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*B. Sc. Semester V Examination, ~~Dec/~~ Jan 2021*

**Subject:** STATISTICS (Old Course) **Paper** – STA – 301

Paper Name: ***Distribution Theory - I***

***Date: / /2020*** ***Time: 2 Hours*** ***Marks: 50***

*Instructions*

1. *There are two sections in this question paper.*
2. *All questions in Section – I carry equal marks.*
3. *Attempt ANY THREE questions from Section* – I.
4. *Section – II is compulsory.*
5. *Figures to the right indicate full marks of the questions/sub-questions*

## Section - I

### Attempt ANY THREE QUESTIONS from SECTION – I

**Q. 1** *a* State probability mass function of *negative binomial distribution* and obtain its mean and variance of negative binomial distribution. **(07)**

*b* Obtain *poisson distribution* as a limiting case of *negative binomial distribution..* **(07)**

**Q. 2** *a* If a random variable $X$ follows *geometric distribution*, then in usual notations, derive moment generating function of $X$. **(07)**

*b* In usual notations, obtain recurrent relation for the central moments of *negative binomial distribution*. **(07)**

**Q. 3** *a* What is the purpose of truncation in theory of probability distribution? Derive mean and variance of *truncated poisson distribution*, truncated at $X = 0$. **(07)**

*b* For a *normal distribution* with mean $\mu$ and standard deviation $\sigma$, derive mean of *truncated normal distribution* to the right $X = b$. **(07)**

**Q. 4** *a* Derive probability mass function of truncated *poisson distribution*, truncated at $X = 0$. Obtain its mean and variance. **(07)**

*b* For a *normal distribution* with mean $\mu$ and standard deviation $\sigma$, derive the *truncated normal distribution* to the right of $X = b$. **(07)**

**Q. 5** *a* In usual notations, derive the recurrent relation for the central moments of *power series distribution*. **(07)**

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*b* For *power series distribution*, in usual notations, derive recurrent relation for *cumulants*. **(07)**

**Q. 6** *a* For binomial distribution, using *power series distribution*, obtain moment generating function and first two cumulants. **(07)**

*b* Use *power series distribution* to derive the moment generating function of *poisson distribution*. Also, find its mean and variance. **(07)**

**Q. 7** *a* Explain term: "order statistics". **(07)**

If probability density function a random variable X is $f(x) = \begin{cases} 1 & , o \le x \le 1 \\ 0 & , otherwise \end{cases}$

then obtain the probability distribution of the smallest order.

*b* In usual notations, derive the joint probability density function of order statistics. **(07)**

OR

**Q. 8** *a* Obtain the distribution of the smallest and the largest order statistics. **(07)**

*b* If probability distribution function of a random variable X is **(07)**

$$F(x) = \begin{cases} 1 - e^{-x} & , 0 \le x \le 1 \\ 0 & , otherwise \end{cases},$$

Obtain the probability density function of the largest order statistics and a sample range.

**Section – II**

**Q. 9** **Answer ANY EIGHT (08) from following** **(08)**

*1* State mean and variance of *negative binomial distribution*. Also, state the relation between mean and variance of *negative binomial distribution*

*2* State memoryless property of *geometric distribution*.

*3* State one use of truncation.

*4* State probability density function of *truncated normal distribution*, truncated to the left of $X=a$. Also, state its mean and variance.

*5* State mean and variance of *power series distribution*.

*6* State the value of *f(θ)*, for which *power series distribution* gives *poisson distribution*.

*7* For a *negative binomial distribution*, using *power series distribution*, obtain state the cumulant generating function.

*8* State mean and variance of *geometric distribution* as a case of *power series distribution*.

*9* State use of order statistics.

*10* State the probability density function of the smallest order statistics when a random variable X follows Rectangular distribution *R (2,5)*.

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