PGDM 2016 - 18

Research Methodology

Subject Code- DM-207

Trimester – II, End-Term Examination: December 2016

Time allowed: 2 hrs 30 min
Max Marks: 50

Roll No: _____

Instruction: Students are required to write Roll No on every page of the question paper, writing anything except the Roll No will be treated as **Unfair Means.** In case of rough work please use answer sheet.

Section A

Attempt ANY three questions in this section. Each question carries 5 marks. (3 x 5)

A1. Compare scientific and non-scientific methods. List the challenges of conducting scientific method based researches for business problems.

A2. For a marketing research explain 'Validity' and 'Reliability' with suitable examples.

A3. Describe any three methods of probability sampling.

A4. In a class of sixty students three short duration tests were conducted. Each test was of 15 minutes duration and contained two descriptive questions. How can the teacher know whether student performances are progressing or regressing?

A5. Compare and contrast the following

i. Informal and Formal research design

ii. Factorial design and Latin Square design

Section B

Attempt ANY two questions in this section. Each question carries 10 marks. (2 x 10)

B1. In an analysis of crime statistics, a regression was done to estimate the relationship between the size of the state, represented by its population, and the number of murders.

Based on the SPSS outputs shown below (***the commas in the output represent decimal point***) answer the questions that follow.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,872[a]	,761	,756	,76322	2,323

a. Predictors: (Constant), Log_pop

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	90,988	1	90,988	156,202	,000[a]
	Residual	28,543	49	,583		
	Total	119,531	50			

a. Predictors: (Constant), Log_pop

b. Dependent Variable: Log_murder

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-13,067	1,420		-9,203	,000		
	Log_pop	1,222	,098	,872	12,498	,000	1,000	1,000

a. Dependent Variable: Log_murder

i. Write down the hypothesis for the regression model (3 marks)

ii. Describe the model fitment (4 marks)
Also discuss the F-statistic observed and its significance

iii. Write down the regression equation (3 marks)
and test the significance of the coefficients

B2. A national survey was carried out to investigate the perception of food risks. The purpose was to determine the underlying constructs of perceived food risk.

Using the following SPSS outputs, answer the questions that follow. Your answer should be related to the outputs and you should indicate wherever relevant the significance of numbers from the output.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.935
Bartlett's Test of Sphericity	Approx. Chi-Square	8189.553
	df	153
	Sig.	.000

Communalities

	Initial	Extraction
Bacteria	.347	.298
Pesticides	.520	.511
Imported_food	.270	.273
Tap_water	.292	.318
Food_irradiation	.479	.506
Antibiotics_food	.493	.503
Mad_cow	.595	.624
Wild_game	.490	.548
Foot_mouth	.641	.755
Food_additives	.495	.525
Bottled_water	.283	.334
GMO	.541	.565
Improper_label	.433	.432
Mercury_fish	.449	.458
Growth_hormones	.605	.739
Artificial_sweet	.427	.451
Food_packaging	.447	.483
Agroterrorism	.386	.381

Extraction Method: Principal Axis Factoring.

Rotated Factor Matrix[a]

	Factor		
	1	2	3
Growth_hormones	.802		
GMO	.614		.380
Antibiotics_food	.598		.344
Mercury_fish	.519	.399	
Pesticides	.514	.344	.359
Food_additives	.505		.497
Improper_label	.490	.385	
Foot_mouth		.833	
Mad_cow		.730	
Wild_game		.707	
Agroterrorism		.471	
Bacteria		.419	
Food_packaging	.341		.578
Food_irradiation	.349		.547
Bottled_water			.534
Artificial_sweet	.406		.525
Tap_water			.486
Imported_food			.377

Extraction Method: Principal Axis Factoring.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.493	41.625	41.625	6.999	38.882	38.882	3.165	17.586	17.586
2	1.593	8.850	50.475	1.178	6.547	45.429	2.957	16.430	34.016
3	1.072	5.955	56.430	.526	2.923	48.352	2.580	14.336	48.352
4	.905	5.026	61.456						
5	.772	4.287	65.743						

Truncated SPSS output for the total variance explained for extracted factors.

i. Is the sample adequate for Factor Analysis? (2 marks)

ii. Draw a Scree plot, clearly indicating the axes labels. Using this and the relevant table(s), how many factors are retained? What is the total variability retained? (3 marks)

iii. What do the Communalities represent with respect to the factor model? (2 marks)

iv. Discuss the Rotated Factor Matrix with respect to the emerging latent constructs of perceived food risk (3 marks)

B3. Consider a two way ANOVA with interaction among the factors. (Call the factors FA and FB respectively.

i. What are the different hypothesis – specify them. (3 marks)

ii. Develop the template ANOVA table (2 marks)

iii. How would you find from the ANOVA table the fitness of the model? (2 marks)

iv. How would you find from the ANOVA table which of FA, FB is significant? How would you find the significance of the interaction? (3 marks)

SECTION C

This section is compulsory and carries 15 marks. (1 x 15)

C1. **Comparing the effect of petrol additives**

We want to examine the effect of 3 fuel additives on reduction in oxides of nitrogen in fuel emission. We have at our disposal 3 cars and 3 drivers.

