Anekant Education Society's

Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati

(Autonomous)

QUESTION BANK

S.Y.B.Sc.(Sem-III) Statistics

Paper – I (STAT2301)

Statistical Techniques- I

Unit-1 Standard Discrete Distributions:

1.1 Negative Binomial Distribution:

A] Questions for 1 mark

I] Choose the correct alternative

1. Which is a. r. v. whose distribution follows countable finite values?

   a) Negative binomial distribution.

   b) Binomial distribution.

   c) Geometric distribution.

   d) Poisson distribution.

2. A discrete random variable X has its m. g. f. $Mx(t) = 1/(6 - 5e^t)$ then distribution of r. v. X is

   a) Geometric with p = 1/6 b) B(n = 1, p = 1/6)

   c) NB(p = 1/6, k = 2) d) Poisson distribution with m = 5/6

3. If $X \rightarrow NB(K, P)$ such that, E(X) = 25, Var(X) = 150 the parameter k and p is given by

   . a) k = 5, p = 1/6 b) k = 5, p = 5/6

   c) k = 25, p = 1/6 d) k = 25, p = 5/6

4. Which is a. r. v. whose distribution follows countable infinite values?

   a) Negative binomial distribution. b) Poisson distribution.

   c) Geometric distribution. d) All above

5. A discrete random variable X has its m. g. f. $Mx(t) = (2/3+1/3e^t)^5$ then distribution of r. v. X is

   a) Geometric with p = 1/3 b) B(n = 5, p = 1/3)

   c) NB(p = 1/3, k = 5) d) Poisson distribution with m = 1/3

6. If X~Geometric distribution (p) taking values 0,1,2,3…. then

   a) Mean > Variance b) Mean < Variance

   c) Mean = Variance d) Mean = 2Variance

7. A discrete random variable X has its m. g. f. $Mx(t) = 1/(6 - 5e^t)$ then distribution of r. v. X is

   a) Geometric with p = 1/6 b) B(n = 1, p = 1/6)

   c) NB(p = 1/6, k = 2) d) Poisson distribution with m = 5/6

8. If X~NB(k, p) such that E(X) = 16 and Var(X) = 80 then

a)K = 4, p = 1/5 b) K = 4, p = 4/5
c) K = 8, p = 1/3 d) K = 8, p = 2/3

9. If X follows negative binomial distribution then

a) Mean > Variance b) Mean < Variance
c) Mean = Variance d) Mean = 2Variance

10. Suppose X and Y are independent random variables such that X~NB(k_1,p) and Y~NB(k_2,p) then the distribution of X – Y follows.

a) Negative binomial distribution. b) Poisson distribution.

c) Geometric distribution. d) None of above.

11. 'Number of persons to be interviewed for a post until a suitable candidate is found' is a counter example of

a) Negative binomial distribution. b) Poisson distribution.

c) Geometric distribution. d) Binomial distribution.

12. If X_1, X_2,..,X_k are independent and identically distributed random variables having geometric distribution with parameter p then the probability distribution of $\sum X_i$.

a) Geometric with p b) B(n, p)

c) NB(k, p) d) Poisson distribution with m

13. Which distribution possesses lack of memory property

a) Negative binomial distribution. b) Poisson distribution.

c) Geometric distribution. d) Binomial distribution.

14. Geometric distribution is particular case of

a) Negative binomial distribution. b) Poisson distribution.

c) Bernoulli distribution. d) Binomial distribution.

15. If X and Y are two independent and identically distributed random variables having geometric distribution with parameter p then X +Y does follow

a) Negative binomial distribution. b) Poisson distribution.

c) geometric distribution   d) Binomial distribution.

16. Suppose X and Y are independent random variables such that X~NB(k_1,p) and Y~NB(k_2,p) then the distribution of X + Y follows.

a) Negative binomial distribution. b) Poisson distribution.

c) Geometric distribution.   d) None of above.

17. The Negative distribution is

a) Negative Skewed   . b) Symmetric

c) Positive Skewed   d) None of above.

18. The Negative distribution is

a) Leptokurtic   . b) Mesokurtic

c) Platykurtic   d) None of above.

