

UNIVERSITY OF COLOMBO, SRI LANKA

FACULTY OF ARTS

THIRD YEAR EXAMINATION IN ARTS (ONLINE), SEMESTER II - 2019/2020

**GYG 3262 - QUANTITATIVE ANALYSIS**

**OPEN BOOK EXAMINATION**

**Instructions to Students:**

- The question paper starts on page 2
- All written assessments must be **handwritten**. Handwriting must be **clear and readable**.
- Answers should be written on an **A4 size paper** (ruled/lined paper/or otherwise), using a **black ball point pen**.
- As is the case of an in-person examination, word processing or type setting of answers will not be permitted. This rule does not apply to any candidate who has been exempted by the University under applicable bylaws (e.g., due to visual impairment).
- The **index number must be written on the top right-hand side** of each page of the answer script. Do not write your name anywhere on the answer script.
- **Number the pages** of the answer script using the following format at the **bottom of the page**: E.g., if it consists of 5 pages 1/5, 2/5...etc.
- Use the **common front page** (provided on LMS) as the first page of the answer script. You may print, or hand write the front page which must be the first page of your assessment.
- The **total number of pages** should be indicated on the front page of the answer script.
- **Scan/take photos of the answer script and convert it to a single PDF file** in the order of the page numbers.
- The full page of the answer script must be properly covered in the scanned image, and the scanned image must be clear/readable.
- LMS does not permit individual pages to be uploaded separately.
- **The only acceptable file format is PDF. The PDF file should be named with your index number**, e.g. A 12345
- Uploading answer scripts as JPEG/JPG or any other form will not be permitted.
- Complete and upload the final version of the answer script to LMS **within the stipulated 24 hours**.
- Once the answer script has been uploaded to LMS, take **a screen shot of the full page** of the LMS with the word 'submitted', as an acknowledgement and keep with you.
- **If** there is an **unexpected technical issue** with the uploading of an answer script to LMS, you may send your answer script via email to [exam3@arts.cmb.ac.lk](mailto:exam3@arts.cmb.ac.lk) within the stipulated 24-hour period.

UNIVERSITY OF COLOMBO, SRI LANKA

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GYG 3262 - QUANTITATIVE ANALYSIS

OPEN BOOK EXAMINATION

Duration: **24 hours** for completion and submission of answer scripts to LMS

Answer **3** questions only

1. (i) Explain the differences between the following pairs.
- (a) One Sample Test and Two Samples Test.
  - (b) Independent Hypothesis Test and Dependent (Paired) Hypothesis Test
  - (c) Standard Deviation ( $\sigma$ ) is known and Standard Deviation ( $\sigma$ ) is unknown
  - (d) Large Sample and Small Sample
- (08 marks)
- (ii) A marriage counselor administered a test designed to measure overall contentment to 20 randomly selected married couples. The scores for each couple are given **Table No. 1**. A higher number corresponds to greater contentment or happiness.
- (a) Test, at the 1% level of significance, the hypothesis that on average men and women are not equally happy in marriage.
- (06 marks)
- (b) Test, at the 1% level of significance, the hypothesis that on average men are happier than women in marriage.
- (06 marks)
- (Total 20 marks)

**Table No. 1**

<b>Couple</b>	<b>Husband</b>	<b>Wife</b>
1	47	44
2	44	46
3	49	44
4	53	44
5	42	43
6	45	45
7	48	47
8	45	44
9	52	44
10	47	42
11	40	34
12	45	42
13	40	43
14	46	41
15	47	45
16	46	45
(a) 17	46	41
(b) 18	46	41
19	44	45
20	45	43

2. (i) Explain the following.

(a) Difference between Simple Regression and Multiple Regression

(b) Total Variance, Explained Variance and Unexplained Variance

(c) Coefficient of Determination and Relative Importance

(2\*3 = 06 marks)

- (ii) **Table No. 2** is a list of 20 randomly selected individuals with level of heart disease, cycling (hours per month), and smoking (per day).

**Table No. 2**

Person	Cycling	Smoking	Level of Heart Disease
1	31	11	12
2	65	2	3
3	2	18	17
4	45	3	7
5	69	16	4
6	54	29	10
7	49	9	8
8	5	13	16
9	66	12	3
10	35	23	12
11	52	14	6
12	53	25	9
13	49	11	7
14	26	7	11
15	11	6	14
16	47	14	9
17	62	17	5
18	34	6	9
19	40	13	10
20	63	23	6

(a) Construct a multiple regression equation.

(08 marks)

(b) Test the hypotheses:  $H_0: B_1 = 0$ ,  $H_0: B_2 = 0$ , using  $\alpha = 0.05$ .

(04 marks)

(c) Comment on the results of your analysis.

(02 marks)

(Total 20 marks)

3. (i) What is Analysis of Variance

(02 marks)

(ii) What are the difference between One-way ANOVA and Two-way ANOVA?

(04 marks)

(iii) The data in **Table No. 3** show the number (in thousands) of computer production per day by Technicians using different types of machines.

**Table No. 3**

Technicians	Machines			
	A	B	C	D
P	54	48	57	46
Q	56	50	62	53
R	44	46	54	42
S	53	48	56	44
T	48	52	59	48

(a) Test whether the mean productivity of different type of machines are same?

