[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2098 **I**

Unique Paper Code : 2922061102

Name of the Paper : Statistics for Business Decisions

Name of the Course : **BMS NEP**

Semester : I

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. There are **8** questions in all. Each question carries **15** marks.
3. Attempt any **6** questions.
4. Attempt **all** parts of a question together and show your workings clearly as apart of the solution.
5. Use of simple calculator is allowed.
6. Use of binomial distribution table, Poisson distribution table, Standard Normal table, t-distribution table is allowed.

1. (a) Categorize the following variables on the basis of measurement scales,giving suitable justification :

   (i) Car Brands: Tata, Maruti, Hyundai

   (ii) SAT Score

   (iii) Rating satisfaction of meal at restaurant

   (iv) Weight (in kg) of individuals

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(b) The board of a major credit card company requires that the mean wait time for customers when they call customer service is at most 3 minutes. To ensure that the mean wait time is not exceeding the requirement, an assistant manager tracks the wait time of 25 selected calls and finds the mean wait time to be 3.2 minutes. Assuming the population standard deviation is 0.9 minutes, is there sufficient evidence to say that the mean wait time is no longer than 3 minutes with a 90% level of confidence? (6+9)

2. An NGO organized a collection drive for mental health charity. The collection was scheduled on a Saturday in a specified locality where volunteers were posted on seven busy spots to ask for donations from people who pass-by. The details of collection are as follows :

Volunteer	**A**	**B**	**C**	**D**	**E**	**F**	**G**
Time(in mins)	100	120	160	90	150	70	80
Amount(in ₹ '00)	21	23	28	27	44	19	20

Estimate the two regression equations using the method of least squares and predict the amount collected if a volunteer spends 100 minutes at a location. Also, compute the coefficient of correlation between the time spent in collection and the amount collected. Comment on the strength of the correlation using an appropriate measure. (15)

3. (a) What is Big Data? Enumerate the characteristics of such data. Give tworeal life examples of big data.

(b) A flower show was organized where two judges were invited to grade 8 participants and award them prizes. The following scores were awarded by the judges :

Participant	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Judge A	15	20	28	12	40	60	20	80
Judge B	40	30	50	30	20	10	30	60

Compute the Spearman's rank correlation coefficient between the score awarded by the two judges. (6+9)

4. (a) What is a scatter diagram? Explain its utility in the study of correlation between two variables.

(b) In a city with a total of 100 drivers, traffic violations are categorized based on the severity of the infraction. Among these drivers, 45 have committed minor violations, 25 have committed moderate violations, and the remaining have committed major violations. The probability of a driver with a minor violation being stopped by the police is 0.007, for those with moderate violations it's 0.06, and for drivers with major violations, the probability is 0.18. Using the above data, calculate :

(i) If a driver has been stopped by the police, what is the probability that he committed a major violation?

(ii) What is the probability that a driver will not be stopped by the police? (6+9)

5. (a) The complement of level of significance 'α', is the level of confidence $(1-\alpha)$. It is therefore desirable that when testing a hypothesis, we should set 'α' as low as possible. Do you agree? Explain.

(b) A company manages a fast-food chain with self-service soda dispensers. The machine is calibrated to dispense an average of 200ml of soda per cup with a standard deviation of 15ml. The quantity dispensed is known to follow the normal distribution. The management team is analysing the performance of these machines to ensure consistent customer service.

(i) What is the probability that the average soda dispensed per cup is at least 205ml?

(ii) What is the probability that the average soda dispensed per cup is between 195ml and 203ml? (6+9)

6. (a) A company has two flagship services, Service A and Service B. The customer preference for Service A is strong, with a 60% chance of being chosen by any customer, while Service B is chosen 40% of the time. If on a busy day,ten customers are selected at random:

(i) Find the probability that at least 8 customers go for Service A, reflecting the strong popularity of this service

(ii) How likely is it that at most 6 customers will choose Service A?

