THE OPEN UNIVERSITY OF SRI LANKA
FACULTY OF MANAGEMENT STUDIES
BACHELOR OF MANAGEMENT STUDIES (HONOURS) DEGREE PROGRAMME
LEVEL: 05
OSU5509: QUANTITATIVE TECHNIQUES FOR MANAGEMENT II
FINAL EXAMINATION – 2024/25
DURATION – THREE (03) HOURS

DATE: 30th November 2025 **TIME: 9.30 am – 12.30 pm**

INSTRUCTIONS:

1. **Answer FIVE questions ONLY.**
2. **All questions carry equal marks.**
3. **Use of a non-programmable calculator is allowed.**
4. **All workings pertaining to answers should be properly submitted.**
5. **This question paper consists of 6 questions in 8 pages.**

Question 1

A. A manufacturing company produces laptops, and it is known that 3% of the laptops are defective. If a random sample of 10 laptops is selected from the production line, what is the probability that more than 2 laptops are defective? (5 marks)

B. A game server receives an average of 15 player logins per hour. What is the probability that more than 10 logins occur in a given hour? (5 marks)

C. The height of adult women in a certain country is normally distributed with a mean of 163 cm and a standard deviation of 6 cm. What is the probability that a randomly selected woman has a height between 170 cm and 175 cm? (5 marks)

D. A company is launching a new product, and they have conducted a survey to estimate the product's acceptance rate among potential customers. From the survey, they found that 85% of the respondents indicated that they would be likely to purchase the new product. The company decides to use this information to forecast sales. They produced an initial batch of 20 products to test the market. What is the probability that more than 15 out of 20 customers will purchase the new product? (5 marks)

(Total 20 Marks)

Question 2

A. An online retailer wants to estimate the average delivery time for its products with 95% confidence level. A random sample of 60 recent orders is selected, and the delivery times (in days) are recorded. The sample mean delivery time is 4 days, and the sample standard deviation is 2 days. Calculate the 95% confidence interval for the population mean delivery time. (5 marks)

B. A manufacturing company claims that the average lifespan of their light bulbs is 900 hours. To verify this claim, a quality control inspector selects a random sample of 50 light bulbs and finds that the average lifespan is 880 hours with a standard deviation of 50 hours. Test the company's claim at the 1% significance level. (5 marks)

C. Briefly describe the following: (10 marks)

i. Null and alternative hypotheses
ii. Type I and type II errors

(Total 20 marks)

Question 3

A university is studying the relationship between a student's specialization of subjects and their primary method of transportation to the university. The researcher surveyed 540 students and classified them according to two variables. The results are summarized in the following table:

Specialization	**Primary transportation method**				**Total**
	Personal vehicle	**Train**	**Bus**	**Bicycle**	
Science	60	55	40	10	165
Management	45	50	32	80	207
Arts	36	30	27	75	168
Total	141	135	99	165	**540**

At 5% significance level, determine whether there is a significant association between student's specialization of subjects and their primary method of transportation to the university.

(Total 20 marks)

Question 4

A university admissions office wants to investigate the relationship between Mathematics score at the entrance examination and their first year GPA. They collect data from a random sample of 10 students, for their Mathematics scores and GPAs. The data are as follows:

Student	Mathematics score	GPA
1	65	3.1
2	58	2.4
3	72	3.5
4	61	2.8
5	75	3.8
6	55	2.2
7	68	3.3
8	52	2.0
9	70	3.6
10	64	3.0

A. Plot the data on a scatter diagram and interpret the relationship you can observe. (4 marks)

B. Calculate the correlation between Mathematics score and GPA. Interpret the correlation between the two factors? (6 marks)

C. Calculate the regression equation and draw the regression line in the same graph drawn for part (A). (5 marks)

D. If you know that for a particular student's Mathematics score is 68, what GPA value would you predict for the student? Compare the predicted value with actual data in the table and discuss the reasons for variations. (5 marks)

(Total: 20 marks)

