PRN:		Course Code :	AMT1501

Third Year **B. Tech** End Semester Examination Summer 2024

Advanced Statistics

Day and Date: Max Marks: **100**

Time : Duration: **03** hrs.

Instructions: 1) All questions are compulsory.
2) Use of non-programmable calculator is allowed
3) Use of statistical tables is allowed & it is made available in exam room.

		Marks	Bloom's Level	CO
Q.1	**Attempt the following**			
a)	Calculate arithmetic mean, geometric mean, harmonic mean, standard deviation, mode and median for the data	08	L3	CO1

x	2	3	4	5	6	7	8
f	2	4	6	2	3	2	1

Price of share $A(X)$:	55	54	52	53	56	58	52	50	51	49
Price of share $B(Y)$:	108	107	105	105	106	107	104	103	104	101

b) From the prices X and Y of share A and B respectively given below. State which share is more stable in value — 08 — L3 — CO1

OR — OR

b) Calculate first central moments for the following data — 08 — L3 — CO1

x	0 – 10	10 – 20	20 – 30	30 – 40
f	1	3	4	2

Q.2	**Attempt the following**			
a)	Write a brief note on measures of complexities.	08	L2	CO2
b)	List out key functions and expressions of statistics with short explanation.	08	L2	CO2

OR

b) Find Eigen values and Eigen vector of the largest Eigen value for — 08 — L4 — CO2

$$A = \begin{bmatrix} 3 & -1 & 1 \\ -1 & 3 & -1 \\ 1 & -1 & 3 \end{bmatrix}$$

Q.3	**Attempt any two from the following**			
a)	Write a brief note on Freeman-Tukey transform.	08	L3	CO3
b)	Write a brief note on log and exponential transform and hence plot the graph of $z = \frac{1}{1+e^{-x}}$; $[-5, 5]$	08	L3	CO3

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c) Plot a rough graph of the following data — 08 L3 CO3

i) $z = \sqrt{x}; [0,10]$ ii)

x	−4	−3	−2	−1	0	1	2	3	4
y	11	9	7	5	3	1	−1	−3	−5

Q.4 **Attempt any two from the following**

a) The number of accidents per month in a certain town was as follows: 12, 8, 20, 2, 14, 10, 15, 6, 9, 4. Are these frequencies in agreement with the belief that accident conditions were the same during this 10 month period? Check at 5% level of significance. — 08 L2 CO4

b) A typist in a company commits the following number of mistakes per page in typing 432 pages. — 08 L3 CO4

Mistake / page	0	1	2	3	4	5
pages	223	142	48	15	4	0

Does this information verify that the mistakes are distributed according to the Poisson law?

c) The data set 338.7, 308.5, 317.7, 313.1, 322.7, 294.2 is a small sample of six batches drawn at random from the same population. Verify that whether it follows normal distribution or not with mean 315.82, Median 315.4 and standard deviation 14.8 using Anderson – Darling test. — 08 L2 CO4

Q.5 **Attempt any Two of the following**

a) It is claimed that a random sample of 100 tyres with a mean life of 15269 kms is drawn from a population of tyres which has a mean life of 15200 kms and a standard deviation of 1248 kms. Test the validity of the claim at 5% and 1% level of significance. — 09 L4 CO4

b) The mean height of 50 male students who showed above average participation in college athletics was 68.2 inches with a standard deviation of 2.5 inches while 50 male students who showed no interest in such participation had a mean height of 67.5 inches with a standard deviation of 2.8 inches. Test the hypothesis that male students who participate in college athletics are taller than other male students at 5% and 1% level of significance. — 09 L3 CO4

c)	A dice was thrown 9000 times and of these 3220 yielded at 3 or 4. Can the die be regarded as unbiased? Check the claim at 1% and 5% level of significance.	09	L5	CO4