19. Under certain conditions, negative binomial distribution follows the Poisson distribution

a) $K\to\infty$, $P = q/p \to 0$, $KP = m$. b) $K\to 0$ $P = q/p \to 0$, $KP = m$

c) $K\to\infty$, $P = p/q \to 0$, $KP = m$ d) $K\to\infty$ $P = q/p \to\infty$, $KP = m$

20. A blood bank needs 5 donors of blood group A. There are 20% of donors of blood group A. This is a situation from

a) Geometric with p = 0.20   b) NB(5, 0.80)

c) NB(5, 0.20)   d) Geometric with p = 0.80

II] State whether the following statement is *True* or *False* (1 each)

1. Geometric distribution is particular case of Negative Binomial Distribution.
2. ‘Number of persons to be interviewed for a post until a suitable candidate is found ‘This is counter example of geometric distribution.
3. Poisson distribution possesses lack of memory property
4. If X is follows Negative Binomial Distribution then value of mean is greater than variance.
5. Negative Binomial is general case of Geometric distribution.
6. If X and Y are two independent and identically distributed random variables having geometric distribution with parameter p then X +Y does follow geometric distribution.
7. Poisson distribution possesses lack of memory property

III] Define (1 each)

1. Define Negative binomial distribution

2. M.G.F. of NB(k, p)

3. Nature of Negative binomial distribution

4. Random variable of Negative binomial distribution

5. Additive Property of Negative binomial distribution

B] Questions for 2 marks

1. Give any two real life situations from Negative Binomial distribution

2. Suppose X and Y are independent random variables such that $X \sim NB(k_1,p)$ and $Y \sim NB(k_2,p)$ then state the distribution of X+Y.

3. State Poisson approximation to negative binomial distribution.

4. State the relationship between the negative binomial and geometric distribution.

5. If $X_1 \sim NB(k_1, p)$ and $X_2 \sim NB(k_1, p)$ are independent. Is $X_1 - X_2$ also a negative binomial distribution.

6. If X ~ NB(k, p), show that E(X) > Var(X).

7. Explain why negative binomial distribution is called as waiting time distribution.

C] Questions for 4 marks

1. If X ~ NB(k, p), find the mean of x.

2. If X ~ NB(k, p), find the m.g.f. of x.

3. Explain how a geometric distribution is a particular case of negative binomial distribution.

4. State and prove additive property of negative binomial distribution.

5. If X_1, X_2,..,X_k are independent and identically distributed random variables having geometric distribution with parameter p, obtain the probability distribution of $\sum X_i$.

6. Define negative binomial distribution and Give any two real life situations where it is observed.

D] Questions for 6 marks

1. If X ~ NB(k, p), find the mean and variance of X. Also, show that E(X) > Var(X).

2. If X ~ NB(k, p), find the c.g.f. of X. Obtain the E(X) and Var(X) from c.g.f. of X.

3. If X ~ NB(k, p), find the c.g.f. of X. Obtain first three cumulants of r.v. X.

4. Show that Poisson distribution as a Limiting case of Negative Binomial Distribution.

5. Explain the need of introduction of negative binomial distribution? List the various application of negative binomial distribution.

1.2 Multinomial Distribution:

A] Questions for 1 mark

I] Choose the correct alternative

1. If $(X_1, X_2, X_3) \rightarrow MD(8, \frac{1}{2}, \frac{1}{4}, \frac{1}{4})$ then $E(X_2)$ is

a) 3 b) 1

c) 2 d) $\frac{3}{2}$

2. If (X_1, X_2, X_3) is a trinomial r. v. with parameters (n, p_1, p_2, p_3) then the conditional distribution of X_1 given $X_2 = x_2$ is

a) $B(n - x_1, \frac{p_2}{1 - p_1})$ b) $B(n - x_1, \frac{p_1}{1 - p_2})$

c) $B(n - x_2, \frac{p_1}{1 - p_2})$ d) $B(n - x_2, \frac{p_2}{1 - p_2})$

3. If $(X_1, X_2, X_3) \rightarrow MD(4, \frac{1}{2}, \frac{1}{4}, \frac{1}{4})$ then $COV(X_1, X_2)$ is

a) $-\frac{1}{2}$ b) $\frac{1}{2}$

c) $-\frac{1}{4}$ d) $\frac{1}{4}$

4. If $(X_1, X_2, X_3, X_4) \rightarrow MD(n, p_1, p_2, p_3, p_4)$ then the (X_1+X_2, X_3, X_4) follows

a) $MD(n, p_1 + p_2, p_3, p_4)$ b) $MD(n, p_1 + p_3, p_2, p_4)$

c) $B(n, p_1 + p_3)$ d) $B(n, p_1 + p_2)$

5. Rank of variance-covariance matrix $\underline{X} = (X_1, X_2, .., X_k)$ is

a) k b) 0

c) k+1 d) k-1

6. If $(X_1, X_2, X_3, X_4) \rightarrow MD(10, \frac{1}{8}, \frac{2}{8}, \frac{3}{8}, \frac{2}{8})$ then Correlation coefficient between X_2 and X_3 is