Question 5

A real estate analyst is investigating the factors that influence the selling price of residential homes in a specific neighborhood. The analyst collects data on 20 recently sold homes, and recorded the data for four variables:

Selling Price (Y): The price of the home (in thousands of Rupees), Square Footage (X1): The size of the home's living area, Age of Home (X2): The number of years since the home was built, Number of Bathrooms (X3): The total number of full and half bathrooms

A. Determine the regression equation based on the output tables given below. (2 marks)

Table 1

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.783	.613	.682	.14821

*Predictors: (Constant), Square footage, Age of home, Number of bathrooms
**Dependent Variable: Selling price

Table 2

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	31.85	0.481		3.859	.004
Square footage	45.62	5.372	45.87	5.252	.005
Age of home	-10.59	0.783	-11.15	2.356	.000
Number of bathrooms	6.42	0.093	6.78	0.125	.035

B. The researcher claims that the 'Selling Price' increases with the 'square footage'. Is this statement correct? Justify your answer. (3 marks)

C. Interpret the coefficient of the variable of 'Number of bathrooms'. (Its strength and how it may affect the Sales Revenue) (3 marks)

D. Estimate the 'Selling Price' when the scores for the three dimensions, square footage, Age of home (in years) , Number of bathrooms are 3000, 10, and 2 respectively. (2 marks)

E. Use the following table to answer the question given below.

Dimension	Coefficient of correlation with variable F	Sig (p)
A	0.785	0.065
B	-0.325	0.031
C	0.451	0.022
D	-0.982	0.000
E	-0.025	0.058

Comment on the correlation coefficient values (i.e. the relationship and its strength) given in the above table. (10 marks)

(Total 20 marks)

Question 6

A. The quarterly sales data of a company are available for the past 4 years. An analysis is required to predict future sales.

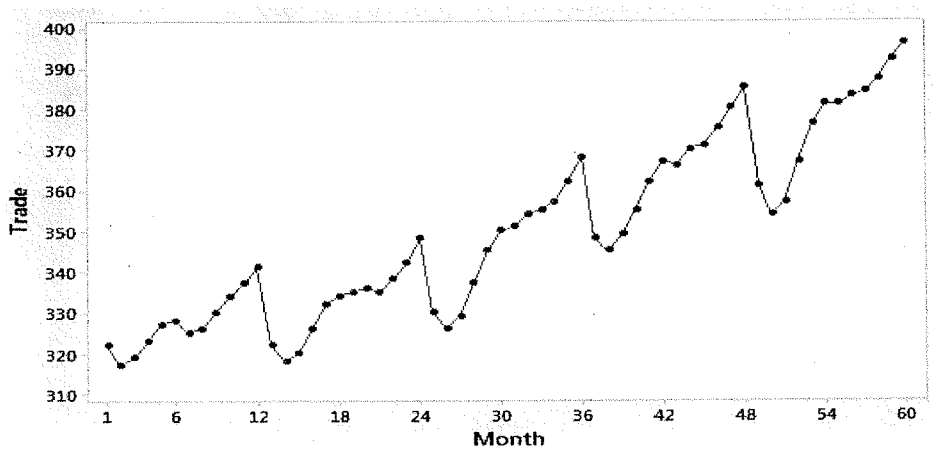
Period	Year	Quarter	Sales (Rs. '000)	Quarterly Moving Averages	Centered Moving Averages (CMA)	Sales/ CMA
1	2021	1	75			
2		2	88			
3		3	65	80.25	80.75	0.80495
4		4	93	81.25	82.125	1.13242
5	2022	1	79	83	83.875	(k)
6		2	95	(a)	85	1.11765
7		3	72	(b)	85.875	(l)
8		4	95	86.5	(f)	1.08571
9	2023	1	84	88.5	(g)	0.94515
10		2	103	89.25	(h)	1.14444
11		3	75	90.75	(i)	(m)
12		4	101	91.75	(j)	1.09337
13	2024	1	88	(c)	93.625	(n)
14		2	108	(d)	95.375	1.13237
15		3	80	(e)		
16		4	110			

a) Calculate the values for *(a) – (n)*. (7 marks)

b) Find the adjusted seasonal index values. (5 marks)

c) If the trend line equation is, Sales = 75.88+1.45*Period, find the forecasted sales for the four quarters of year 2025. (4 marks)

d) Interpret the following graph with the knowledge of time series. (4 marks)