We are mostly interested in estimating main effects, in particular the one for the fuel additives factor. At the same time, we want to make sure that the main effects for drivers and cars do not bias our estimate of the main effect for the fuel additive.

If you labeled the additives with the letters A, B, and C, the Latin square design that would allow you to derive unconfounded main effects estimates could be summarized as follows:

	Car 1	Car 2	Car 3
Driver1	Additive A	Additive B	Additive C
Driver1	Additive A	Additive B	Additive C
Driver2	Additive C	Additive A	Additive B
Driver2	Additive C	Additive A	Additive B
Driver3	Additive B	Additive C	Additive A
Driver3	Additive B	Additive C	Additive A

The Nitrogen Oxide emission data (in milligram per kilometre) collected as per the above plan are displayed in the table below:

	Car 1	Car 2	Car 3
Driver1	96	64	34
Driver1	90	80	38
Driver2	90	93	69
Driver2	84	85	79
Driver3	33	86	95
Driver3	39	94	99

Some computations are provided below, which may help you in arriving the the final ANOVA table. However, you may choose to ignore the table and do your calculations using the raw experimental data from the above tables.

Factor Additive	Mean	SD	Factor Driver	Mean	SD	Factor Car	Mean	SD
A	93.00	4.94	1	80.33	11.41	1	85.33	8.38
B	74.00	6.51	2	83.33	8.55	2	83.67	10.97
C	84.33	7.42	3	87.67	10.15	3	82.33	11.96

ANOVA (template)

Source of Variation	*SS*	*Df*	*MS*	*F*	*F crit*
Additive					
Driver					
Car					
Error					
Total					

i. Write down all the Hypotheses associated with the above 'Main Effects' model (3 marks)

ii. Compute the ANOVA Table (8 marks)

iii. Interpret the results obtained. (4 marks)

F Table (alpha = 0.05)