a) $-\sqrt{\frac{1}{5}}$ b) $\sqrt{\frac{1}{5}}$

c) $-\sqrt{\frac{2}{42}}$ d) $\sqrt{\frac{2}{42}}$

7. If $(X_1, X_2, X_3, X_4) \rightarrow MD(20, \frac{1}{2}, \frac{1}{8}, \frac{2}{8}, \frac{1}{8})$ then $X_1 + X_3$ follows

a) $B(20, \frac{3}{8})$ b) $B(20, \frac{6}{8})$

c) $B(20, \frac{4}{8})$ d) $B(20, \frac{2}{8})$

8. Multinomial distribution is general case of

a) Negative binomial distribution. b) Poisson distribution.

c) Geometric distribution. d) Binomial distribution.

9. In tri variate distribution the number of unknown variables is

a) k b) one

c) three d) two

10. In tri variate distribution the number of outcomes is

a) k b) one

c) three d) two

11. In multinomial distribution the conditional distributions turns out to be

a) Negative binomial distribution. b) Poisson distribution.

c) Geometric distribution. d) Binomial distribution.

12. In multinomial distribution the variable $(X_1, X_2, ..., X_k)$ are

a) Dependent b) independent

c) Dependent and negatively correlated d) None of above.

13. Class obtained in an examination as First, Second, Third and Fail is a real life situation from

a) Negative binomial distribution. b) Multinomial distribution.

c) Geometric distribution. d) Binomial distribution.

14 All the diagonal elements of correlation matrix is

a) Zero b) One

c) 0.5 d) None of above.

15. In multinomial distribution $E(X_1 / X_2 = x_2)$ is linear function of

a) x_1 b) x_2

c) x_1 and x_2 d) None of above.

16. In multinomial distribution $E(X_1 / X_2 = x_2)$ is linear function with regression coefficient

a) $\frac{p_1}{q_1}$ b) $-\frac{p_1}{q_1}$

c) $\frac{p_1}{q_2}$ **d)** $-\frac{p_1}{q_2}$

17. If $X_1, X_2, .., X_k$ are i.i.d. Poisson variate then the conditional distribution of $(X_1, X_2, .., X_k)$ given $X_1 + X_2 + ... + X_k = n$ is

a) Negative binomial distribution. b) Poisson distribution.

c) Geometric distribution. d) Binomial distribution.

II] State whether the following statement is *True* or *False* (1 each)

1. Rank of variance-covariance matrix $\underline{X} = (X_1, X_2, .., X_5)$ is 5.

2. Multinomial distribution is general case of binomial distribution.

3. If $\underline{X} = (X_1, X_2, .., X_k)$ follows multinomial distribution then the variable $\underline{X}$ is of (k-1) dimensional variable only.

4. The marginal distribution of r.v. from multinomial distribution is binomial.

5. Additive property does not hold for multinomial distribution.

6. The sum of values of k random variables for multinomial distribution is n-1.

III] Define (1 each)

1. Multinomial distribution.

2. m.g.f. of multinomial distribution

3. Additive property of multinomial distribution

4. Univariate marginal distribution of r.v. from multinomial distribution.

B] Questions for 2 marks

1. If $(X_1, X_2, X_3) \rightarrow MD(6, \frac{1}{3}, \frac{1}{3}, \frac{1}{3})$ then obtain correlation matrix of X.

2. If $(X_1, X_2, X_3) \rightarrow MD(4, \frac{1}{2}, \frac{1}{4}, \frac{1}{4})$ then obtain $E(X_1)$.

3. Variance-covariance matrix of multinomial distribution.

4. State the univariate marginal distribution of r.v. from multinomial distribution.

5. If $(X_1, X_2, X_3) \rightarrow MD(4, \frac{1}{2}, \frac{1}{4}, \frac{1}{4})$ then obtain $Var(X_2)$.

6. Give the justification about 'rank of variance-covariance matrix of multinomial distribution is k-1'.

C] Questions for 4 marks

1. Four chips are selected at random with replacement from 10 chips of which 5 are red, 3 are white and 2 are black. Find the probability that (i) one white and one black chips are selected and (ii) at most two red chips are selected.