(Total: 20 marks)

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Cumulative Binomial Probabilities

e. n = 9

k	0.01	0.05	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	0.95	0.99
0	0.914	0.630	0.387	0.134	0.040	0.010	0.002	0.000	0.000	0.000	0.000	0.000	0.000
1	0.997	0.929	0.775	0.436	0.196	0.071	0.020	0.004	0.000	0.000	0.000	0.000	0.000
2	1.000	0.992	0.947	0.738	0.463	0.232	0.090	0.025	0.004	0.000	0.000	0.000	0.000
3		0.999	0.992	0.914	0.730	0.483	0.254	0.099	0.025	0.003	0.000	0.000	0.000
4		1.000	0.999	0.980	0.901	0.733	0.500	0.267	0.099	0.020	0.001	0.000	0.000
5			1.000	0.997	0.975	0.901	0.746	0.517	0.270	0.086	0.008	0.001	0.000
6				1.000	0.996	0.975	0.910	0.768	0.537	0.262	0.053	0.008	0.000
7					1.000	0.996	0.980	0.929	0.804	0.564	0.225	0.071	0.003
8						1.000	0.998	0.990	0.960	0.866	0.613	0.370	0.086
9							1.000	1.000	1.000	1.000	1.000	1.000	1.000

f. n = 10

k	0.01	0.05	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	0.95	0.99
0	0.904	0.599	0.349	0.107	0.028	0.006	0.001	0.000	0.000	0.000	0.000	0.000	0.000
1	0.996	0.914	0.736	0.376	0.149	0.046	0.011	0.002	0.000	0.000	0.000	0.000	0.000
2	1.000	0.988	0.930	0.678	0.383	0.167	0.055	0.012	0.002	0.000	0.000	0.000	0.000
3		0.999	0.987	0.879	0.650	0.382	0.172	0.055	0.011	0.001	0.000	0.000	0.000
4		1.000	0.998	0.967	0.850	0.633	0.377	0.166	0.047	0.006	0.000	0.000	0.000
5			1.000	0.994	0.953	0.834	0.623	0.367	0.150	0.033	0.002	0.000	0.000
6				0.999	0.989	0.945	0.828	0.618	0.350	0.121	0.013	0.001	0.000
7				1.000	0.998	0.988	0.945	0.833	0.617	0.322	0.070	0.012	0.000
8					1.000	0.998	0.989	0.954	0.851	0.624	0.264	0.086	0.004
9						1.000	0.999	0.994	0.972	0.893	0.651	0.401	0.096
10							1.000	1.000	1.000	1.000	1.000	1.000	1.000

g. n = 15

k	0.01	0.05	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	0.95	0.99
0	0.860	0.463	0.206	0.035	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1	0.990	0.829	0.549	0.167	0.035	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	1.000	0.964	0.816	0.398	0.127	0.027	0.004	0.000	0.000	0.000	0.000	0.000	0.000
3		0.995	0.944	0.648	0.297	0.091	0.018	0.002	0.000	0.000	0.000	0.000	0.000
4		0.999	0.987	0.836	0.515	0.217	0.059	0.009	0.001	0.000	0.000	0.000	0.000
5		1.000	0.998	0.939	0.722	0.403	0.151	0.034	0.004	0.000	0.000	0.000	0.000
6			1.000	0.982	0.869	0.610	0.304	0.095	0.015	0.001	0.000	0.000	0.000
7				0.996	0.950	0.787	0.500	0.213	0.050	0.004	0.000	0.000	0.000
8				0.999	0.985	0.905	0.696	0.390	0.131	0.018	0.000	0.000	0.000
9				1.000	0.996	0.966	0.849	0.597	0.278	0.061	0.002	0.000	0.000
10					0.999	0.991	0.941	0.783	0.485	0.164	0.013	0.001	0.000
11					1.000	0.998	0.982	0.909	0.703	0.352	0.056	0.005	0.000
12						1.000	0.996	0.973	0.873	0.602	0.184	0.036	0.000
13							1.000	0.995	0.965	0.833	0.451	0.171	0.010
14								1.000	0.995	0.965	0.794	0.537	0.140
15									1.000	1.000	1.000	1.000	1.000