(07 marks)

(b) Test whether the five technicians differ with respect the mean productivity?

(07 marks)

(Total 20 marks)

4. (i) Explain the difference in the following pairs
- (a) Graphical Solution Method and Simplex Solution Method
- (b) The Problem of Maximization and the Problem of Minimization

(04 marks)

- (ii) A manufacturer produces three models of bicycles. The time (in hours) required for assembling, painting, and packaging each model is given **Table No. 4**.

**Table No. 4**

	Model A	Model B	Model C
Assembling	2	2.5	3
Painting	1.5	2	1
Packaging	1	0.75	1.25

The total time available for assembling, painting, and packaging is 4006 hours, 2495 hours and 1500 hours, respectively. The profit per unit for each model is \$45 (Model A), \$50 (Model B), and \$55 (Model C). How many of each model should be produced to obtain a maximum profit? Is there enough time for that?

(16 marks)

(Total 20 marks)

5. **Table No. 5** shows of correlation coefficients for seven categories of crime for the fifty states of the United States.

**Table No. 5**

**Correlation Coefficients Matrix (R)**

	Murder	Rape	Robbery	Assault	Burglary	Larceny	Auto Theft
Murder	1.0000	0.6012	0.4837	0.6486	0.3858	0.1019	0.0688
Rape	0.6012	1.0000	0.5919	0.7403	0.7121	0.6140	0.3489
Robbery	0.4837	0.5919	1.0000	0.5571	0.6372	0.4467	0.5907
Assault	0.6486	0.7403	0.5571	1.0000	0.6229	0.4044	0.2758
Burglary	0.3858	0.7121	0.6372	0.6229	1.0000	0.7921	0.5580
Larceny	0.1019	0.6140	0.4467	0.4044	0.7921	1.0000	0.4442
Auto Theft	0.0688	0.3489	0.5907	0.2758	0.5580	0.4442	1.0000

- (i) Extract first principal component, using the R matrix. (06 marks)
- (ii) According to the loadings of this component, group the variables into a suitable number of classes. (02 marks)
- (iii) Calculate the Eigen value and the percentage of the variation that could be explained. (02 marks)
- (iv) Extract second principal component. (10 marks)
- (Total 20 marks)

## The Students t Distribution

### Distribution of $t$ for given probability Levels

df	<i>Level of significance for one-tailed test</i>					
	<b>0.10</b>	<b>0.05</b>	<b>0.025</b>	<b>0.01</b>	<b>0.005</b>	<b>0.0005</b>
	<i>Level of significance for two-tailed test</i>					
	<b>0.20</b>	<b>0.10</b>	<b>0.05</b>	<b>0.02</b>	<b>0.01</b>	<b>0.001</b>
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
$\infty$	1.282	1.645	1.960	2.326	2.576	3.291

of the *F* Distribution

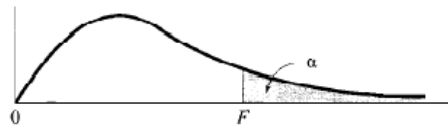


Table 1  $\alpha = 0.05$

		Degrees of Freedom for Numerator															
		1	2	3	4	5	6	7	8	9	10	15	20	25	30	40	50
Degrees of Freedom for Denominator	1	161.4	199.5	215.8	224.8	230.0	233.8	236.5	238.6	240.1	242.1	245.0	248.4	248.9	250.5	250.8	252.6
	2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38	19.40	19.43	19.44	19.46	19.47	19.48	19.48
	3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.70	8.66	8.63	8.62	8.59	8.58
	4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.86	5.80	5.77	5.75	5.72	5.70
	5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.62	4.56	4.52	4.50	4.46	4.44
	6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	3.94	3.87	3.83	3.81	3.77	3.75
	7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.51	3.44	3.40	3.38	3.34	3.32
	8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.22	3.15	3.11	3.08	3.04	3.02
	9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.01	2.94	2.89	2.86	2.83	2.80
	10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.85	2.77	2.73	2.70	2.66	2.64
	11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.72	2.65	2.60	2.57	2.53	2.51
	12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.62	2.54	2.50	2.47	2.43	2.40
	13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.53	2.46	2.41	2.38	2.34	2.31
	14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.46	2.39	2.34	2.31	2.27	2.24
	15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.40	2.33	2.28	2.25	2.20	2.18
	16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.35	2.28	2.23	2.19	2.15	2.12
	17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45	2.31	2.23	2.18	2.15	2.10	2.08
	18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.27	2.19	2.14	2.11	2.06	2.04
	19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.23	2.16	2.11	2.07	2.03	2.00
	20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.20	2.12	2.07	2.04	1.99	1.97
	22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30	2.15	2.07	2.02	1.98	1.94	1.91
	24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25	2.11	2.03	1.97	1.94	1.89	1.86
	26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22	2.07	1.99	1.94	1.90	1.85	1.82
	28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24	2.19	2.04	1.96	1.91	1.87	1.82	1.79
	30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.01	1.93	1.88	1.84	1.79	1.76
	40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	1.92	1.84	1.78	1.74	1.69	1.66
	50	4.03	3.18	2.79	2.56	2.40	2.29	2.20	2.13	2.07	2.03	1.87	1.78	1.73	1.69	1.63	1.60