

2071
B.A./B.Sc. (General) Second Semester
Applied Statistics
Paper - 102AS: Probability

Time allowed: 3 Hours

Max. Marks: 90

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Unit.

x-x-x

1. Answer the following:-

- i) Define the sample space and give two examples.
- ii) Distinguish between discrete and continuous random variables.
- iii) Define random variable with a suitable example.
- iv) Write the probability mass function (pmf) of hypergeometric Distribution.
- v) If a and b are two constants, then prove that $E[aX+b]=aE[X]+b$.
- vi) What are the limitations of classical definition of probability?
- vii) Define the term "lack of memory".
- viii) What is the relation between mean and variance of Binomial distribution?
- ix) Find mean and variance in case of continuous Uniform Distribution. (9×2)

Unit-I

2 a) Give an axiomatic definition of probability. Prove that for n events $A_1, A_2, A_3, \dots, A_n$,

$$P\left(\bigcup_{i=1}^n A_i\right) \leq \sum_{i=1}^n P(A_i). \text{ When will the equality hold?} \quad (10)$$

(b): State and prove conditional probability theorem for two events. (8)

3 a) State and Prove Bayes' Theorem. (9)

P.T.O.

(2)

b). Let X be a continuous random variable with p.d.f.:

$$f(x) = \begin{cases} ax & , 0 \leq x \leq 1 \\ a & , 1 \leq x \leq 2 \\ -ax + 3a, & 2 \leq x \leq 3 \\ 0 & , \text{elsewhere} \end{cases} \quad (9)$$

(i) Determine the constant 'a', (ii) Determine F(x), the c.d.f. (iii) Compute $p(X \leq 1.5)$.

4. a) Define independent events. Suppose that A and B are independent events associated with an experiment. If the probability that A or B occurs equals 0.7, while the probability that A occurs equals 0.5, determine the probability that B occurs. (9)

(b): Define the following:

- (i) Probability Density Function (PDF).
- (ii) Random Experiment with suitable examples.
- (iii) Probability Mass Function (PMF). (9)

5. a) Define cumulative distribution function (cdf) of a random variable and state its properties. (9)

b) It is known that the population of a certain city is 45% female and 55% male. Suppose that 70% of the males and 10% of the female smoke. Find the probability that a smoker is male. (9)

Unit-II

6 (a): Define Binomial distribution with probability mass function. Also find its mean, variance and moment generating function. (9)

(b): If X and Y are independent random variables then $E(XY) = E(X) \cdot E(Y)$. (9)

(3)

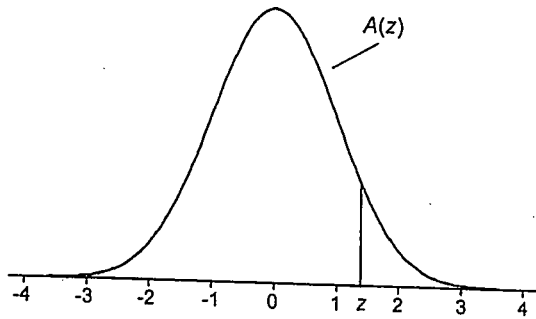
- 7 a) Obtain the mean and variance of hypergeometric distribution. (9)
b) Write the probability density function of geometric distribution and obtain its mean, variance and moment generating function. (9)
- 8 a) With the usual notations, find p for a binomial variate X , if $n=6$ and $9P(X=4) = P(X=2)$. (6)
b) X is a normal variate with mean 30 and S.D. 5. Find the probability that (i) $26 \leq X \leq 40$, and (ii) $X \geq 40$. (4)
c) Find the mode of the Poisson distribution. (8)
- 9 a) Prove that sum of two Poisson variates follow a Poisson distribution. (9)
b) Find the moment generating function of Normal distribution. (9)

 $x-x-x$

TABLE A.1

Cumulative Standardized Normal Distribution

$A(z)$ is the integral of the standardized normal distribution from $-\infty$ to z (in other words, the area under the curve to the left of z). It gives the probability of a normal random variable not being more than z standard deviations above its mean. Values of z of particular importance:



z	$A(z)$	
1.645	0.9500	Lower limit of right 5% tail
1.960	0.9750	Lower limit of right 2.5% tail
2.326	0.9900	Lower limit of right 1% tail
2.576	0.9950	Lower limit of right 0.5% tail
3.090	0.9990	Lower limit of right 0.1% tail
3.291	0.9995	Lower limit of right 0.05% tail

z	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	0.9977	0.9978	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
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.6	0.9998	0.9998	0.9999							

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