2. If (X_1, X_2, X_3) is a trinomial r. v. with parameters (n, p_1, p_2, p_3) then find the conditional distribution of X_1 given $X_2 = x_2$.

3. State and prove the additive property for the multinomial distribution.

4. If $(X_1, X_2, ..., X_k) \rightarrow MD((n, p_1, ..., p_k)$ then find the conditional distribution of X_i given X_j.

5. If $(X_1, X_2, ..., X_k) \rightarrow MD((n, p_1, ..., p_k)$ then obtain $Var(X_i)$.

6. Define multinomial distribution and obtain its m.g.f.

D] Questions for 6 marks

1. Let $(X_1, X_2, \ldots\ldots X_k) \rightarrow MD\ (n, p_1, p_2, \ldots\ldots, p_k)$. State the moment generating function (m.g.f.) of $(X_1, X_2, \ldots\ldots X_k)$ and hence find $Cov(X_i, X_j)$, i # j.

2. If $(X_1, X_2, X_3) \sim MD\ (5, 0.2, 0.5, 0.3)$,

find i) $P(X_2 = 1 | X_1 = 3)$

ii) $P(X_1 = 3, X_2 = 1)$

iii) Correlation matrix of X

3. Suppose X_1, X_2,..,X_k are independent Poisson random variables with parameters m_1, m_2,...,m_k respectively, then find the conditional distribution of (X_1, X_2,..,X_k) given $X_1 + X_2 + ... + X_k = n$.

4. Explain the need of introduction of multinomial distribution? List the various application of multinomial distribution.

1.3 Truncated Distributions:

A] Questions for 1 mark

I] Choose the correct alternative

1. The mean of Poisson distribution truncated below at X=0 is

a) $m(1-e^{-m})$

b) $\frac{m}{(1-e^{-m})}$

c) $\frac{m}{(1+e^{-m})}$

d) $\frac{m}{2(1-e^{-m})}$

2. If X follows B(n,p) and X_T follows B(n,p) truncated below at x=0 then

a) $E(x) > E(X_T)$ b) $E(x) < E(X_T)$
c) $E(x) = E(X_T)$ d) $E(x) \leq E(X_T)$

3. The number of members (X) in family follows following distribution

a) Binomial b) Truncated Poisson at X = 0
c) Truncated binomial at X = 0 d) Truncated binomial at X = n

4. If X follows Poisson distribution with parameter m then X_T follows Poisson distribution truncated below at x=0 then

a) $E(x) < E(X_T)$ b) $E(x) > E(X_T)$

c) $E(x) = E(X_T)$ d) $E(x) \geq E(X_T)$

5. The mean of binomial distribution truncated below at X=0 is

a) $np(1-q^n)$

b) $\frac{np}{(1-q^n)}$

c) np

d) None of above

6. The way that we can obtain the truncated distribution for specific distribution

a) Left truncated　　　　b) Right Truncated

c) Left and right truncated　　　　d) All the above

7. A good lot of 8 apples is purchased. The number of good apples is a random variable with binomial distribution. The probability that any apple will be rotten is 0.2. If the previous experience says that there is at least one good apple, identify the probability distribution of number of good apples in a lot of size 8.

a) Left truncated binomial　　　　b) Right truncated binomial

c) Left truncated Poisson　　　　d) None of the above

II] State whether the following statement is *True* or *False* (1 each)

1. The mean of binomial distribution is greater than mean of truncated binomial distribution at X=0.

2. If X_T is truncated binomial r.v. then the sum of probabilities that X_T takes is not equal to 1.

3. If X_T is truncated Poisson (λ), then the sum of probabilities that X_T takes is not equal to 1.

4. Truncated distribution is distribution over a reduced range of corresponding random variable.

III] Define (1 each)

1. Truncated distribution
2. Truncated at left
3. Truncated at right
4. Truncated at left and right

B] Questions for 2 marks

1. State p.m.f. of a Poisson r.v. truncated below at X=1.

2. Truncated binomial distribution at X=0.

3. If X_T is a binomial r.v. with n = 6 and p = 0.4, truncated to the left at x = 0 then find P (X_T = 2).

4. Truncated Poisson distribution at X=0.

5. State p.m.f. of a binomial r.v. truncated below at X=0

C] Questions for 4 marks

1. Let X has Poisson distribution with parameter m. If the distribution is truncated by discarding the value zero, find the p.m.f. of the resulting distribution and its mean.

