

Model Paper - I
FOR REDUCED SYLLABUS 2020-21
SUBJECT: STATISTICS (31)

[Total No. of questions: 44]

Time: 3Hrs. 15Mins.

Max. Marks: 100

- Note: 1. Statistical table and graph sheets will be supplied on request.
2. Scientific calculators may be used.
3. All working steps should be clearly shown.

Section – A

I. Answer any ten of the following questions. 10 × 1 = 10

1. Define fertility.
2. If NRR per woman is less than 1, then what does it indicate about the population?
3. What is longevity?
4. What is the value of index number for the base year?
5. Write the formula of quantity relative.
6. State the condition required to satisfy circular test.
7. Which price of the commodities are used in the construction of cost of living index number?
8. Define time series.
9. What is Historigram?
10. Write the relationship between mean and variance of a Bernoulli distribution.
11. Write down the range of a Poisson distribution.
12. Find mode of a chi-square variate with 8 degrees of freedom.

Section – B

II. Answer any ten of the following questions. 10 × 2 = 20

13. Given $P_0 = 8000$, Births = 200, Deaths = 120. Estimate the population if it is free from migration.
14. In a life table, if $l_1 = 95,400$ and $l_2 = 93,492$ then, find survival ratio of the first year.
15. Which average is considered as the best average in the construction of index number? Why?
16. State two norms (considerations) for the selection of base year.
17. If $P_{01}^L = 101.6$ and $P_{01}^F = 99.6$, find P_{01}^P .
18. Mention any two uses of time series.
19. Name four methods of measuring trend.
20. Write two assumptions of interpolation and extrapolation.
21. Mention two features of binomial distribution.
22. Find $P(X = 0)$ in a Poisson distribution with mean 5.
23. Mean and variance of a normal distribution are 12 and 4 respectively. Find points of inflexion.
24. If the parameter of t-distribution is 6, find mean and variance.

Section – C

III. Answer any eight of the following questions.

8 × 5 = 40

25. The following table gives the age and sex distribution, the number of live births occurring in a year in a population. Find CBR and GFR.

Age [in years]	Male Population	Female Population	Number of live births
0 - 14	20730	19840	0
15 - 19	7066	7310	212
20 - 24	7300	7120	657
25 - 29	6300	5860	592
30 - 39	9980	9120	326
40 - 49	7400	6920	81
50 & above	8400	7900	0

26. In a locality 3,000 live births occurred. The number of infant deaths was 138, the number of neo-natal deaths was 84 and 24 mothers died due to child birth complications. Find IMR, NMR and MMR.
27. What is an index number? Mention any three characteristics of index number.
28. Compute suitable index number from the following data and comment on the result.

Item	p ₀	p ₁	q ₁
I	5	6	30
II	3	4	15
III	4	5	18
IV	2	2	10

29. The group indices and the corresponding weights for the working class in an industrial town for the years 2010 and 2015 with base 2005 are given below. Calculate consumer price index numbers and compare them.

Group	Group weights	Group Index with base 2005	
		2010	2015
Food	60	370	380
Clothing	8	420	500
Fuel	10	470	340
House Rent	12	110	120
Misc.	10	280	282

30. Mention the components of time series and explain any one of them with example.
31. Calculate trend values by 4 yearly moving averages for the following data.

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Production (in tons)	464	515	518	467	502	540	557	571	586	612

32. Fit a straight line trend for the following data by least squares method.

Year	2007	2008	2009	2010	2011

Price (in Rs.)	12	20	31	40	47
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33. Interpolate and extrapolate the production for the years 1989 and 1991 with the help of the following table.

Year	1986	1987	1988	1989	1990	1991
Production	120	122	126	-	135	-

34. The incidence of an occupational disease in an industry is such that the workers have 20% chance of suffering from it. If there are 500 workers what is the probability that sample of 5 workers at most 1 suffer from the disease?
35. A car hire agency has two cars. On an average there is a demand for one car during a particular hour. What is the probability that i) both the cars are free ii) some demand is refused?
36. A pond has 10 fishes among which 4 are marked ones (marked fishes are under scientific observation). 4 fishes are caught from the pond. Find the probability that two of them are marked ones. Also find the mean of marked ones.

Section – D

IV. Answer any two of the following questions.

$2 \times 10 = 20$

37. From the following data, compute standardized death rates for Town A and Town B. Comment on the results.

Age group [in years]	Town - A		Town - B		Standard Population
	Population	Deaths	Population	Deaths	
0 – 20	5,000	100	7,000	105	4,000
20 – 50	14,000	392	15,000	465	16,000
50 – 70	20,000	300	25,000	500	18,000
70 & above	1,000	200	3,000	390	2,000

38. For the following data verify whether Fisher's index number satisfies TRT and FRT.

Item	Price (Rs.)		Quantity	
	Base year	Current year	Base year	Current year
A	4	6	4	2
B	6	4	4	8
C	8	10	5	3

39. The following figures gave the annual production of a commodity. Estimate the production in 2011 by using the trend equation of the type $y = a + bx + cx^2$.

