UNIVERSITY OF COLOMBO

FACULTY OF ARTS

SPECIAL DEGREE EXAMINATION IN ARTS (PART II) - Sem II - 2018/19

GYG 3262 - QUANTITATIVE ANALYSIS

(THREE HOURS)

Answer <u>three</u> questions only

Statistical tables are attached to the question paper. Use of calculator is allowed

1. (a) What is a hypothesis in research?

(02 marks)

(b) Explain the differences between small sample tests and large sample tests.

(03 marks)

(c) A researcher wants to know whether people drink alcohol more on the weekends or weekdays. In order to that researcher collected data from 36 patrons on the weekend and 36 patrons during the week days**.** **Table No.1** shows the information from the two samples. Is there enough evidence to conclude that drinking on the weekend is different from drinking during the week days? $\alpha = 0.05$.

. Table No. 1

Weekend	***Weekday***
$M_{we} = 3.5$ litters	$M_{wd} = 2.1$ litters
$\sigma_{we} = 1.4$	$\sigma_{wd} = 0.8$

(05 marks)

(d) A statistics teacher wants to determine the effectiveness of her statistics lesson. She gives a simple skills test to ten students before start of class (a pre-test) and the same skills test to the same students at the end of class (a post-test). Assume the significance level of 0.05. The data is shown in **Table No. 2**.

. **Table No. 2**

Student	Pre-test	Post-test
1	78	80
2	67	69
3	56	70
4	78	79
5	96	96
6	82	84
7	84	88
8	90	92
9	87	92
10	65	75

(10 marks)

(Total 20 marks)

2. The data given **Table No. 3** represent the number of units of production per day turned out by 5 different workers using 4 different types of machines.

Table No. 3

Workers	Machine			
	A	B	C	D
1	44	38	47	36
2	46	40	52	43
3	34	36	44	32
4	43	38	46	33
5	38	42	49	39

Test the hypothesis that there is no significant difference among the means of production per day between workers and machines.

(20 marks)

3. (a) State the three major aspects that should be incorporated when you write a linear programming problem?

(02 marks)

(b) What are the differences between minimization problem and maximization problem?

(03 marks)

(c) Using the simplex method, solve the following problem:

Objective:

$50x1 + 120x2 + 40x3 + 50x4 = Z \text{ (max)}$

Constrain:

$2x1 + x2 + x3 \leq 450$

$3x2 + x3 + x4 \leq 180$

$4x1 + x3 \leq 400$

$x1 + x2 + x4 \leq 110$

and

$x1, x2, x3, x4 \geq 0$

(15 marks)

(Total 20 marks)

4. A Data matrix (**Table No. 4**) and correlation coefficient matrix (**Table No. 5**) for 20 variables and 16 census tracts are given below.

A - the mean altitude above sea level **in** feet.

B - the mean annual temperature, in degrees Fahrenheit.

C - the mean annual precipitation, in inches.

D - the number of persons per square mile.

E - the percentage of Negroes.

F - the median age in years.

G - the percentage urban population.

H - the number of births per 1000 population.

I - the percentage rural farm population.

J - the percentage of employment in manufacturing.

K - the number of automobiles per 100 population.

L - the number of telephones per 100 population.

M - the average income in dollars.

N - the federal revenue per 100 dollars

O - the number of lawyers per 100,000 population.

P - the number of doctors per 100,000 population.

Q - the white infant mortality per 1000 births.

R - the school years completed, in tenths of a year.

S - the education expenditure per pupil in tens of dollars.

T - the percentage of houses with sound plumbing.

Table No. 4 - Data Matrix (X)

Census	Variable																			
tract	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
AL	50	68	68	64	30	26	22	55	12	31	39	33	19	22	82	79	25	89	28	54
AS	65	62	49	34	22	29	22	43	17	29	33	30	18	24	79	91	23	87	32	48
DE	6	54	45	226	14	29	23	66	4	37	40	53	33	15	115	135	20	108	54	80
FL	10	72	56	91	18	31	20	74	2	15	45	45	24	11	150	142	23	106	41	78
GA	60	62	47	68	29	26	24	55	9	32	37	36	22	19	125	102	23	88	33	58
KY	75	56	41	76	7	28	22	45	17	27	38	32	20	21	108	95	26	85	32	53
LA	10	70	63	72	32	25	25	63	7	17	32	36	21	21	128	114	21	86	42	61
MD	35	58	44	314	17	29	20	73	31	25	37	48	30	11	175	158	22	10	50	81
MI	30	65	49	46	42	24	24	38	23	31	29	25	16	21	101	76	23	86	27	45
MO	80	56	35	63	9	32	21	67	12	28	37	47	26	17	72	149	21	93	45	66
NC	70	60	44	93	25	26	22	40	16	42	35	31	20	15	77	100	22	85	32	57
SC	35	64	47	79	35	23	22	41	14	43	35	28	18	16	72	80	22	84	28	54
TE	90	61	47	85	17	27	22	52	15	35	35	35	20	22	115	113	24	86	30	57
TS	170	67	29	37	12	27	22	75	7	20	42	41	23	15	144	111	26	101	40	69
VA	95	59	44	100	21	27	21	56	9	27	34	38	24	15	114	108	24	92	38	66
WV	150	56	44	71	5	29	20	38	7	27	31	34	20	15	97	103	26	87	33	57

