. (4)

4.3. Interpret the estimated value for α. (2)

4.4. Interpret the estimated value for β. (2)

4.5. What is the R^2 for this regression? (1)

4.6. What is its interpretation? Evaluate the model fit. (3)

4.7 Perform the following hypothesis tests:

4.7.1. H_0: $\alpha = 0$, H_1: $\alpha \neq 0$, at the 5% significance (or 95% confidence) level (2)

4.7.2. H_0: $\beta = 0$, H_1: $\beta \neq 0$, at the 10% significance (or 90% confidence) level (2)

[Subtotal: 17]

QUESTION 5

Use the following SPSS output, as well as Appendix A (*t* table) to test the following hypothesis:

H_0: $\beta = 0.75$, H_1: $\beta \neq 0.75$, at the 5% significance (or 95% confidence) level

Include your calculations.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.130[a]	.017	.012	10.36898	.017	3.417	1	199	.066

a. Predictors: (Constant), RelationshipStatus

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	367.420	1	367.420	3.417	.066[b]
	Residual	21395.635	199	107.516		
	Total	21763.055	200			

a. Dependent Variable: PurposeINlife

b. Predictors: (Constant), RelationshipStatus

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	70.068	2.194		31.933	.000
	RelationshipStatus	-2.858	1.546	-.130	-1.849	.066

a. Dependent Variable: PurposeINlife

[Subtotal: 9]

QUESTION 6

Compare the following Excel outputs with regards to WAGE, without and with RACE GROUP (being black or Hispanic) as a predictor. Answer all the questions below.

WAGE without RACE GROUP

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.60
R Square	0.36
Adjusted R Square	0.30
Standard Error	4.73
Observations	61

ANOVA

	Df	*SS*	*MS*	*F*	*Significance F*
Regression	4	514.31	128.58	5.74	0.00
Residual	56	896.20	22.41		
Total	60	1410.51			

	Coefficients	Standard Error	t Stat	P-value
Intercept	-8.05	4.39	-1.83	0.07
EDUC	1.21	0.29	4.18	0.00
EXPER	0.12	0.07	1.80	0.08
FEMALE	-2.72	1.45	-1.87	0.07
MARRIED	0.98	1.47	0.67	0.51

WAGE with RACE GROUP

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.64
R Square	0.41
Adjusted R Square	0.33
Standard Error	4.64
Observations	61

ANOVA

	Df	SS	MS	F	Significance F
Regression	5	571.87	114.37	5.32	0.00
Residual	55	838.65	21.50		
Total	60	1410.51			

	Coefficients	Standard Error	t Stat	P-value
Intercept	-6.00	4.48	-1.34	0.19
EDUC	1.14	0.29	3.96	0.00
EXPER	0.10	0.07	1.45	0.15
FEMALE	-2.58	1.42	-1.81	0.08
MARRIED	0.66	1.45	0.45	0.65
BLKHISP	-2.94	1.80	-1.64	0.11

6.1. What is the interpretation of the estimated coefficient to BLKHISP? (2)

6.2. Does the model with BLKHISP, as whole, outperform the one without BLKHISP?

Explain. (3)

6.3. Is the coefficient to BLKHISP statistically different from zero at the 5% level of significance (95% level of confidence)?

Explain the implication thereof. (3)

6.4. Using the OUTPUT that includes BLKHISP, test whether the coefficient to EDUC is statistically different from 1.79 at the 1% significance (99% confidence) level.

Include all your calculations. (9)

[Subtotal: 17]

QUESTION 7

Consider the following SPSS output:

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	68.885	3.625		19.001	.000
	RelationshipStatus	-2.531	1.577	-.115	-1.605	.110
	Gender	-.638	1.518	-.030	-.420	.675
	Qualification	.462	.407	.081	1.133	.258

a. Dependent Variable: PurposeINlife

Using the appropriate equation, predict the level of purpose in life of a person who is in a committed relationship (value = 1), is a female (value = 2), and has Doctorate qualification (value = 8).

