MA (First Semester) Examination, 2013

Elementary Statistics

Model Answer

Ans. 1.

(i) $M = l_1 + \frac{m-c}{f} \times i$

M = Median

l_1 = lower limit of the median class

$m = \frac{n}{2}$

f = frequency of the median class

c = Cumulative frequency of the group preceding the Median Class

(i) = magnitude of the Median Class

(ii) Kinds of Average

(a) Positional Averages

Mode

Median

(b) Mathematical Averages

Arithmetic Average

Geometric Mean

Harmonic Mean

Quadratic Mean

(c) Commercial Averages

Moving Average

Progressive Average

Composite Average

(iii) Karl Pearson's coefficient of correlation method
Spearmen's Rank coefficient of correlation method

(iv) An index ~~a~~ number is special type of average that provides a measurement of relative change from time to time or from place to place

(v) Interpolation is useful in commerce and industry by providing best possible estimate on the basis of certain assumptions.

(vi) There are two regression lines Y on x and x on Y. One Regression lines cannot minimise the sum of squares of deviations for both the x and y series unless the relationship between them indicates perfect positive or negative correlation. For this reason one regression line minimises the sum of the squares of deviations of the x-series and the other regression line takes care of the deviations of Y-series.

(vii) All the items have been treated as equally important in Simple Index Number, but where the relative importance of items is not equal, weighted average gives better results than an unweighted one. As such index numbers should be weighted.

(vii) When such problems are faced where it is possible to arrange the various items of a series in serial order but the quantitative measurement of their value is difficult.

(ix) Regression analysis is done for estimating or predicting the unknown value of one variable from the known value of the other variable. This is a very useful statistical tool which is used both in natural and social sciences particularly in the field of business.

(x) The term dispersion refers to the variability in the size of items. It indicates that the size of items in a series is not uniform. If the variation is substantial, dispersion is said to be considerable and if the variation is little, dispersion is insignificant.

If there is a series in which the scatter of the value is much say from 100 to 1000 this series would be said to have more dispersion than the one in which the values range only from 100 to 200. However, the term dispersion not only gives a general impression about the variability of a series, but also a precise measure of this variation.

Section- B

Ans 2.

Marks	no. of students (f)	c.f.	MV(x)	dx (x-22·5)	ds	fds
5-10	6	6	7·5	-15	-3	-18
10-15	5	11	12·5	-10	-2	-10
15-20	15	26	17·5	-5	-1	-15
20-25	10	36	22·5	0	0	0
25-30	5	41	27·5	5	1	5
30-35	4	45	32·5	10	2	8
35-40	2	47	37·5	15	3	6
40-45	2	49	42·5	20	4	8
						-11

$$\bar{x} = a + \frac{\Sigma fds}{\Sigma f} \times i$$

$$\bar{x} = 22\cdot5 + \frac{-11}{49} \times 5$$

$$\bar{x} = 22\cdot5 + \frac{-55}{49}$$

$$\bar{x} = 22\cdot5 - 1\cdot1224$$

$\bar{x} = 21\cdot3776$ Marks → Arithmetic Mean

$$M = l_1 + \frac{\frac{n}{2} - c}{f} \times i$$

$$= 15 + \frac{24\cdot5 - 11}{15} \times 5$$

$$= 15 + \frac{13\cdot5\cancel{9}}{15} \times 5$$

$= 15 + \frac{13\cdot5}{15} \times 5 = 15 + \cancel{0.233}\ 4\cdot5$

$= \cancel{15.833}\ 19\cdot5$ → Median

Ans. 3. AM = 60 AM = 50

x	dx	dx^2	y	dy	dy^2	$dxdy$
42	−18	324	56	6	36	−108
44	−16	256	49	−1	1	16
58	−2	4	53	3	9	−6
55	−5	25	58	8	64	−40
89	29	841	65	15	225	435
98	38	1444	76	26	676	988
66	6	36	58	8	64	48
452 Σx	73 −41 32 Σdx	2930 Σdx^2	415	65 Σdy	1075 Σdy^2	1487 −154 1333 $\Sigma dxdy$

$$\bar{x} = \frac{452}{7} = 64.57$$

$$\bar{y} = \frac{\Sigma y}{n} = \frac{415}{7} = 59.28$$

$$r = \frac{n.\Sigma dxdy - (\Sigma dx)(\Sigma dy)}{\sqrt{n.\Sigma dx^2 - (\Sigma dx)^2 \times n.\Sigma dy^2 - (\Sigma dy)^2}}$$

$$= \frac{7.1333 - (32)(65)}{\sqrt{7.2930 - (32)^2 \times 7.1075 - (65)^2}}$$

$$= \frac{9331 - 2080}{\sqrt{20510 - 1024 \times 7525 - 4225}}$$

$$= \frac{7251}{\sqrt{19486 \times 3300}} = \frac{7251}{\sqrt{64303800}} = \frac{7251}{8018.96}$$

$r = 0.904$

We found high degree of positive correlation between export and import.