Table No. 5 - Correlation Coefficient Matrix (R)

Variable	Variable																			
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*	*N*	*O*	*P*	*Q*	*R*	*S*	*T*
A	1.00	-0.24	-0.61	-0.37	-0.53	0.12	-0.34	-0.11	-0.11	-0.08	-0.06	-0.12	-0.19	-0.02	-0.08	-0.14	0.71	0.12	-0.22	-0.16
B	-0.24	1.00	0.56	-0.40	0.55	-0.35	0.26	0.22	-0.24	-0.44	0.20	-0.25	-0.40	0.11	0.21	-0.23	0.07	0.20	-0.27	-0.10
C	-0.61	0.56	1.00	-0.06	0.56	-0.29	0.29	-0.10	-0.10	-0.11	-0.10	-0.24	-0.28	0.33	-0.06	-0.27	-0.14	0.02	-0.24	-0.19
D	-0.37	-0.40	-0.06	1.00	-0.20	0.25	-0.28	0.42	0.34	0.07	0.21	0.64	0.78	-0.56	0.53	0.63	-0.42	-0.64	0.69	0.71
E	-0.53	0.55	0.56	-0.20	1.00	-0.78	0.61	-0.30	0.22	0.26	-0.38	-0.54	-0.47	0.32	-0.18	-0.54	-0.32	-0.03	-0.44	-0.43
F	0.12	-0.35	-0.29	0.25	-0.78	1.00	-0.62	0.48	-0.18	-0.40	0.44	0.69	0.57	-0.34	0.19	0.74	-0.05	0.02	0.58	0.54
G	-0.34	0.26	0.29	-0.28	0.61	-0.62	1.00	-0.18	-0.07	0.14	-0.32	-0.33	-0.26	0.59	-0.12	-0.42	-0.29	0.26	-0.17	-0.40
H	-0.11	0.22	-0.10	0.42	-0.30	0.48	-0.18	1.00	-0.26	-0.59	0.71	0.85	0.73	-0.48	0.69	0.78	-0.23	-0.08	0.78	0.85
I	-0.11	-0.24	-0.10	0.34	0.22	-0.18	-0.07	-0.26	1.00	0.25	-0.39	-0.28	-0.14	0.14	0.03	-0.07	-0.04	-0.81	-0.17	-0.24
J	-0.08	-0.44	-0.11	0.07	0.26	-0.40	0.14	-0.59	0.25	1.00	-0.27	-0.32	-0.15	0.16	-0.62	-0.40	-0.24	0.01	-0.35	-0.35
K	-0.06	0.20	-0.10	0.21	-0.38	0.44	-0.32	0.71	-0.39	-0.27	1.00	0.61	0.50	-0.44	0.40	0.46	0.06	0.21	0.41	0.64
L	-0.12	-0.25	-0.24	0.64	-0.54	0.69	-0.33	0.85	-0.28	-0.32	0.61	1.00	0.96	-0.60	0.52	0.91	-0.38	-0.07	0.93	0.94
M	-0.19	-0.40	-0.28	0.78	-0.47	0.57	-0.26	0.73	-0.14	-0.15	0.50	0.96	1.00	-0.61	0.51	0.85	-0.45	-0.19	0.94	0.91
N	-0.02	0.11	0.33	-0.56	0.32	-0.34	0.59	-0.48	0.14	0.16	-0.44	-0.60	-0.61	1.00	-0.47	-0.62	0.16	0.21	-0.57	-0.78
O	-0.08	0.21	-0.06	0.53	-0.18	0.19	-0.12	0.69	0.03	-0.62	0.40	0.52	0.51	-0.47	1.00	0.57	0.05	-0.39	0.53	0.67
P	-0.14	-0.23	-0.27	0.63	-0.54	0.74	-0.42	0.78	-0.07	-0.40	0.46	0.91	0.85	-0.62	0.57	1.00	-0.42	-0.28	0.88	0.88
Q	0.71	0.07	-0.14	-0.42	-0.32	-0.05	-0.29	-0.23	-0.04	-0.24	0.06	-0.38	-0.45	0.16	0.05	-0.42	1.00	0.09	-0.51	-0.33
R	0.12	0.20	0.02	-0.64	-0.03	0.02	0.26	-0.08	-0.81	0.01	0.21	-0.07	-0.19	0.21	-0.39	-0.28	0.09	1.00	-0.17	-0.17
S	-0.22	-0.27	-0.24	0.69	-0.44	0.58	-0.17	0.78	-0.17	-0.35	0.41	0.93	0.94	-0.57	0.53	0.88	-0.51	-0.17	1.00	0.89
T	-0.16	-0.10	-0.19	0.71	-0.43	0.54	-0.40	0.85	-0.24	-0.35	0.64	0.94	0.91	-0.78	0.67	0.88	-0.33	-0.17	0.89	1.00

(i) Obtain first principal component using the data provided.