Year	2004	2005	2006	2007	2008	2009	2010
Production ('000 tons)	8	10	13	17	22	28	35

40. The weights of 1000 students are normally distributed with mean 55 kgs. and S.D. 3kgs. Find the number of students with weight i) less than 58kgs. ii) between 57kgs. and 60kgs. iii) more than 50 kgs.

Section – E

V. Answer any two of the following questions.

2 × 5 = 10

41. Find the GRR from the following data. Obtain the average number of female children born to woman of child bearing age.

Age group [in years]	15 - 19	20 - 24	25 - 29	30 - 34	35 - 39	40 - 44	45 - 49
Female population	13000	15000	14000	12000	15000	16000	15000
Female births	390	750	840	600	600	384	90

42. Calculate simple geometric mean price index number for the following data.

Item		A	B	C	D	E
Price (Rs.)	Base year	24	40	20	16	50
	Current year	30	35	24	16	60

43. The following table shows the expectation of life at different ages. Interpolate the expectation of life at the age 15.

Age (in Years)	10	20	30	40
Expectation of life (in years)	50	42	33	22

44. Four unbiased coins are tossed 128 times. Find the theoretical frequencies for the number of heads obtained.

Model Paper – II
FOR REDUCED SYLLABUS 2020-21
SUBJECT: STATISTICS (31)

[Total No. of questions: 44]

Time: 3Hrs. 15Mins.

Max. Marks: 100

- Note: 1. Statistical table and graph sheets will be supplied on request.
2. Scientific calculators may be used.
3. All working steps should be clearly shown.

Section – A

I. Answer any ten of the following questions.

10 × 1 = 10

1. Mention a method of obtaining vital statistics.
2. Define fecundity.
3. What is life table?
4. Which index number shows upward bias?
5. Write down the formula of unweighted arithmetic mean price index number.
6. State the relation between Laspeyre's, Paasche's and Dorbish–Bowley's index numbers.
7. Define consumer price index number.
8. Mention a use of time series.
9. Which variation of the time series is unpredictable?
10. For what value of 'p' binomial distribution is symmetrical?
11. Name the distribution for which variance and S.D. are equal.
12. Write the range of a student's t-distribution.

Section – B

II. Answer any ten of the following questions.

10 × 2 = 20

13. In a locality out of 20000 births 100 mothers died due to child birth complications. Calculate maternal mortality rate.
14. Mention two uses of vital statistics.
15. State two limitations of index numbers.
16. If $\sum p_1q = 450$ and $\sum p_0q = 400$, find Kelly's price index number.
17. Find consumer price index number from the following data.

Group	A	B	C	D
Group Index	100	120	130	110
Weight	2	3	1	4

18. What are the different phases in a business cycle?
19. Mention a factor causing following variations:
i) Seasonal variation ii) Irregular variation
20. Write down the conditions for applying of Binomial expansion method of interpolation and extrapolation.
21. Find the mean and variance of a Bernoulli distribution with parameter $p = 0.8$.

22. In a Poisson distribution $3 \times p(3) = p(4)$. Find mean.
23. If $a = 5$, $b = 15$ and $n = 3$, then find the variance of hyper geometric distribution.
24. For a chi square (χ^2) variate, with 10 d.f. $P(0 < \chi^2 < 9.33) = 0.5$. Find median and mode.

Section – C

III. Answer any eight of the following questions.

8 × 5 = 40

25. Find the total fertility rates and compare the fertility of the two communities.

Age [in years]	Age-Specific fertility rates	
	Community A	Community B
15 - 19	25	40
20 - 24	100	60
25 - 29	150	90
30 - 34	110	100
35 - 39	80	69
40 - 44	30	30
45 - 49	5	11

26. Compute crude death rate and age specific death rates for the following data.

Age [in years]	Population	Deaths
Under 10	12,000	450
10 - 19	20,000	480
20 – 39	40,000	800
40 – 59	20,000	670
60 & above	8,000	500

27. What are the steps involved in the construction of index number? Explain any two.

28. Calculate suitable index number from the following data. Comment on the result.

Item	Current year price	Quantity	
		Base year	Current year
A	30	8	10
B	45	10	15
C	100	7	10
D	22	20	25

29. Compute cost of living index number.

Group	Price (in Rs.)		Weight
	Base year	Current year	
Food	130	170	65
Clothing	50	60	20
Fuel	90	110	20
Entertainment	30	50	15
Medicine & education	40	70	10
Other	50	90	15

30. Mention the conditions for applying the least square method. Write 2 merits and 1 demerit.

31. Obtain trend values by 3 yearly moving averages for the following data.

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
No. of Students	15	18	17	20	23	25	29	36	33	40

32. For the following time series fit a linear trend by the method of least squares.

Year	2002	2004	2006	2008	2010	2012
Profit (in crores)	10	20	32	36	52	60

33. Interpolate and Extrapolate the population of India for the census years 1981 and 2021 from the following data.

Census Year	1961	1971	1981	1991	2001	2011	2021
Population(Crores)	44	55	-	84	103	122	-

34. If 2% of electric bulbs manufactured by a company are known to be defective, what is the probability that a sample of 150 electric bulbs taken from the production process of that company would contain i) exactly one defective bulb? ii) more than two defective bulbs? (Use Poisson approximation).