2. Let X has binomial distribution with parameters n and p. If the distribution is truncated by discarding the value zero, find the p.m.f. of the resulting distribution and its mean.

3. A good lot of 8 apples is purchased. The number of good apples is a random variable with binomial distribution. The probability that any apple will be rotten is 0.2. If the previous experience says that there is at least one good apple, identify the probability distribution of number of good apples in a lot of size 8. Also find the : (i) Probability that lot contains all good apples.

4. Define the Poisson distribution (i) truncated below at X = 0 (ii) truncated below at X = 1.

5. Suppose X_T is Poisson r.v. with m = 2 truncated below at X = 0. Find : (i) $P(X_T = 2)$ (ii) $P(X_T \geq 3)$ (iii) $E(X_T)$ (iv) $Var(X_T)$.

D] Questions for 6 marks

1. Let X has Poisson distribution with parameter m. If the distribution is truncated by discarding the value zero, find the p.m.f. of the resulting distribution and its mean and variance.

2. Let X has binomial distribution with parameters n and p. If the distribution is truncated by discarding the value zero, find the p.m.f. of the resulting distribution and its mean and variance.

3. Explain the need of introduction of truncated distribution? List the various applications of truncated binomial and Poisson distributions.

2. Index Numbers:

A] Questions for 1 mark

I] Choose the correct alternative

1. A series of numerical figures which show the relative position is called
   a) index number b) relative number
   c) absolute number d) none

2. Index number for the base period is always taken as
   a) 200 b) 50 c) 1 d) 100

3. ______play a very important part in the construction of index numbers.
   a) Weights b) classes c) estimations d) none

4.______is particularly suitable for the construction of index numbers.

a) H.M. b) A.M. c) G.M. d) none

5. Index numbers show________________changes rather than absolute amounts of change.

a) relative b) percentage c) multiple d) none

6. The_______ makes index numbers time-reversible.

a) A.M. b) G.M. c) H.M. d) none

7. Index number is equal to

a) sum of price relatives b) average of the price relatives
c) product of price relative d) none

8.The__of group indices given the General Index

a) H.M. b) G.M. c) A.M. d) none

9.A ratio or an average of ratios expressed as a percentage is called

a) a relative number b) an absolute number
c) an index number d) none

10.The value at the base time period serves as the standard point of comparison

a. false b) true c) both d) none

11. An index time series is a list of____________numbers for two or more periods of time

b. index b) absolute c) relative
d) none

12. Index numbers are often constructed from the

a) frequency b) class c) sample d) none

13.___________ is a point of reference in comparing various data describing individual behaviour.

a) Sample b) Base period c) Estimation d) none

14. The ratio of price of single commodity in a given period to its price in the preceding year price is called the

(a) base period (b) price ratio (c) relative price (d) none

15. P_{01} is the index for time

(a) 1 on 0 (b) 0 on 1 (c) 1 on 1 (d) 0 on 0

16. The best average for constructing an index numbers is

(a) Arithmetic Mean (b) Harmonic Mean
(c) Geometric Mean (d) None
of these.

17. Paasche's index is based on

(a) Base year quantities. (b) Current year quantities.
(c) Average of current and base year. (d) None of these.

18. Fisher's ideal index number is

(a) The Median of Laspeyre's and Paasche's index numbers
(b) The Arithmetic Mean of Laspeyre's and Paasche's index numbers
(c) The Geometric Mean of Laspeyre's and Paasche's index numbers
(d) None of these.

19. P_{10} is the index for time

(a) 1 on 0 (b) 0 on 1 (c) 1 on 1 (d) 0 on 0

20. We use price index numbers

(a) To measure and compare prices (b) to measure prices
(c) to compare prices (d) none

21. Laspeyre's index is based on

(a) Base year quantities. (b) Current year quantities.
(c) Average of current and base year. (d) None of these.

22. Index numbers are called as

a) atmospheric barometer b) economic indicator.
c) economic trend d) economic barometer.