(b) Draw a Stem and Leaf diagram for the aptitude scores of 30 students given below :

20	12	39	38	19	57	48	58	65	50
23	36	43	53	68	35	29	14	42	55
38	19	38	22	46	71	9	65	15	38

Using the diagramascertains the following :

(i) Median

(ii) Mode

(iii) Number of observations above 40

(iv) Percentage of observations less than 25 (6+9)

7. (a) A fleet of 25 delivery vans crosses a bumpy section of a highway every day. The probability that any given van will experience a flat tyre while crossing this section of the highway is 0.1. Assuming that the occurrence of a flat tyre follows Poisson distribution, compute the following:

(i) What is the probability that at most 1 van will have a flat tyre?

(ii) What is the probability that exactly 2 vans will have a flat tyre?

(b) Salary package (in ₹ lakh p.a.) offered to 11 fresh graduates of two colleges for a particular year are given below :

College	1	2	3	4	5	6	7	8	9	10	11
A	6.5	5	4	2.5	4.5	6	7.5	6.5	9	11.5	3
B	5.5	4	9.5	10	2.5	7	7	14.5	9	12	7

Using the above dataset to comment on the following :

(i) Mean salary for each college

(ii) Identify the college which has a more consistent salary package

(iii) Skewness of the distribution of salary in the two colleges. (6+9)

8. (a) A management consulting firm is evaluating the productivity of employees in a company by analysing the average number of hours worked per week. A random sample of 100 employees is taken from the company's workforce. The sample shows that the average number of hours worked is 130 hours per month, with a standard deviation of 20 hours. Based on this data, calculate the 99% confidence interval for the mean number of hours worked per month for the entire workforce.

(b) The monthly salary of 9 alumni of a post graduate management institute, chosen randomly, is given below :

Alumnus	1	2	3	4	5	6	7	8	9
Monthly Salary (in '000 Rs.)	78	90	75	117	105	92	89	102	80

Would it be right to say that the mean monthly salary of the institute is Rs. 95,000?Test at 5% level of significance. (6+9)

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TABLES TO BE PRINTED

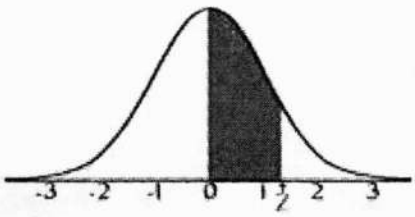
Binomial Distribution Table

2

		p										
n	*x*	*0.05*	*0.1*	*0.2*	*0.3*	*0.4*	*0.5*	*0.6*	*0.7*	*0.8*	*0.9*	*0.95*
9	0	0.630	0.387	0.134	0.040	0.010	0.002					
	1	0.299	0.387	0.302	0.156	0.060	0.018	0.004				
	2	0.063	0.172	0.302	0.267	0.161	0.070	0.021	0.004			
	3	0.008	0.045	0.176	0.267	0.251	0.164	0.074	0.021	0.003		
	4	0.001	0.007	0.066	0.172	0.251	0.246	0.167	0.074	0.017	0.001	
	5		0.001	0.017	0.074	0.167	0.246	0.251	0.172	0.066	0.007	0.001
	6			0.003	0.021	0.074	0.164	0.251	0.267	0.176	0.045	0.008
	7				0.004	0.021	0.070	0.161	0.267	0.302	0.172	0.063
	8					0.004	0.018	0.060	0.156	0.302	0.387	0.299
	9						0.002	0.010	0.040	0.134	0.387	0.630
10	0	0.599	0.349	0.107	0.028	0.006	0.001					
	1	0.315	0.387	0.268	0.121	0.040	0.010	0.002				
	2	0.075	0.194	0.302	0.233	0.121	0.044	0.011	0.001			
	3	0.010	0.057	0.201	0.267	0.215	0.117	0.042	0.009	0.001		
	4	0.001	0.011	0.088	0.200	0.251	0.205	0.111	0.037	0.006		
	5		0.001	0.026	0.103	0.201	0.246	0.201	0.103	0.026	0.001	
	6			0.006	0.037	0.111	0.205	0.251	0.200	0.088	0.011	0.001
	7			0.001	0.009	0.042	0.117	0.215	0.267	0.201	0.057	0.010
	8				0.001	0.011	0.044	0.121	0.233	0.302	0.194	0.075
	9					0.002	0.010	0.040	0.121	0.268	0.387	0.315
	10						0.001	0.006	0.028	0.107	0.349	0.599