35. A box contains 8 red and 4 white balls. From this box 5 balls are drawn at random. What is the probability that the sample contains 3 red balls? Also find the mean number of red balls

36. The weekly wages of workers are normally distributed with mean Rs.3000 and S.D. Rs.500. Find the probability of workers whose weekly wages will be i) more than Rs.2500 ii) between Rs.2600 and Rs.3200.

Section – D

IV. Answer any two of the following questions.

2 × 10 = 20

37. For the following data, compute the GRR, NRR and hence comment on the results.

Age group [in years]	15 - 19	20 - 24	25 - 29	30 - 34	35 - 39	40 - 44	45 - 49
Female population	8,000	9,000	10,000	9,000	8,000	7,000	6,000
Female births	240	450	600	360	160	70	30
Survival ratio	0.90	0.88	0.85	0.84	0.82	0.80	0.80

38. Find Fisher's price index numbers for 2000 from the following data. Verify whether Fishers index number satisfy TRT

Item	1995		2000	
	Price (Rs.)	Quantity	Price (Rs.)	Quantity
A	6	50	10	56
B	2	100	2	120
C	4	60	6	60
D	10	30	12	24
E	8	40	12	36

39. Population figures for a city are given below.

Year	2008	2009	2010	2011	2012
Population ('000)	132	142	157	170	191

Fit a curve of the type $y = ab^x$ and estimate the population for the year 2014.

40. The following data relates to the number of defective items in a sample of 5 for 500 samples.

Number of defective items	0	1	2	3	4	5
Number of samples	171	200	99	20	8	2

Fit a binomial distribution to the data. Obtain the theoretical frequencies.

Section – E

- V. Answer any two of the following questions.

$2 \times 5 = 10$

41. From the following data, show that Town B is healthier.

Age [in years]	Deaths per 1000		Standard Population
	Town A	Town B	
Below 10	18	12	15,000
10 – 20	4	4	18,000
20 – 50	8	9	22,000
40 – 70	10	8	12,000
70 & above	80	90	8,000

42. Calculate the weighted geometric mean price index number for the following data.

Item		Stereo	Television	Radio
Price Rs/ Unit	Base year	20,000	15,000	500
	Current year	25,000	20,000	800
Weight		30	50	20

43. Below are given the wages earned by workers per day in a certain factory. Using Newton's advancing difference method estimate the number of workers earning up to Rs.550 per day.

Wages per day up to (Rs.)	500	600	700	800
No. of workers	50	150	300	500

44. In a normal distribution, mean and S.D. are 50 and 15 respectively. Find Q_1 , Q_2 and Q_3 .

Model Paper - III
SUBJECT: STATISTICS (31)

[Total No. of questions: 44]

Time: 3Hrs. 15Mins.

Max. Marks: 100

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- Note: 1. Statistical table and graph sheets will be supplied on request.
2. Scientific calculators may be used.
3. All working steps should be clearly shown.

Section – A

- I. Answer any ten of the following questions. 10 × 1 = 10**
1. Generally what is the child bearing age of women?
 2. Define infant mortality rate.
 3. Define cohort.
 4. Name the index number which satisfies circular test.
 5. Name the common average used in the construction of index numbers.
 6. Which weight is used in the construction of Paasche's quantity index number?
 7. Write a use of consumer price index number.
 8. Define secular trend.
 9. Write a merit of method least squares for measuring trend.
 10. Write the parameter of a Bernoulli distribution.
 11. Write the range of a hyper geometric distribution.
 12. What is the total area under the normal curve?

Section – B

- II. Answer any ten of the following questions. 10 × 2 = 20**
13. The average population of a town in a year was 150000. In the year 6000 live births occurred in the town. Find The CBR.
 14. The quinquennial age specific fertility rates for women of child bearing age group are 40, 60, 90, 100, 69, 30 and 11. Compute TFR.
 15. Mention any four steps involved in the construction of general price index number.
 16. The sum of price relatives of 5 different commodities is 200. Find a suitable un-weighted price index number.
 17. Why Fisher's index number is called as an 'Ideal index number'?
 18. Define random variation. Give an example.
 19. Given a second degree trend equation $Y = 25 - 0.75X + 2X^2$. Estimate the value of Y, when $X=3$.
 20. Write down the conditions for applying Newton's advancing difference method of interpolation.
 21. Write down two features of binomial distribution.
 22. In a Poisson distribution the first probability term is 0.3679. Find the next probability term.