23. If the value of Laspeyre's and Paasche's index number is 125.7 and 126.5 respectively the value of Fisher's ideal index number is

(a) 125.7 (b) 126.5 (c) 126.099 (d) 126.1

24. Consumer price index number is calculated by using

(a) Retail prices (b) Trading prices
(c) Wholesale prices (d) None of the above

25.The following are popular price index number

(a) Bombay stock exchange index number
(b) National stock exchange index number
(c) Consumer price index number
d) All the above

26. P_{01} is the price index for time

(a) For the current period 1 with base year 0

(b) For the current period 0 with base year 1

(c) For the current period 1 with base year 1

(d) None of above

27. There are types of index numbers

(a) Price Index Number

(b) Quantity Index Number

(c) Value Index Number

(d) All the above

28 The price relative is given by

a) $\frac{p_1}{p_0}$ b) $p_1 - p_0$

c) $p_0 \text{ X } p_1$ d) None of above

29. _____play a very important part in the construction of index numbers.

a) Weights b) classes

c) estimations d) none

II] State whether the following statement is *True* or *False* (1 each)

1. Index number for the base period is always taken as 100
2. Index number for the base period is always taken as 0
3. Price relative is the difference between current year price and base year price.
4. Selection of improper base year gives misleading indices.
5. Index numbers are always lies between 0 and 100.
6. Index numbers are unit less.
7. Consumer price index number uses only one commodity.
8. Index numbers are called as economic barometer.

III] Define

1. Base period
2. Index number
3. Relative change
4. Consumer price index number
5. Current year
6. Price index number

B] Questions for 2 marks

1. State relation between Fisher's and Laspeyre's & Paasche's index numbers.
2. State any two problems in construction of index numbers.
3. Comment on 'index number is called as economic barometer.'
4. Define index number. State any two real life situations of index number.
5. What is use of consumer price index numbers?
6. State any four index numbers which is useful for government.
7. Define Index Number and state any two uses of it.

C] Questions for 4 marks

1. Explain the concept of Index Number.
2. What is Index Numbers? Give the importance or utility of Index Numbers?
3. Explain the various methods of constructing Index Numbers?
4. What are the methods of constructing Consumer Price Index or Cost of Living Index Numbers?
5. What problems are involved in the construction of index numbers?
6. Calculate Fisher's Price Index Number from the following data.

Commodity	Year - 2014		Year - 2016	
	Price	Qty.	Price	Qty.
M	20	74	30	82
N	50	125	40	140
O	70	40	60	33

7. From the following data, calculate Fisher's price Index Number.

Commodity	Year 2010		Year 2014	
	Price	Quantity	Price	Quantity
Wheat	28	6	40	8
Rice	22	5	30	6
Jowar	17	4	28	5
Gram	25	2	34	3

8. .From the following data, calculate Fisher's price Index Number.

Commodity	Year 2016		Year 2015	
	Price	Quantity	Price	Quantity
A	10	4	12	4
B	12	3	11	2
C	15	2	14	3
D	18	3	15	1

9. Given : $\sum p1q0 = 1900$, $\sum p0q0 = 1360$, $\sum p1q1 = 1880$, $\sum p0q1 = 1344$

Find Laspeyre’s, Paasche’s and Fisher’s Price Index Number.

10. Given : $\sum p1q0 = 175$, $\sum p0q0 = 91$, $\sum p1q1 = 190$, $\sum p0q1 = 100$

Find Laspeyre’s, Paasche’s and Fisher’s Price Index Number.

11. Calculate cost of living Index number:

Group	Index no.	Weight
Food	350	50
Fuel	200	10
Clothing	240	10
House rent	160	10
miscellaneous	250	20

12. Calculate Price index number by:

i) Simple aggregate method ii) Average of price relative

	Price	
Group	Base year	Current year
Food	30	47
Fuel	8	12
Clothing	14	18
House rent	22	15
miscellaneous	25	30

13. Calculate cost of living Index number by family Budget Method:

	2010		2015	
Commodity	Price	Quantity	Price	Quantity
A	5	12	8	4
B	4	10	16	2
C	2	4	2	3

D] Questions for 6 marks

1. For the following data, calculate the
   i) Laspeyr's Price Index Number
   ii) Paasches Price Index Number
   iii) Fisher's Price Index Number

Commodity	1995		2005	
	Price	Quantity	Price	Quantity
A	5	10	8	4
B	2	12	16	2
C	1	4	2	3

2.Calculate price index number by using Fisher'sMethod.