Include your calculations. (9)

[Subtotal: 9]

QUESTION 8

Answer all the following questions:

8.1. Explain the Quadratic Model using an analogy (example) and a graph to explain this concept. (3)

8.2. Some nonlinear relationships can be partly "straightened out" by transforming existing variables. What is a common way of doing this? (1)

[Subtotal: 4]

QUESTION 10

10.1. Describe "Time Index". (3)

10.2. Define a "Panel data set". Give an example. (2)

10.3. Define "Perfect Multicollinearity". (2)

10.4. Name five of the seven Classical Linear Regression Model assumptions. (5)

[Subtotal: 12]

TOTAL: 100

Chapter 1: An Introduction to the Linear Regression Model

Expected Value

$$E(Y \mid X_i) = \alpha + \beta X_i$$

Expected Value including error term

$$Y_i = \alpha + \beta X_i + u_i$$

Sample regression function (SRF)

$$\hat{Y}_i = a + bX_i$$

$$Y_i = \hat{Y}_i + e_i$$

$$Y_i = a + bX_i + e_i$$

Population regression function (PRF)

$$E(Y \mid X_i) = \alpha + \beta X_i$$

Chapter 2: The Least-Squares Estimation Method

Ordinary Least-Squares

$$\boldsymbol{Y_i = a + bX_i + e_i}$$

$$a = \bar{Y} - b\bar{X}$$

$$b = \frac{\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})}{\sum_{i=1}^{n}(X_i - \bar{X})^2}$$

Chapter 3: Model Performance and Evaluation

Behaviour of Y = Variation in Y

$$TSS = \sum (Y_i - \bar{Y})^2$$

Explained sum of squares

$$ESS = \sum (\hat{Y}_i - \bar{Y})^2$$

Residual sum of squares

$$RSS = \sum e_i^2$$

Total sum of squares

$$TSS = ESS + RSS$$

R squared

$$R^2 = \frac{ESS}{TSS}$$

T statistic

$$\boldsymbol{t\ \text{statistic}} = \frac{\boldsymbol{b}}{\mathbf{se}(\boldsymbol{b})}$$

$$\boldsymbol{t\ \text{statistic}} = \frac{\boldsymbol{b} - \boldsymbol{h}}{\mathbf{se}(\boldsymbol{b})}$$

Chapter 4: Multiple Regression Analysis

Population multiple regression analysis

$$Y_i = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + u_i$$

Sample multiple regression analysis

$$Y_i = a + b_1 X_{1i} + b_2 X_{2i} + e_i$$

$$Y_i = a + b_1 X_{1i} + b_2 X_{2i} + b_3 X_{3i} + e_i$$

t Table

cum. prob	$t_{.50}$	$t_{.75}$	$t_{.80}$	$t_{.85}$	$t_{.90}$	$t_{.95}$	$t_{.975}$	$t_{.99}$	$t_{.995}$	$t_{.999}$	$t_{.9995}$
one-tail	**0.50**	**0.25**	**0.20**	**0.15**	**0.10**	**0.05**	**0.025**	**0.01**	**0.005**	**0.001**	**0.0005**
two-tails	**1.00**	**0.50**	**0.40**	**0.30**	**0.20**	**0.10**	**0.05**	**0.02**	**0.01**	**0.002**	**0.001**
df											
1	0.000	1.000	1.376	1.963	3.078	6.314	12.71	31.82	63.66	318.31	636.62
2	0.000	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	22.327	31.599
3	0.000	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	0.000	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	0.000	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	0.000	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	0.000	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	0.000	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	0.000	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	0.000	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	0.000	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	0.000	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	0.000	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	0.000	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	0.000	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	0.000	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	0.000	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	0.000	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	0.000	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	0.000	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	0.000	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	0.000	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	0.000	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.485	3.768
24	0.000	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	0.000	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	0.000	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	0.000	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	0.000	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	0.000	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	0.000	0.683	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	0.000	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	0.000	0.679	0.848	1.045	1.296	1.671	2.000	2.390	2.660	3.232	3.460
80	0.000	0.678	0.846	1.043	1.292	1.664	1.990	2.374	2.639	3.195	3.416
100	0.000	0.677	0.845	1.042	1.290	1.660	1.984	2.364	2.626	3.174	3.390
1000	0.000	0.675	0.842	1.037	1.282	1.646	1.962	2.330	2.581	3.098	3.300
z	0.000	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	3.090	3.291
	0%	50%	60%	70%	80%	90%	95%	98%	99%	99.8%	99.9%
	Confidence Level										