$P(r) = {}^{n}C_r p^r q^{(n-r)}$

$P(x) = \frac{e^{-\lambda}\lambda^x}{x!}$ where, e = 2.718

$r = \frac{\sum xy - \frac{\sum(x).\sum(y)}{n}}{\sqrt{\left(\sum x^2 - \frac{(\sum x)^2}{n}\right)\left(\sum y^2 - \frac{(\sum y)^2}{n}\right)}}$

$x - E < \mu < x + E$ where, $E = Z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$ or $E = t_{\alpha/2} \frac{s}{\sqrt{n}}$

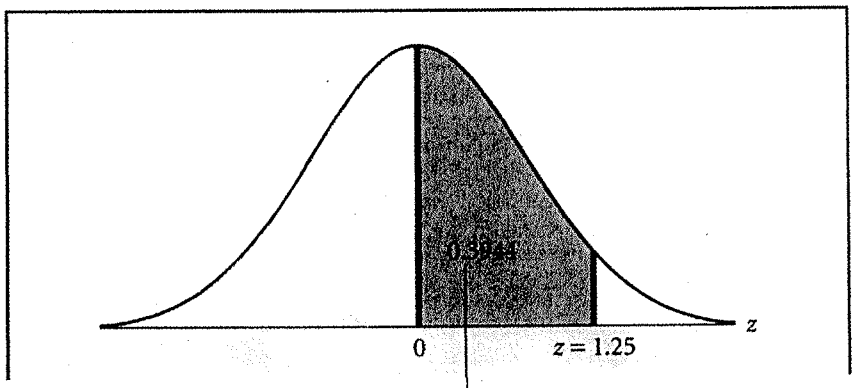
$b = \frac{n\sum xy - (\sum x)(\sum y)}{n\sum x^2 - (\sum x)^2}$

$p - E < p < p + E$ where, $E = Z\sqrt{\frac{p(1-p)}{n}}$

$a = \frac{\sum y}{n} - b.\frac{\sum x}{n}$

$\chi^2_{STAT} = \sum_{all\ cells} \frac{(f_o - f_e)^2}{f_e}$

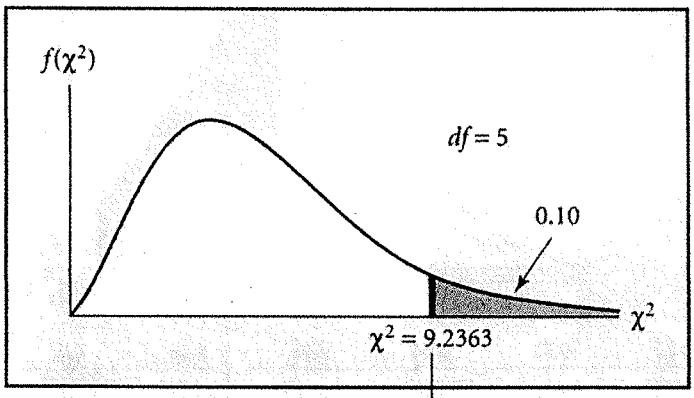
Standard Normal Distribution Table



z	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990

Highlighted value is 0.3944

Critical Values for Chi-Squared Distribution



PROBABILITIES (OR AREAS UNDER CHI-SQUARE DISTRIBUTION CURVE ABOVE GIVEN CHI-SQUARE VALUES)