Commodity	Base Year		Current Year	
	Price	Qty	Price	Qty
A	21	15	20	17
B	70	10	75	12
C	60	14	62	15
D	32	10	30	10
E	36	12	38	08

3 Time Series:

A] Questions for 1 mark

I] Choose the correct alternative

1. Additive model for time series Y =. . .
A) T × S × C × I
B) T − S − C− I
C) T + S + C + I
D) None

2.The most commonly used mathematical method for measuring the trend is
A) Semi Average
B) Moving Average
C) Free Hand Curve
D) Least Squares

3. A rise in prices before Eid is an example of
A) Cyclical Trend
B) Secular Trend
C) Irregular Trend
D) Seasonal Trend

4.Prosperity, Recession, and depression in a business is an example of
A) Irregular Trend
B) Secular Trend
C) Cyclical Trend
D) Seasonal Trend

5. In moving average method we cannot find trend values of some
A) End Periods
B) Middle Period
C) Starting and End Periods
D) Starting Periods

6. Seasonal variations are
A) None
B) Short term variation
C) Long term variation
D) Sudden variation

7. A fire in a factory delaying production for some weeks is
A) Secular Trend
B) Cyclical Trend
C) Irregular Trend
D) Seasonal Trend

8. Multiplicative model for time series is Y =. . .
A) $T \times S \times C \times I$
B) $T + S + C + I$
C) None
D) $T - S - C - I$

9. In the theory of time series, shortage of certain consumer goods before the annual budget is due to
A) Seasonal Variation
B) Secular Trend
C) Irregular Variations
D) Cyclical Variation

10. A set of observations recorded at an equal interval of time is called
A) Array data
B) Data
C) Geometric Series
D) Time series data

11. The best fitted trend line is one for which sum of squares of residuals or errors is
A) Positive
B) Minimum
C) Maximum
D) Negative

12. Graph of time series is called
A) Line graph
B) Trend
C) Historigram
D) Histogram

13. In the measurement of the secular trend, the moving averages:
A) Smooth out the time series
B) None
C) Give the trend in a straight line
D) Measure the seasonal variations

14. The following are the movement(s) in the secular trend
A) Smooth
B) Regular
C) None
D) Steady

15. Time series data have a total number of components?
A) 3
B) 5
C) 6
D) 4

16. The following series is not time series
A) Price of gold B) Price of share
C) Population D) Area of country

17. The fluctuations in a time series which repeat regularly every year or some specific period of time is observed in
A) Secular trend B) Seasonal variations
C) Cyclical variations D) Irregular variations

18. In time series analysis the exponential smoothing method helps to

A) Smooth out the random fluctuations B) Remove trend
D) Estimate exponential trend C) Estimate logarithmic trend

19. Reduced production in a factory due to strike amounts to following component in time series.
A) trend B) seasonal variation
C) cyclical variation D) irregular variation

II] State whether the following statement is *True* or *False* (1 each)

1. In additive model of time series, it assumes that there is no interaction between all the components and act independently.
2. Irregular variations are predictable in the analysis of time series.

3. Seasonal variation occurs the regularly during the year.
4. Cyclical variation is known as business cycle.
5. Moving average method is same as simple average method.

III] Define (1 each)

a) Seasonal variation.
b) Multiplicative model.
c) Time series.
d) Cyclical variation.
e) Components of time series
f) Additive model.
g) Linear model
f) Exponential model

B) Question of 2marks

1. State the two uses of exploratory data analysis of time series data.
2. State the autoregressive model of order 1.
3. Given $\alpha = 0.1$, estimate the profit for the year 2018 using exponential smoothing method for:

Year	Profit(in crores)
2016	21.8
2017	24.5

4. Define time series. Give any two time series in business.
5. Define time series. State the four components of time series.
6. State any two differences in secular trend and Seasonal variation.
7. State any two time series each belonging to seasonal and irregular variation.
8. State the difference between 'seasonal variations' and 'cyclical variations'.

C) Questions for 4 marks

1. Find 5- yearly moving average of the production of commodity for the year 2001 to 2013 as given below:

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Production('000)	3	5	7	8	10	12	19	21	24	35

2. Find 3- yearly moving average of the production of commodity for the year 2009 to 2018 as given below:

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Production('000)	11	14	13	12	14	16	19	21	24	27

3. Describe the method of fitting second degree curve.
4. Describe the component 'Cyclical variation'.
5. Describe the component 'Irregular variation'.

6. Describe the method of ratio to moving averages for the estimation of seasonal indices and discuss its demerits.

7. Explain the terms ‘seasonal variations’ and ‘cyclical variations’ with suitable illustrations.

D) Questions for 6 marks

1. Find 4-yearly moving average of the production of commodity for the year 2008 to 2017 as given below:

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Sales	20	21	22	24	23	25	27	29	28	27

2 Fit a trend line to the following data by least square method.

Year	2010	2011	2012	2013	2014
Sales	12	20	28	32	50

Also obtain the trend value of sales for the year 2017.