Q.6 **Attempt any Two of the following**

a)	Certain pesticide is packed into bags by a machine. A random sample of 10 bags is drawn and their contents are found to weigh (in Kg.) as follows: 50, 49, 52, 44, 45, 48, 46, 45, 49, 45. Test if the average packing can be taken to be 50 kg.	09	L3	CO4
b)	A group of 5 patients treated with medicine A with their weights 42, 39, 48, 60, 41 kg's. Second group of 7 patients from the same hospital treated with medicine B and their weighs are 38, 42, 56, 64, 68, 69, 62 kg's. Do you agree with the claim that medicine B increases weight significantly at 5% level of significance?	09	L3	CO4
c)	Sample of two types of electric bulbs were tested for length of life and following data is obtained	09	L2	CO4

	Type I	Type II
Sample number	8	7
Sample means	1234 hrs.	1036 hrs.
Sample S. D.	36 hrs.	40 hrs.

Is the difference in the means sufficient to warrant that type I is superior to type II regarding length of life? Ch claim at 5% level of significance.

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TABLE IV

Chi-Square (χ^2) Distribution

Area to the Right of Critical Value

Degrees of Freedom	0.995	0.99	0.975	0.95	0.90	0.10	0.05	0.025	0.01	0.005
1	—	—	0.001	0.004	0.016	2.706	3.841	5.024	6.635	7.879
2	0.010	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210	10.597
3	0.072	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345	12.838
4	0.207	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860
5	0.412	0.554	0.831	1.145	1.610	9.236	11.071	12.833	15.086	16.750
6	0.676	0.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548
7	0.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278
8	1.344	1.646	2.180	2.733	3.490	13.362	15.507	17.535	20.090	21.955
9	1.735	2.088	2.700	3.325	4.168	14.684	16.919	19.023	21.666	23.589
10	2.156	2.558	3.247	3.940	4.865	15.987	18.307	20.483	23.209	25.188
11	2.603	3.053	3.816	4.575	5.578	17.275	19.675	21.920	24.725	26.757
12	3.074	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217	28.299
13	3.565	4.107	5.009	5.892	7.042	19.812	22.362	24.736	27.688	29.819
14	4.075	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141	31.319
15	4.601	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801
16	5.142	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000	34.267
17	5.697	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409	35.718
18	6.265	7.015	8.231	9.390	10.865	25.989	28.869	31.526	34.805	37.156
19	6.844	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191	38.582
20	7.434	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997
21	8.034	8.897	10.283	11.591	13.240	29.615	32.671	35.479	38.932	41.401
22	8.643	9.542	10.982	12.338	14.042	30.813	33.924	36.781	40.289	42.796
23	9.260	10.196	11.689	13.091	14.848	32.007	35.172	38.076	41.638	44.181
24	9.886	10.856	12.401	13.848	15.659	33.196	36.415	39.364	42.980	45.559
25	10.520	11.524	13.120	14.611	16.473	34.382	37.652	40.646	44.314	46.928
26	11.160	12.198	13.844	15.379	17.292	35.563	38.885	41.923	45.642	48.290
27	11.808	12.879	14.573	16.151	18.114	36.741	40.113	43.194	46.963	49.645
28	12.461	13.565	15.308	16.928	18.939	37.916	41.337	44.461	48.278	50.993
29	13.121	14.257	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.336
30	13.787	14.954	16.791	18.493	20.599	40.256	43.773	46.979	50.892	53.672
40	20.707	22.164	24.433	26.509	29.051	51.805	55.758	59.342	63.691	66.766
50	27.991	29.707	32.357	34.764	37.689	63.167	67.505	71.420	76.154	79.490
60	35.534	37.485	40.482	43.188	46.459	74.397	79.082	83.298	88.379	91.952
70	43.275	45.442	48.758	51.739	55.329	85.527	90.531	95.023	100.425	104.215
80	51.172	53.540	57.153	60.391	64.278	96.578	101.879	106.629	112.329	116.321
90	59.196	61.754	65.647	69.126	73.291	107.565	113.145	118.136	124.116	128.299
100	67.328	70.065	74.222	77.929	82.358	118.498	124.342	129.561	135.807	140.169

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