(08 marks)

(ii) Calculate Eigen value and Explained Variation.

(04 marks)

(iii) According to the loadings of this component, group the variables into a suitable number of classes.

(04 marks)

(iv) What steps are necessary if you wish to regionalize the 16 census tracts?

(04 marks)

(Total 20 marks)

5. Are a person's brain size and body size predictive of his or her intelligence?

Interested in answering the above research question, some researchers collected the data (**Table No. 6**) on a sample of n = 20 college student:

Y - Performance IQ scores

X_1 - Brain size

X_2 - Height

(a) Construct a multiple regression equation.

(12 marks)

(b) Test the hypothesis that whether there is a significant relationship between a person's brain size and body size predictive of his or her intelligence. **(α = 0.05)**

(06 marks)

(c) Comment on the results of your analysis.

(02 marks)

(Total 20 marks)

Table 6

Y	X_1	X_2
124	82	65
150	104	73
128	96	69
134	95	65
110	93	69
131	99	65
98	85	66
84	90	66
147	96	69
124	93	65
128	108	70
124	92	69
147	86	71
90	88	66
96	87	68
120	85	69
102	95	74
64	81	66
86	89	70
84	91	77

ස්ටුඩන්ට් t ව්‍යාප්තිය

The Students t Distribution

Distribution of *t* for given probability Levels

df	*Level of significance for one-tailed test*					
	0.10	**0.05**	**0.025**	**0.01**	**0.005**	**0.0005**
	Level of significance for two-tailed test					
	0.20	**0.10**	**0.05**	**0.02**	**0.01**	**0.001**
1	3.078	6.314	12.706	31.821	63.657	636.619
2	1.886	2.920	4.303	6.965	9.925	31.598
3	1.638	2.353	3.182	4.541	5.841	12.941
4	1.533	2.132	2.776	3.747	4.604	8.610
5	1.476	2.015	2.571	3.365	4.032	6.859
6	1.440	1.943	2.447	3.143	3.707	5.959
7	1.415	1.895	2.365	2.998	3.499	5.405
8	1.397	1.860	2.306	2.896	3.355	5.041
9	1.383	1.833	2.262	2.821	3.250	4.781
10	1.372	1.812	2.228	2.764	3.169	4.587
11	1.363	1.796	2.201	2.718	3.106	4.437
12	1.356	1.782	2.179	2.681	3.055	4.318
13	1.350	1.771	2.160	2.650	3.012	4.221
14	1.345	1.761	2.145	2.624	2.977	4.140
15	1.341	1.753	2.131	2.602	2.947	4.073
16	1.337	1.746	2.120	2.583	2.921	4.015
17	1.333	1.740	2.110	2.567	2.898	3.965
18	1.330	1.734	2.101	2.552	2.878	3.992

19	1.328	1.729	2.093	2.539	2.861	3.883
20	1.325	1.725	2.086	2.528	2.845	3.850
21	1.323	1.721	2.080	2.518	2.831	3.819
22	1.321	1.717	2.074	2.508	2.819	3.792
23	1.319	1.714	2.069	2.500	2.807	3.767
24	1.318	1.711	2.064	2.492	2.797	3.745
25	1.316	1.708	2.060	2.485	2.787	3.725
26	1.315	1.706	2.056	2.479	2.779	3.707
27	1.314	1.703	2.052	2.473	2.771	3.690
28	1.313	1.701	2.048	2.467	2.763	3.674
29	1.311	1.699	2.045	2.462	2.756	3.659
30	1.310	1.697	2.042	2.457	2.750	3.646
40	1.303	1.684	2.021	2.423	2.704	3.551
60	1.296	1.671	2.000	2.390	2.660	3.460
120	1.289	1.658	1.980	2.358	2.617	3.373
∞	1.282	1.645	1.960	2.326	2.576	3.291

සම්මත ප්‍රමත ව්‍යාප්තියේ ප්‍රතිශත අගගයන්

Percentage Points of the Normal Distribution

P	Z
90%	0.1257
80%	0.2533
70%	0.3853
60%	0.5244
50%	0.6745
40%	0.8416
30%	1.0364
20%	1.2816
10%	1.6449
5%	1.9600
2%	2.3263
1%	2.5758
0.2%	3.0902
0.1%	3.2905