Ans. 4. Assume x = Subject A

Y = Subject B

$\bar{x} = 39.5, \ \bar{Y} = 47.6$

$\sigma_x = 10.8 \quad \sigma_y = 16.9$

$r = 0.42$

Regression equation of x on Y

$$x - \bar{x} = r \frac{\sigma_x}{\sigma_Y} (Y - \bar{Y})$$

$$x - 39.5 = 0.42 \frac{10.8}{16.9} (Y - 47.6)$$

$$x - 39.5 = 0.268 (Y - 47.6)$$

$$x - 39.5 = 0.268 Y - 12.76$$

$$x = 0.268 Y - 12.76 + 39.5$$

$$x = 26.74 + 0.268 Y$$

Regression equation of Y on x

$$Y - \bar{Y} = r \frac{\sigma_y}{\sigma_x} (x - \bar{x})$$

$$Y - 47.6 = 0.42 \frac{16.9}{10.8} (x - 39.5)$$

$$Y - 47.6 = 0.657x - 25.96$$

$$Y = 21.64 + 0.657x$$

If the marks of subject B is 55, $Y = 55$

$$x = 26.74 + 0.268 \times 55$$

$$x = 41.48$$

If the marks of subject A is 50, $x = 50$

$$Y = 21.64 + 0.657 \times 50$$

$$Y = 54.49$$

Ans. 1) Regression equation of x on Y; $x = 26.74 + 0.268Y$
2) Regression equation of Y on x; $Y = 21.64 + 0.657x$
3) If the marks of Subject B = 55 marks of subject A will be 41.48
4) If the marks of Subject A = 50 marks of subject B will be 54.49

Ans. 5

Year		Price		$\frac{P_1}{P} \times 100$	Chain relative
1991	0	175	P_0	—	$I_{00} = 100$
1992	1	200	P_1	$\frac{200}{175} \times 100$	$I_{01} = 114.28$
1993	2	250	P_2	$\frac{250}{200} \times 100$	$I_{12} = 125.00$
1994	3	300	P_3	$\frac{300}{250} \times 100$	$I_{23} = 120.00$
1995	4	280	P_4	$\frac{280}{300} \times 100$	$I_{34} = 93.33$

Ans 6 PTO

Ans. 6

Class	frequency (f)	Mid value (x)	$dx = \frac{x-25}{10}$	fdx	C.f.
0-10	46	5	-2	-92	46
10-20	73 f_1	15	-1	-73	119
20-30	26	25	0	0	145
30-40	15	35	1	15	160
40-50	09	45	2	18	169
	$\Sigma f = 169$			-165	
				33	
				-132	

By observation maximum frequency = 73

So 10-20 is model class

$$Z = l_1 + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times i$$

$$= 10 + \frac{73-46}{2 \times 73 - 46 - 26} \times 10$$

$$= 10 + \frac{27}{146 - 72} \times 10$$

$$= 10 + \frac{270}{74} = 13.65 \text{ days} \rightarrow \text{Mode}$$

Median no. $m = \frac{n}{2} = \frac{169}{2} = 84.5$

So median class = 10-20

$$M = l_1 + \frac{m-c}{f} \times i$$

$$= 10 + \frac{84.5 - 46}{73} \times 10$$

$$= 10 + \frac{38.5}{73} \times 10 = 15.27 \text{ days} \rightarrow \text{Median}$$

$$\text{Arithmetic Mean } \bar{x} = a + \frac{\Sigma f dx}{\Sigma f} \times i$$

$$= 25 + \frac{-132}{169} \times 10$$

$$= 25 - 7.81 = 17.19 \text{ days} \rightarrow \text{Mean}$$

Ans 7. a. Introduction, Interpolation.

b. Definitions

c. Significance and Utility

d. Assumptions

e. Difference from forecasting giving examples.

f. Summary

Ans. 8.

Rx	Ry	$d = Rx - Ry$	d^2
1	2	-1	1
2	4	-2	4
3	1	2	4
4	5	-1	1
5	3	2	4
6	9	-3	9
7	7	0	0
8	10	-2	4
9	6	3	9
10	8	2	4
			40
			Σd^2

$$r_s = 1 - \frac{6\Sigma d^2}{n(n^2-1)}$$

$$= 1 - \frac{6 \cdot 40}{10(10^2-1)}$$

$$= 1 - \frac{240}{990}$$

$$= 1 - 0.24$$

$$= 0.76 \longrightarrow \text{Ans.}$$

Ans. The knowledge of the students in the two subjects mathematics & statistics is highly correlated. The high degree of positive correlation is found between the two subjects.