23. Under what conditions hyper geometric distribution tends to binomial distribution?
 24. Mention two features of chi-square distribution.

Section – C

III. Answer any eight of the following questions.

8 × 5 = 40

25. For the following data, find GFR and ASFR for (25 – 29) and ASFR for (30 – 39).

Age group [in years]	15 - 19	20 - 24	25 - 29	30 - 34	35 - 39	40 - 44	45 - 49
Female population	8,000	11,000	15,000	20,000	15,000	6,000	5,000
Live births	320	660	1,350	2,000	1,035	180	55

26. In a locality 10,000 live births occurred. The number of infant deaths was 450, the number of neo-natal deaths was 270 and 90 mothers died due to child birth complications. Find IMR, NMR and MMR.

27. Explain briefly the steps involved in the construction of cost of living index number.

28. The following are the prices (in Rs.) of items in 2010 and 2015. Find simple geometric mean price index number.

Item		A	B	C	D	E	F
Price (Rs.)	2010	50	60	20	50	80	125
	2015	55	75	30	75	90	130

29. For the following data show that Fisher’s price index number satisfies TRT.

Item	Base year		Current year	
	Price	Quantity	Price	Quantity
A	4	4	6	2
B	6	4	4	8
C	8	5	10	3

30. Explain the semi averages method of measuring trend. Write down its merits and demerits.

31. Find trend values by five yearly moving averages for the following time series.

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
Value	10	15	18	21	25	30	33	40	50

32. For the the following time series fit a linear trend by the method of least squares.

Year	1980	1984	1988	1992	1996	2000
Sales ('000)	16	20	19	14	18	21

33. Using Newton’s forward difference method interpolate the value of ‘y’ when x = 25.

X	10	20	30	40	50
Y	55	48	39	26	7

34. In a certain university, the chance that a professor suffers from dust allergy is 1/5. Calculate the chance that out of 8 professors in a university i) 2 will not suffer from the allergy, ii) at least 2 will suffer from the allergy.

35. In a text book, on an average 0.3 mistakes per page is found. If there are 500 pages in the text book, in how many pages will there be i) three mistakes ii) at the most two mistakes?
36. Write any five properties of normal distribution.

Section – D

IV. Answer any two of the following questions.

2 × 10 = 20

37. From the following data, compute standardized death rates by taking locality B population as standard and comment on results.

Age group [in years]	Locality A		Locality B	
	Population	Deaths	Population	Deaths
0 – 20	4,000	68	6,000	120
20 – 40	9,000	54	12,000	60
40 – 60	7,000	91	8,000	104
60 & Above	3,000	129	4,000	160

38. From the following data compute Marshall-Edgeworth's and Dorbish-Bowley's price Index numbers.

Item	Price (in Rs.)		Quantity	
	Base year	Current year	Base year	Current year
A	6	10	50	56
B	2	2	100	120
C	4	6	60	60
D	10	12	30	24
E	8	12	40	36

39. By the method of least squares fit a parabolic trend for the following time series. Estimate the production for the year 2017.

Year	2011	2012	2013	2014	2015
production ('000 tons)	15	11	10	11	13

40. a) Fit a Poisson distribution to the following data and hence find the theoretical frequencies.

No. of deaths per day	0	1	2	3	4 and more
No. of days	20	45	30	5	0

- b) Heights of 2000 soldiers are normally distributed with mean 175 cm and S.D 4 cm. Find the number of soldiers with height between 173 cm and 177 cm.

Section – E

V. Answer any two of the following questions.

2 × 5 = 10

41. For the following data, calculate net reproduction rate.

Age group [in years]	15 - 19	20 - 24	25 - 29	30 - 34	35 - 39	40 - 44	45 - 49
Female population	8,000	9,000	10,000	9,000	8,000	7,000	6,000
Female births	240	450	600	360	160	70	30
Survival ratio	0.90	0.88	0.85	0.84	0.82	0.80	0.80

42. For the following data find consumer price index number by aggregative expenditure method.

Item	No. of units (quantities) in 2010	Price per unit in Rs.	
		2010	2015
A	100	8	12
B	25	6	7
C	10	5	5
D	20	48	52
E	25	15	16
F	30	9	27

43. Interpolate and extrapolate the production for the years 2000 and 2010 with the help of the following table.

Year	1980	1985	1990	1995	2000	2005	2010
Production (tons)	5	12	19	26	-	40	-

44. If $a = 5$, $b = 15$ and $n = 3$, then find $P(X = 2)$ and S.D of hyper geometric distribution.