t-distribution

cum. prob	$t_{.50}$	$t_{.75}$	$t_{.80}$	$t_{.85}$	$t_{.90}$	$t_{.95}$	$t_{.975}$	$t_{.99}$	$t_{.995}$	$t_{.999}$	$t_{.9995}$
one-tail	0.50	0.25	0.20	0.15	0.10	0.05	0.025	0.01	0.005	0.001	0.0005
two-tails	1.00	0.50	0.40	0.30	0.20	0.10	0.05	0.02	0.01	0.002	0.001
df											
1	0.000	1.000	1.376	1.963	3.078	6.314	12.71	31.82	63.66	318.31	636.62
2	0.000	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	22.327	31.599
3	0.000	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	0.000	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	0.000	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	0.000	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	0.000	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	0.000	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	0.000	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	0.000	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	0.000	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.025	4.437



STANDARD NORMAL TABLE (Z)

Entries in the table give the area under the curve between the mean and z standard deviations above the mean. For example, for $z = 1.25$ the area under the curve between the mean (0) and z is 0.3944.

z	0.00	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	0.0190	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	0.2969	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	0.3513	0.3554	0.3577	0.3529	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
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998

TABLE 2 Poisson Probabilities

Tabulated values are $P(X \le k) = \sum_{x=0}^{k} p(x)$. (Values are rounded to four decimal places.)

	μ															
k	0.10	0.20	0.30	0.40	0.50	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
0	0.9048	0.8187	0.7408	0.6703	0.6065	0.3679	0.2231	0.1353	0.0821	0.0498	0.0302	0.0183	0.0111	0.0067	0.0041	0.0025
1	0.9953	0.9825	0.9631	0.9384	0.9098	0.7358	0.5578	0.4060	0.2873	0.1991	0.1359	0.0916	0.0611	0.0404	0.0266	0.0174
2	0.9998	0.9989	0.9964	0.9921	0.9856	0.9197	0.8088	0.6767	0.5438	0.4232	0.3208	0.2381	0.1736	0.1247	0.0884	0.0620
3	1.0000	0.9999	0.9997	0.9992	0.9982	0.9810	0.9344	0.8571	0.7576	0.6472	0.5366	0.4335	0.3423	0.2650	0.2017	0.1512
4		1.0000	1.0000	0.9999	0.9998	0.9963	0.9814	0.9473	0.8912	0.8153	0.7254	0.6288	0.5321	0.4405	0.3575	0.2851
5				1.0000	1.0000	0.9994	0.9955	0.9834	0.9580	0.9161	0.8576	0.7851	0.7029	0.6160	0.5289	0.4457
6						0.9999	0.9991	0.9955	0.9858	0.9665	0.9347	0.8893	0.8311	0.7622	0.6860	0.6063
7						1.0000	0.9998	0.9989	0.9958	0.9881	0.9733	0.9489	0.9134	0.8666	0.8095	0.7440
8							1.0000	0.9998	0.9989	0.9962	0.9901	0.9786	0.9597	0.9319	0.8944	0.8472
9								1.0000	0.9997	0.9989	0.9967	0.9919	0.9829	0.9682	0.9462	0.9161
10									0.9999	0.9997	0.9990	0.9972	0.9933	0.9863	0.9747	0.9574
11									1.0000	0.9999	0.9997	0.9991	0.9976	0.9945	0.9890	0.9799
12										1.0000	0.9999	0.9997	0.9992	0.9980	0.9955	0.9912
13											1.0000	0.9999	0.9997	0.9993	0.9983	0.9964
14												1.0000	0.9999	0.9998	0.9994	0.9986
15													1.0000	0.9999	0.9998	0.9995
16														1.0000	0.9999	0.9998
17															1.0000	0.9999
18																1.0000
19																
20																