

# BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI

## Work Integrated Learning Programmes Division

Cluster Programme - M. Tech in AI & ML

II Semester , 2023 – 24(July,2024)

Mid semester Examination (**MAKEUP**)

Course No : AIMLC ZC418  
 Course Title : Introduction to Statistical Methods  
 Nature of Exam. : Open Book (Online)  
 Weightage : 30 Marks  
 Duration : 120 minutes  
 Date : 27<sup>th</sup> July,2024\_10 AM

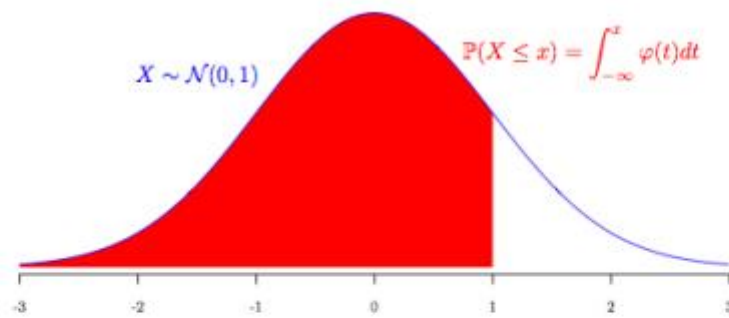
Number of questions:8

Number of Pages: 2

Q. No	Question	Marks																																				
Q.1	Let A and B are two independent events with probabilities 0.25 and 0.20 respectively. Then find the following a) $P(A \cup B)$ b) $P(A \cap B)$ c) $P(A / B)$ d) $P(B/A)$ e) $P(A^c/B)$ f) $P(A^c \cap B^c)$ (where $A^c$ indicates the compliment of event A)	3M																																				
Q.2	If mean and standard deviation of a binomial distribution are given as 4 and $(2/\sqrt{3})$ .Then find a) The probability distribution function b) Expectation of $X^2$ c) $P(6 < X < 9)$	4M																																				
Q.3	<table border="1"><thead><tr><th>Vehicle</th><th>Credit card/Debit card</th><th>Travel</th><th>Employment</th></tr></thead><tbody><tr><td>BMW</td><td>Credit card</td><td>Flight</td><td>Business</td></tr><tr><td>Scooter</td><td>Debit card</td><td>Bus</td><td>Salaried</td></tr><tr><td>Bicycle</td><td>None</td><td>Local train</td><td>Business</td></tr><tr><td>Verna</td><td>Credit card</td><td>Vande Bharat</td><td>Salaried</td></tr><tr><td>Scooter</td><td>Credit card</td><td>Flight</td><td>Salaried</td></tr><tr><td>Auto</td><td>None</td><td>Bus</td><td>Business</td></tr><tr><td>BMW</td><td>Debit card</td><td>Vande Bharat</td><td>Salaried</td></tr><tr><td>No</td><td>No</td><td>Bus</td><td>Salaried</td></tr></tbody></table> <p>Based on the data is it possible to find whether the following is salaried or business person. If possible find with the help of suitable theorem / algorithm. Show the working, mention assumptions if any. <b>“Vehicle = scooter; Credit Card = yes, Travel = Bus”</b></p>	Vehicle	Credit card/Debit card	Travel	Employment	BMW	Credit card	Flight	Business	Scooter	Debit card	Bus	Salaried	Bicycle	None	Local train	Business	Verna	Credit card	Vande Bharat	Salaried	Scooter	Credit card	Flight	Salaried	Auto	None	Bus	Business	BMW	Debit card	Vande Bharat	Salaried	No	No	Bus	Salaried	8M
Vehicle	Credit card/Debit card	Travel	Employment																																			
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Scooter	Debit card	Bus	Salaried																																			
Bicycle	None	Local train	Business																																			
Verna	Credit card	Vande Bharat	Salaried																																			
Scooter	Credit card	Flight	Salaried																																			
Auto	None	Bus	Business																																			
BMW	Debit card	Vande Bharat	Salaried																																			
No	No	Bus	Salaried																																			
Q.4	Let X be a discrete random variable whose probability distribution function is given as $p(x) = k(x + 1)/4$ where $x = -1,0,1,2$ ,then find a) k value b) Expectation of x c) Expectation of $x^2$ d) Variance e) $P(-1 < x < 2)$	4M																																				

Q.5	<p>Consider the probability density function <math>f(X,Y) = k (X + Y)/8</math> where <math>0 &lt; X &lt; 2</math> and <math>0 &lt; Y &lt; 2</math>. Then find</p> <ol style="list-style-type: none"> <li>k value</li> <li>Marginal probability density function of X</li> <li>Marginal probability density function of Y</li> <li>Are X and Y are independent? Justify it</li> </ol>	<b>4M</b>
Q.6	<p>Salaries of 500 employees in a company follows normal distribution with an average salary of 20(lakhs per annum) and variance of 4(lakhs). Then find the number of employees</p> <ol style="list-style-type: none"> <li>whose salary is above 22(lakhs)</li> <li>whose salary is below 16(lakhs)</li> <li>Whose salary is between 16 and 22(Lakhs)</li> <li>Are there any inconsistencies observed in this data?</li> </ol>	<b>4M</b>
Q.7	<ol style="list-style-type: none"> <li>Consider a population which follows binomial distribution. Sampling is done with a sample of size 45 and the sample mean is 10 with standard deviation 2. Can we conclude that the sampling distribution of mean also follows binomial distribution? Support your answer.</li> <li>Consider a population which follows binomial distribution. Sampling is done with a sample of size 25 and the sample mean is 10 with standard deviation 2. Can we conclude that the sampling distribution of mean also follows binomial distribution? Support your answer.</li> <li>Consider a population which normal distribution. Sampling is done with a sample of size 9. Then discuss about the distribution that sampling distribution of mean follows.</li> </ol>	<b>3M</b>

