



HCV-003-001322

B. Sc. (Sem. III) (CBCS) Examination

October/November - 2017

Statistics : Paper - 301

(Descriptive Statistics & Probability Theory)

(Old Course)

Faculty Code : 003

Subject Code : 001322

Time : $2\frac{1}{2}$ Hours]

[Total Marks : 70

Instructions :

- (1) Q. No. 1 carries 20 marks, Q. No. 2 and Q. No. 3 each carries 25 marks.
- (2) Student can use their own scientific calculator.

1 Filling the blanks and short questions. 20

- (1) If $4 \times {}^n P_3 = 5 \times {}^{(n-1)} P_3$ then value $n =$ _____.
- (2) _____ districts words can be formed by using all the letters of the HONEY.
- (3) There can be established one to one correspondence between events and _____.
- (4) Mathematical probability is also known as _____ probability.
- (5) Two events A and B are equal if _____ and _____.

- (6) The probability based on the concept of relative frequency is called _____ or _____.
- (7) Probability can vary from _____.
- (8) If $B \subset A$, the $P(A\bar{B})$ is _____ or _____.
- (9) If A and B are two events, the $P(A \cap \bar{B})$ is _____.
- (10) If $P(A) = p_1$, $P(B) = p_2$ and $P(A \cap B) = p_3$, then

$$P(\bar{A} \cup B) = \text{_____}.$$
- (11) A discrete variable can take a _____ number of values within its range.
- (12) The probability density function $f(x)$ cannot exceed _____.
- (13) The second moment about mean measures _____.
- (14) If $\mu_3 < 0$, then given distribution is _____.
- (15) If $\beta_2 > 3$; $\gamma_2 > 0$ then curve is known as _____.
- (16) In Binomial distribution variance _____ mean.
- (17) If Binomial distribution function is $p(x) = \binom{9}{x} \left(\frac{1}{3}\right)^x \left(\frac{2}{3}\right)^{9-x}$
then variance are _____.
- (18) If Poisson distribution $p(x) = \frac{e^{-2} 2^x}{x!}$; $x = 0, 1, 2, \dots$. then
mean are _____.

(19) For Poisson distribution $\mu_1' = \underline{\hspace{2cm}}$ and

$$\mu_2' = \underline{\hspace{2cm}}.$$

(20) Within σ limits, the area under a normal curve is
 $\underline{\hspace{2cm}}$.

2 (a) Write the answer any three : **6**

(1) Define Mutually exclusive events with example.

(2) If A and B are any two events (subset of sample space S) and are not disjoint, then prove that

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

(3) Define Mathematical Expectation and also write any three properties of it.

(4) Obtain moment generating function of Geometric distribution.

(5) Prove that ${}^n C_r + {}^n C_{(r-1)} = {}^{(n+1)} C_r$.

(6) The probability that a person can hit a target in any trial is $\frac{2}{3}$. Find the probability that he will hit the target fourth time at the ninth trial.

(b) Write the answer any three : **9**

(1) If X and Y are two independent continuous random variables then prove that $E(XY) = E(X) E(Y)$ provided all the expectations exist.

- (2) If $X_1, X_2, X_3, \dots, X_n$ be n random variables then

$$V\left(\sum_{i=1}^n a_i X_i\right) = \sum_{i=1}^n a_i^2 V(x_i) + 2 \sum_{i=1}^n \sum_{\substack{j=1 \\ i < j}}^n a_i a_j \text{Cov}(X_i, X_j)$$

- (3) Obtain moment generating function of Negative Binomial distribution. Also obtain mean and variance of Negative Binomial distribution from it.
- (4) Obtain central moment generating function of Poisson distribution. Also obtain first four central moment form it.
- (5) The probability that A speaks the truth is 0.6 and the probability that B speaks the truth is 0.7. They both the agree about a statement. Find the probability that the statement is true.
- (6) There are 50 screws in a lot; and 2% of them are defective. If a random sample of 20 screws is taken from the lot, find the probability that none among them is defective. Also find the average number of defective screws in the sample.

- (c) Write the answer any two : 10

- (1) For Binomial distribution prove that $k_{(r+1)} = pq \frac{dk_r}{dp}$

- (2) For Poisson distribution prove that

$$\mu_{(r+1)} = r m \mu_{(r-1)} + m \frac{d\mu_r}{dm}$$

- (3) Prove that Poisson distribution is limiting case of the Binomial distribution.

- (4) In the production of electric fuses 2% are defective. Find the probability of getting (i) all non-defective fuses in a box containing 200 fuses.(ii) at the most 2 defective fuses (iii) 3 defective fuses.
- (5) The daily profit of a business man is Rs. 120 and the s.d. of the profit is Rs. 15. Find the number of days out of 365 days on which his profit will be less than Rs. 100.

3 (a) Write the answer any three : **6**

- (1) Define Equally events with example.
- (2) Prove that $P(A' \cap B) = P(B) - P(A \cap B)$ for any two events A and B
- (3) Define Bernoulli distribution.
- (4) Obtain moment generating function of Negative Binomial distribution.
- (5) If ${}^{10}C_3 + 2({}^{10}C_4) + {}^{10}C_5 = {}^{12}C_x$ then find the value of x .
- (6) The mean of a Poisson variate is 0.81, find its S.D. and find the probabilities for $x = 0$ and $x = 2$.

(b) Write the answer any three : **9**

- (1) If X and Y are two continuous random variables then prove that $E(X + Y) = E(X) + E(Y)$ provided all the expectations exist.
- (2) Obtain relation between r^{th} central moment and r^{th} raw moment. Also obtain relation between first four central moment and raw moment.

- (3) Obtain moment generating function of Binomial distribution. Also obtain mean and variance of Binomial distribution from it.
- (4) Find mean and variance of Hyper Geometric distribution.
- (5) The probability of occurrence of an occupational disease to a worker of a chemical factory is $\frac{1}{4}$. Find the probability that 2 out of 5 workers chosen at random will suffer from this disease.
- (6) Ninety percent of mangoes are sweet in a lot. The quality of a mango can be known only by the taste. A person requires 6 sweet mangoes. Find the probability of getting 6th sweet mango when 8th mango is tasted.

(c) Write the answer any two :

10

- (1) For Binomial distribution prove that

$$\mu_{(r+1)} = pq \left[nr\mu_{(r-1)} + \frac{d\mu_r}{dp} \right]$$

- (2) Obtain relation between cumulants and moments.

Also show that $\mu_4 = k_4 + 3k_2^2$.

- (3) If $A \subset B$, prove that

- (i) $P(A) \leq P(B)$

- (ii) $P(B - A) = P(B) - P(A)$

- (iii) $P(A) = P(A \cap B)$

- (iv) $P(B) = P(A \cup B)$

- (4) A car is parked among N cars in a row, not at either end. On his return the owner finds that exactly r of the N places are still occupied. What is the probability that both neighboring place are empty?
- (5) The mean and standard deviation of marks of 500 students in an examination are 52 and 8 respectively. If the marks are normally distributed, find
- (i) The number of students getting marks more than 60.
 - (ii) The number of students getting marks between 48 and 56.