	0.995	0.99	0.975	0.95	0.90	0.10	0.05	0.025	0.01	0.005
df						*Values of Chi-Squared*				
1	0.0000	0.0002	0.0010	0.0039	0.0158	2.7055	3.8415	5.0239	6.6349	7.8794
2	0.0100	0.0201	0.0506	0.1026	0.2107	4.6052	5.9915	7.3778	9.2104	10.5965
3	0.0717	0.1148	0.2158	0.3518	0.5844	6.2514	7.8147	9.3484	11.3449	12.8381
4	0.2070	0.2971	0.4844	0.7107	1.0636	7.7794	9.4877	11.1433	13.2767	14.8602
5	0.4118	0.5543	0.8312	1.1455	1.6103	9.2363	11.0705	12.8325	15.0863	16.7496
6	0.6757	0.8721	1.2373	1.6354	2.2041	10.6446	12.5916	14.4494	16.8119	18.5475
7	0.9893	1.2390	1.6899	2.1673	2.8331	12.0170	14.0671	16.0128	18.4753	20.2777
8	1.3444	1.6465	2.1797	2.7326	3.4895	13.3616	15.5073	17.5345	20.0902	21.9549
9	1.7349	2.0879	2.7004	3.3251	4.1682	14.6837	16.9190	19.0228	21.6660	23.5893
10	2.1558	2.5582	3.2470	3.9403	4.8652	15.9872	18.3070	20.4832	23.2093	25.1881
11	2.6032	3.0535	3.8157	4.5748	5.5778	17.2750	19.6752	21.9200	24.7250	26.7569
12	3.0738	3.5706	4.4038	5.2260	6.3038	18.5493	21.0261	23.3367	26.2170	28.2997
13	3.5650	4.1069	5.0087	5.8919	7.0415	19.8119	22.3620	24.7356	27.6882	29.8193
14	4.0747	4.6604	5.6287	6.5706	7.7895	21.0641	23.6848	26.1189	29.1412	31.3194
15	4.6009	5.2294	6.2621	7.2609	8.5468	22.3071	24.9958	27.4884	30.5780	32.8015
16	5.1422	5.8122	6.9077	7.9616	9.3122	23.5418	26.2962	28.8453	31.9999	34.2671
17	5.6973	6.4077	7.5642	8.6718	10.0852	24.7690	27.5871	30.1910	33.4087	35.7184
18	6.2648	7.0149	8.2307	9.3904	10.8649	25.9894	28.8693	31.5264	34.8052	37.1564
19	6.8439	7.6327	8.9065	10.1170	11.6509	27.2036	30.1435	32.8523	36.1908	38.5821
20	7.4338	8.2604	9.5908	10.8508	12.4426	28.4120	31.4104	34.1696	37.5663	39.9969
21	8.0336	8.8972	10.2829	11.5913	13.2396	29.6151	32.6706	35.4789	38.9322	41.4009
22	8.6427	9.5425	10.9823	12.3380	14.0415	30.8133	33.9245	36.7807	40.2894	42.7957
23	9.2604	10.1957	11.6885	13.0905	14.8480	32.0069	35.1725	38.0756	41.6383	44.1814
24	9.8862	10.8563	12.4011	13.8484	15.6587	33.1962	36.4150	39.3641	42.9798	45.5584
25	10.5196	11.5240	13.1197	14.6114	16.4734	34.3816	37.6525	40.6465	44.3140	46.9280
26	11.1602	12.1982	13.8439	15.3792	17.2919	35.5632	38.8851	41.9231	45.6416	48.2898
27	11.8077	12.8785	14.5734	16.1514	18.1139	36.7412	40.1133	43.1945	46.9628	49.6450
28	12.4613	13.5647	15.3079	16.9279	18.9392	37.9159	41.3372	44.4608	48.2782	50.9936
29	13.1211	14.2564	16.0471	17.7084	19.7677	39.0875	42.5569	45.7223	49.5878	52.3355
30	13.7867	14.9535	16.7908	18.4927	20.5992	40.2560	43.7730	46.9792	50.8922	53.6719

Highlighted value is 9.2363