<b>z</b>	<b>0</b>	<b>0.01</b>	<b>0.02</b>	<b>0.03</b>	<b>0.04</b>	<b>0.05</b>	<b>0.06</b>	<b>0.07</b>	<b>0.08</b>	<b>0.09</b>
<b>-0</b>	.50000	.49601	.49202	.48803	.48405	.48006	.47608	.47210	.46812	.46414
<b>-0.1</b>	.46017	.45620	.45224	.44828	.44433	.44034	.43640	.43251	.42858	.42465
<b>-0.2</b>	.42074	.41683	.41294	.40905	.40517	.40129	.39743	.39358	.38974	.38591
<b>-0.3</b>	.38209	.37828	.37448	.37070	.36693	.36317	.35942	.35569	.35197	.34827
<b>-0.4</b>	.34458	.34090	.33724	.33360	.32997	.32636	.32276	.31918	.31561	.31207
<b>-0.5</b>	.30854	.30503	.30153	.29806	.29460	.29116	.28774	.28434	.28096	.27760
<b>-0.6</b>	.27425	.27093	.26763	.26435	.26109	.25785	.25463	.25143	.24825	.24510
<b>-0.7</b>	.24196	.23885	.23576	.23270	.22965	.22663	.22363	.22065	.21770	.21476
<b>-0.8</b>	.21186	.20897	.20611	.20327	.20045	.19766	.19489	.19215	.18943	.18673
<b>-0.9</b>	.18406	.18141	.17879	.17619	.17361	.17106	.16853	.16602	.16354	.16109
<b>-1</b>	.15866	.15625	.15386	.15151	.14917	.14686	.14457	.14231	.14007	.13786
<b>-1.1</b>	.13567	.13350	.13136	.12924	.12714	.12507	.12302	.12100	.11900	.11702
<b>-1.2</b>	.11507	.11314	.11123	.10935	.10749	.10565	.10383	.10204	.10027	.09853
<b>-1.3</b>	.09680	.09510	.09342	.09176	.09012	.08851	.08692	.08534	.08379	.08226
<b>-1.4</b>	.08076	.07927	.07780	.07636	.07493	.07353	.07215	.07078	.06944	.06811
<b>-1.5</b>	.06681	.06552	.06426	.06301	.06178	.06057	.05938	.05821	.05705	.05592
<b>-1.6</b>	.05480	.05370	.05262	.05155	.05050	.04947	.04846	.04746	.04648	.04551
<b>-1.7</b>	.04457	.04363	.04272	.04182	.04093	.04006	.03920	.03836	.03754	.03673
<b>-1.8</b>	.03593	.03515	.03438	.03362	.03288	.03216	.03144	.03074	.03005	.02938
<b>-1.9</b>	.02872	.02807	.02743	.02680	.02619	.02559	.02500	.02442	.02385	.02330
<b>-2</b>	.02275	.02222	.02169	.02118	.02068	.02018	.01970	.01923	.01876	.01831
<b>-2.1</b>	.01786	.01743	.01700	.01659	.01618	.01578	.01539	.01500	.01463	.01426
<b>-2.2</b>	.01390	.01355	.01321	.01287	.01255	.01222	.01191	.01160	.01130	.01101
<b>-2.3</b>	.01072	.01044	.01017	.00990	.00964	.00939	.00914	.00889	.00866	.00842
<b>-2.4</b>	.00820	.00798	.00776	.00755	.00734	.00714	.00695	.00676	.00657	.00639
<b>-2.5</b>	.00621	.00604	.00587	.00570	.00554	.00539	.00523	.00508	.00494	.00480
<b>-2.6</b>	.00466	.00453	.00440	.00427	.00415	.00402	.00391	.00379	.00368	.00357
<b>-2.7</b>	.00347	.00336	.00326	.00317	.00307	.00298	.00289	.00280	.00272	.00264
<b>-2.8</b>	.00256	.00248	.00240	.00233	.00226	.00219	.00212	.00205	.00199	.00193
<b>-2.9</b>	.00187	.00181	.00175	.00169	.00164	.00159	.00154	.00149	.00144	.00139
<b>-3</b>	.00135	.00131	.00126	.00122	.00118	.00114	.00111	.00107	.00104	.00100
<b>-3.1</b>	.00097	.00094	.00090	.00087	.00084	.00082	.00079	.00076	.00074	.00071
<b>-3.2</b>	.00069	.00066	.00064	.00062	.00060	.00058	.00056	.00054	.00052	.00050
<b>-3.3</b>	.00048	.00047	.00045	.00043	.00042	.00040	.00039	.00038	.00036	.00035
<b>-3.4</b>	.00034	.00032	.00031	.00030	.00029	.00028	.00027	.00026	.00025	.00024
<b>-3.5</b>	.00023	.00022	.00022	.00021	.00020	.00019	.00019	.00018	.00017	.00017
<b>-3.6</b>	.00016	.00015	.00015	.00014	.00014	.00013	.00013	.00012	.00012	.00011
<b>-3.7</b>	.00011	.00010	.00010	.00010	.00009	.00009	.00008	.00008	.00008	.00008
<b>-3.8</b>	.00007	.00007	.00007	.00006	.00006	.00006	.00006	.00005	.00005	.00005
<b>-3.9</b>	.00005	.00005	.00004	.00004	.00004	.00004	.00004	.00004	.00003	.00003
<b>-4</b>	.00003	.00003	.00003	.00003	.00003	.00003	.00002	.00002	.00002	.00002



	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990