3.Find 5- yearly moving average of the production of commodity for the year 2009 to 2018 as given below:

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Production(‘000)	11	14	13	12	14	16	19	21	24	27

Also plot the trend values with original observation on same graph.

4.Estimate the trend using $\alpha = 0.10$ smoothing constant for the following time series. Also plot the trend values with original observation on same graph.

Year	1	2	3	4	5	6	7	8	9	10
Sales	31	37	39	41	41	39	33	29	27	29

5.Construct one case study from business where time series may be applied.

4. Chebyshev's Inequality:

A] Questions for 1 mark

I] Choose the correct alternative

1. Chebyshev's inequality states

   a) $P(|X - E(X)| \geq k\sigma) \geq \frac{1}{k^2}$

   b) $P(|X - E(X)| \geq k\sigma) < \frac{1}{k^2}$

   c) $P(|X - E(X)| \leq k\sigma) \geq \frac{1}{k^2}$

   d) $P(|X - E(X)| \leq k\sigma) > \frac{1}{k^2}$

2. If $X \rightarrow B(4, ½)$ then we get by Chebyshev's inequality $P(|X - 2| \geq 2) \leq$ ....

   a) 0.5 b) 0.25 c) 0.75 d) 1

3. Let $X \rightarrow N(5, 16)$. If $P(|X - \mu| < k\sigma) \geq \frac{24}{25}$ then the value of k

   a) 5 b) 10 c) 20 d) 25

4. If X follows probability distribution with mean and variance 4 then by Chebyshev's inequality We get $P(|X - 4| < 4) \geq$ ....

   a) 0.5 b) 0.25 c) 0.75 d) 1

5. Let $X \rightarrow Exp(\Theta = 1)$. The upper bound of $P(|X - \mu| \geq 6)$ given by Chebyshev's inequality is

   a) 0.5 b) 0.1 c) 0.2 d) 1

6. If $X \rightarrow N(\mu = 18, 6 = 2.5)$ then upper bound of $P(8 \leq X \leq 28)$ by using Chebyshev's inequality is

   a) 15/16 b) 1/16 c) 1 d) 1/4

II] State whether the following statement is *True* or *False* (1 each)

III] Define (1 each)

1. Chebyshev's inequality for discrete
2. Chebyshev's inequality for continuous

B] Questions for 2 marks

1. State the purpose of Chebyshev's inequality with an illustration.
2. Let X $\rightarrow$N(5, 16). If P(| X – μ | < kσ) ≥ $\frac{24}{25}$ then find the value of k.
3. Let X → Exp(ϴ = 1). Find the upper bound of P(| X – μ | ≥ 6) given by Chebyshev's inequality.

C] Questions for 4 marks

1. The average check at a local restaurant is $ 36.42 with standard deviation of $ 8.15. What is the minimum percentage of check lies between $ 15.23 and $ 57.61?

2.Let X~B(n = 100, p = 0.3), determine the upper bond regarding probability of X residing between 20 and 40 using Chebyshev's inequality.

3. Let X be the number of screws delivered to box by automatic filling machine. Assume that X follows normal distribution with mean = μ =1000 and variance = 6^2 = 25. Use Chebyshev's inequality to find the bound on P(994 < X < 1006).

4. A discrete random variable X takes values -1, 0 and 1 with respective probability 1/8, ¾ and 1/8. Evaluate P(| X – μ | ≥ 2σ) and compute it with upper bound given by Chebyshev's inequality.

D] Questions for 6 marks

1. A random variable X with E(X) = 3 and E(X^2) = 13 the find

   i) The last value of P(| X – 3 | < 4)
   ii) Lower bound for P(-2 < X < 8)
   iii) Upper bound for P(| X – 3 | > 8)
   iv) Value of C such that P(| X – 3 | < C) > 0.9

2 The continuous random variable X has probability distribution is given by

$$f(x) = e^{-x} \quad \text{where } x \geq 0$$
$$= 0 \quad \text{otherwise}$$

Show that the Chebyshev's inequality. gives P(| X – 1 | ≥ 2) ≤ ¼, where the actual probability is e^{-3}.

3. List the various real life situations where Chebyshev's inequality may be apply.

-00-00-