Upper 5% points

ν_2 \ ν_1	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
1	161·4	199·5	215·7	224·6	230·2	234·0	236·8	238·9	240·5	241·9	243·9	245·9	248·0	249·1	250·1	251·1	252·2	253·3	254·3
2	18·51	19·00	19·16	19·25	19·30	19·33	19·35	19·37	19·38	19·40	19·41	19·43	19·45	19·45	19·46	19·47	19·48	19·49	19·50
3	10·13	9·55	9·28	9·12	9·01	8·94	8·89	8·85	8·81	8·79	8·74	8·70	8·66	8·64	8·62	8·59	8·57	8·55	8·53
4	7·71	6·94	6·59	6·39	6·26	6·16	6·09	6·04	6·00	5·96	5·91	5·86	5·80	5·77	5·75	5·72	5·69	5·66	5·63
5	6·61	5·79	5·41	5·19	5·05	4·95	4·88	4·82	4·77	4·74	4·68	4·62	4·56	4·53	4·50	4·46	4·43	4·40	4·36
6	5·99	5·14	4·76	4·53	4·39	4·28	4·21	4·15	4·10	4·06	4·00	3·94	3·87	3·84	3·81	3·77	3·74	3·70	3·67
7	5·59	4·74	4·35	4·12	3·97	3·87	3·79	3·73	3·68	3·64	3·57	3·51	3·44	3·41	3·38	3·34	3·30	3·27	3·23
8	5·32	4·46	4·07	3·84	3·69	3·58	3·50	3·44	3·39	3·35	3·28	3·22	3·15	3·12	3·08	3·04	3·01	2·97	2·93
9	5·12	4·26	3·86	3·63	3·48	3·37	3·29	3·23	3·18	3·14	3·07	3·01	2·94	2·90	2·86	2·83	2·79	2·75	2·71
10	4·96	4·10	3·71	3·48	3·33	3·22	3·14	3·07	3·02	2·98	2·91	2·85	2·77	2·74	2·70	2·66	2·62	2·58	2·54
11	4·84	3·98	3·59	3·36	3·20	3·09	3·01	2·95	2·90	2·85	2·79	2·72	2·65	2·61	2·57	2·53	2·49	2·45	2·40
12	4·75	3·89	3·49	3·26	3·11	3·00	2·91	2·85	2·80	2·75	2·69	2·62	2·54	2·51	2·47	2·43	2·38	2·34	2·30
13	4·67	3·81	3·41	3·18	3·03	2·92	2·83	2·77	2·71	2·67	2·60	2·53	2·46	2·42	2·38	2·34	2·30	2·25	2·21
14	4·60	3·74	3·34	3·11	2·96	2·85	2·76	2·70	2·65	2·60	2·53	2·46	2·39	2·35	2·31	2·27	2·22	2·18	2·13
15	4·54	3·68	3·29	3·06	2·90	2·79	2·71	2·64	2·59	2·54	2·48	2·40	2·33	2·29	2·25	2·20	2·16	2·11	2·07
16	4·49	3·63	3·24	3·01	2·85	2·74	2·66	2·59	2·54	2·49	2·42	2·35	2·28	2·24	2·19	2·15	2·11	2·06	2·01
17	4·45	3·59	3·20	2·96	2·81	2·70	2·61	2·55	2·49	2·45	2·38	2·31	2·23	2·19	2·15	2·10	2·06	2·01	1·96
18	4·41	3·55	3·16	2·93	2·77	2·66	2·58	2·51	2·46	2·41	2·34	2·27	2·19	2·15	2·11	2·06	2·02	1·97	1·92
19	4·38	3·52	3·13	2·90	2·74	2·63	2·54	2·48	2·42	2·38	2·31	2·23	2·16	2·11	2·07	2·03	1·98	1·93	1·88
20	4·35	3·49	3·10	2·87	2·71	2·60	2·51	2·45	2·39	2·35	2·28	2·20	2·12	2·08	2·04	1·99	1·95	1·90	1·84
21	4·32	3·47	3·07	2·84	2·68	2·57	2·49	2·42	2·37	2·32	2·25	2·18	2·10	2·05	2·01	1·96	1·92	1·87	1·81
22	4·30	3·44	3·05	2·82	2·66	2·55	2·46	2·40	2·34	2·30	2·23	2·15	2·07	2·03	1·98	1·94	1·89	1·84	1·78
23	4·28	3·42	3·03	2·80	2·64	2·53	2·44	2·37	2·32	2·27	2·20	2·13	2·05	2·01	1·96	1·91	1·86	1·81	1·76
24	4·26	3·40	3·01	2·78	2·62	2·51	2·42	2·36	2·30	2·25	2·18	2·11	2·03	1·98	1·94	1·89	1·84	1·79	1·73
25	4·24	3·39	2·99	2·76	2·60	2·49	2·40	2·34	2·28	2·24	2·16	2·09	2·01	1·96	1·92	1·87	1·82	1·77	1·71
26	4·23	3·37	2·98	2·74	2·59	2·47	2·39	2·32	2·27	2·22	2·15	2·07	1·99	1·95	1·90	1·85	1·80	1·75	1·69
27	4·21	3·35	2·96	2·73	2·57	2·46	2·37	2·31	2·25	2·20	2·13	2·06	1·97	1·93	1·88	1·84	1·79	1·73	1·67
28	4·20	3·34	2·95	2·71	2·56	2·45	2·36	2·29	2·24	2·19	2·12	2·04	1·96	1·91	1·87	1·82	1·77	1·71	1·65
29	4·18	3·33	2·93	2·70	2·55	2·43	2·35	2·28	2·22	2·18	2·10	2·03	1·94	1·90	1·85	1·81	1·75	1·70	1·64
30	4·17	3·32	2·92	2·69	2·53	2·42	2·33	2·27	2·21	2·16	2·09	2·01	1·93	1·89	1·84	1·79	1·74	1·68	1·62
40	4·08	3·23	2·84	2·61	2·45	2·34	2·25	2·18	2·12	2·08	2·00	1·92	1·84	1·79	1·74	1·69	1·64	1·58	1·51
60	4·00	3·15	2·76	2·53	2·37	2·25	2·17	2·10	2·04	1·99	1·92	1·84	1·75	1·70	1·65	1·59	1·53	1·47	1·39
120	3·92	3·07	2·68	2·45	2·29	2·17	2·09	2·02	1·96	1·91	1·83	1·75	1·66	1·61	1·55	1·50	1·43	1·35	1·25
∞	3·84	3·00	2·60	2·37	2·21	2·10	2·01	1·94	1·88	1·83	1·75	1·67	1·57	1·52	1·46	1·39	1·32	1·22	1·00

$F = \frac{s_1^2}{s_2^2} = \frac{S_1}{\nu_1} \Big/ \frac{S_2}{\nu_2}$, where $s_1^2 = S_1/\nu_1$ and $s_2^2 = S_2/\nu_2$ are independent mean squares estimating a common variance σ^2 and based on ν_1 and ν_2 degrees of freedom, respectively.