(1.) Find the Coefficient of Correlation from the following data.

Cost	39	65	62	90	82	75	25	98	36	78
Sales	47	53	56	86	62	68	60	91	51	84

Cost (X)	Sales(Y)	dx	dy	dx^2	dy^2	dx.dy
39	47	-26	-19	676	361	494
65	53	0	-13	0	169	0
62	56	-3	-8	9	64	24
90	86	25	20	625	400	500
82	62	17	-4	289	16	-68
75	68	10	2	100	4	20
25	60	-40	-6	1600	36	240
98	91	33	25	1089	625	825
36	51	-29	-15	841	225	435
78	84	13	8	169	324	234
650	660	0	0	5398	2224	2704

$$\bar{X} = \frac{\sum X}{N} = \frac{650}{10} = 65 \qquad \bar{Y} = \frac{\sum Y}{N} = \frac{660}{10} = 66$$

$$r = \frac{N\sum dxdy - (\sum dx)(\sum dy)}{\sqrt{N\sum dx^2 - (\sum dx)^2}\sqrt{N\sum dy^2 - (\sum dy)^2}}$$

$$= \frac{10 \times 2704 - (0)(0)}{\sqrt{10 \times 5398 - (0)^2}\sqrt{10 \times 2224 - (0)^2}}$$

$$= \frac{27040}{\sqrt{53980}\sqrt{22240}} = \frac{27040}{232.33 \times 141.13}$$

$$r_1 = \frac{27040}{34644.37}$$

$$\boxed{r_1 = 0.780}$$

With the following data in 6 cities calculate Person's coefficient of Correlation between density of population and death etc.

City	A	B	C	D	E	F
Area in KM	150	180	100	60	120	80
Population in (000)	30	90	40	42	72	24
No. of Deaths	300	1440	560	840	1224	312

Area	Population	No. of death	dx X-A	dy X-A	dx^2	dy^2	$dx.dy$
150	30	300	-10	-260	100	67600	2600
180	90	1440	50	880	2500	774400	44000
100	40 (A)	560 (A)	0	0	0	0	0
60	42	840	2	280	4	78400	560
120	72	1224	32	664	1024	440896	21248
80	24	312	-16	-248	256	61504	3968
			58	1316	3884	1422800	72376

The r ... students in accordance with their performance in two
Subj ...

$$f = \frac{72376 - \frac{58\,(1316)}{6}}{\sqrt{3884-\left(\frac{58}{6}\right)^2}\sqrt{1422800-\left(\frac{1316}{6}\right)^2}}$$

$$= \frac{59654.67}{\sqrt{3884-93.2}\sqrt{1422800-48105.65}}$$

$$= \frac{59654.67}{\sqrt{3790.63}\sqrt{1374694.35}}$$

$$= \frac{5965.4.67}{61.65 \times 1172.47}$$

$$= \frac{59654.67}{72177.25}$$

$$\boxed{f = 0.826}$$

Find the coefficient of correlation between age and sum assured (in INR 1000 from the following data

Age Group (Yrs)	Sum Assured in Rs				
	10	20	30	40	50
20 - 30	4	6	3	7	1
30 - 40	2	8	15	7	1
40 - 50	3	9	12	6	2
50 - 60	8	4	2	—	—

Age	10	20	30	40	50	M	dM	M/i	fdM	fdx	fdx²	fdxdy	
20-30	4	6	3	7	1	25	-10	-1	-1	21	-21	1	21	5
30-40	9	8	15	7	1	35	0	0	0	33	0	0	0	0
40-50	8	9	12	6	2	45	10	1	1	32	32	1	32	-5
50-60	8	4	2	0	0	55	20	2	2	14	28	4	56	-40
dy	-20	-10	0	10	20					N=100	39	6	109	-40
dy/i	-2	-1	0	1	2									
f	17	27	32	20	4	N=100								
fdy	-34	-27	0	20	8	-33								
dy²	4	1	0	1	4	10								
fdy²	68	-27	0	20	16	131								
fdx.dy	-30	-11	0	-1	2	-40								

$$r = \frac{\Sigma fdxdy - \frac{(\Sigma fdx)(\Sigma fdy)}{N}}{\sqrt{\left(\Sigma fdx^2 - \frac{(\Sigma fdx)^2}{N}\right)\left(\Sigma fdy^2 - \frac{(\Sigma fdy)^2}{N}\right)}}$$

$$= \frac{(-40) - \frac{(39)(-33)}{100}}{\sqrt{109 - \left(\frac{39}{100}\right)^2}\sqrt{131 - \left(\frac{-33}{100}\right)^2}}$$

$$= \frac{-(40) - (-128.7)}{\sqrt{109 - 0.1521}\sqrt{131 - 0.1089}}$$

$$= \frac{-40 + 128.7}{\sqrt{108.8479}\sqrt{130.8911}}$$

$$r = \frac{88.7}{10.433 \times 11.4408} = \frac{88.7}{119.3619} = +0.7431$$

The ranking of 10 students in accordance with their performance in two subject A and B are as follows:

A	6	5	3	10	2	4	9	7	8	1
B	3	8	4	9	1	6	10	7	5	2

A	B	$d = R_1 - R_2$	d^2
6 (5)	3 (8)	-3	9
5 (6)	8 (3)	3	9
3 (8)	4 (7)	1	1
10 (1)	9 (2)	-1	1
2 (9)	1 (10)	-1	1
4 (7)	6 (5)	2	4
9 (2)	10 (1)	1	1
7 (4)	7 (4)	0	0
8 (3)	5 (6)	-3	9
1 (10)	2 (9)	1	1
			36

$$R_s = 1 - \frac{6 \sum d^2}{n^3 - n}$$

$$= 1 - \frac{6 \times 36}{1000 - 10}$$

$$= 1 - \frac{216}{990}$$

$$= 1 - 0.218$$

$$R_s = 0.782$$

...e Spearman's coefficient of Correlation between marks assigned to students ... measure of skewness from the following data by Judges x and y Certain competitive test as shown below

Students	1	2	3	4	5	6	7	8	9	10
Marks by X	52	53	42	60	45	41	37	38	25	27
Marks by Y	65	68	43	38	77	48	35	30	25	50

Student	Judge X	Judge Y	$d = x_1 - x_2$	d^2
1	52 (3)	65 (3)	0	0
2	53 (2)	68 (2)	0	0
3	42 (5)	43 (6)	-1	1
4	60 (1)	38 (7)	-6	36
5	45 (4)	77 (1)	3	9
6	41 (6)	48 (5)	1	1
7	37 (8)	35 (8)	0	0
8	38 (7)	30 (9)	2	4
9	25 (10)	25 (10)	0	0
10	27 (9)	50 (4)	5	25
				73

$$R_s = 1 - \frac{6 \sum d^2}{n^3 - n}$$

$$= 1 - \frac{6 \times 73}{1000 - 10}$$

$$= 1 - \frac{438}{990}$$

$$R_s = 1 - 0.442$$

$$\boxed{R_s \quad 0.558}$$

200-220	220-240	240-260	260-280	2
80	32	23	17	

$\frac{N}{4}$ tion $= \frac{270}{4}$

$Q_1 = 180 + 2$

$= 180$

$Q_1 =$

$\frac{3N}{4} \rightarrow 3$

$=$

$Q_3 =$

$=$

Calculate Bowley's measure of skewness form the following data

Payment of Commission	100-120	120-140	140-160	160-180	180-200	200-220	220-240	240-260	260-280	280-300
No Salesman	4	10	16	29	52	80	39	23	17	7

P. Commission	Salesman	CF	
100-120	4	4	
120-140	10	14	
140-160	16	30	
160-180	29	59	
180-200	52	111	
200-220	80	191	Q_1
220-240	39	223	N
240-260	23	246	Q_3
260-280	17	263	
280-300	7	270	
	$\Sigma f = 270$		

$\left(\frac{N}{4}\right)^{th\ item} = \frac{270}{4} = 67.5^{th\ item}$

$Q_1 = 180 + \frac{20}{52}(675.59)$

$= 180 + 0.3846 \times 85$

$Q_1 = 183.2692$

$\frac{3N}{4} \rightarrow \frac{3 \times 270}{4} = 3 \times 67.5$

$= 202.5$

$Q_3 = 220 + \frac{20}{39}(202.5 - 191)$

$= 220 + 0.625 \times 11.5$

$Q_3 = 227.1875$

$N = \left(\frac{N}{2}\right) = \frac{270}{2} = 135^{th}$

$= 180 + \frac{20}{52}(135 - 50)$

$= 180 + 0.3846 \times 7($

$N = 209.2296$

Bowley's weakness of Skewness

$= \frac{Q_3 + Q_1 - 2N}{Q_3 - Q_1}$

$= \frac{227.1875 + 183.26 + 2 \times 209.9}{227.1875 - 183.2692}$

$= \frac{410.4567 - 418.4592}{43.9183}$

$= \frac{-8.0025}{43.9183}$

$= -0.18221$

A Company that manufactures steels observed the production of steel (in metric tonnes) represented by the time series as given below.

Year	1996	1997	1998	1999	2000	2001	2002
Production of steel (in metric tonnes)	60	72	75	65	80	85	95

Year	Production	X-1999	XY	X^2	Trend
1996	60	-3	-180	9	61.45
1997	72	-2	-144	4	66.3
1998	75	-1	-75	1	71.15
1999	65	0	0	0	76
2000	80	1	80	1	80.85
2001	85	2	170	4	85.7
2002	95	3	285	9	90.55
	$\Sigma Y = 532$	$\Sigma X = 0$	$\Sigma XY = 136$	$\Sigma X^2 = 28$	

$$a = \frac{\Sigma Y}{N} = \frac{532}{7} \Rightarrow 76$$

$$b = \frac{\Sigma XY}{\Sigma X^2} = \frac{136}{28} = 4.85$$

$$Y_c = a + b \Sigma X$$

$$Y_c = a + b (X - 1999)$$

when X = 1996 = Y_c = 76 + 4.85 X(-3) = 61.45

X = 1997 = Y_c = 76 + 4.85 X(-2) = 66.3

1998 = Y_c = 76 + 4.85 X (-1) = 71.15

1999 = Y_c = 76 + 4.85 X (0) = 76

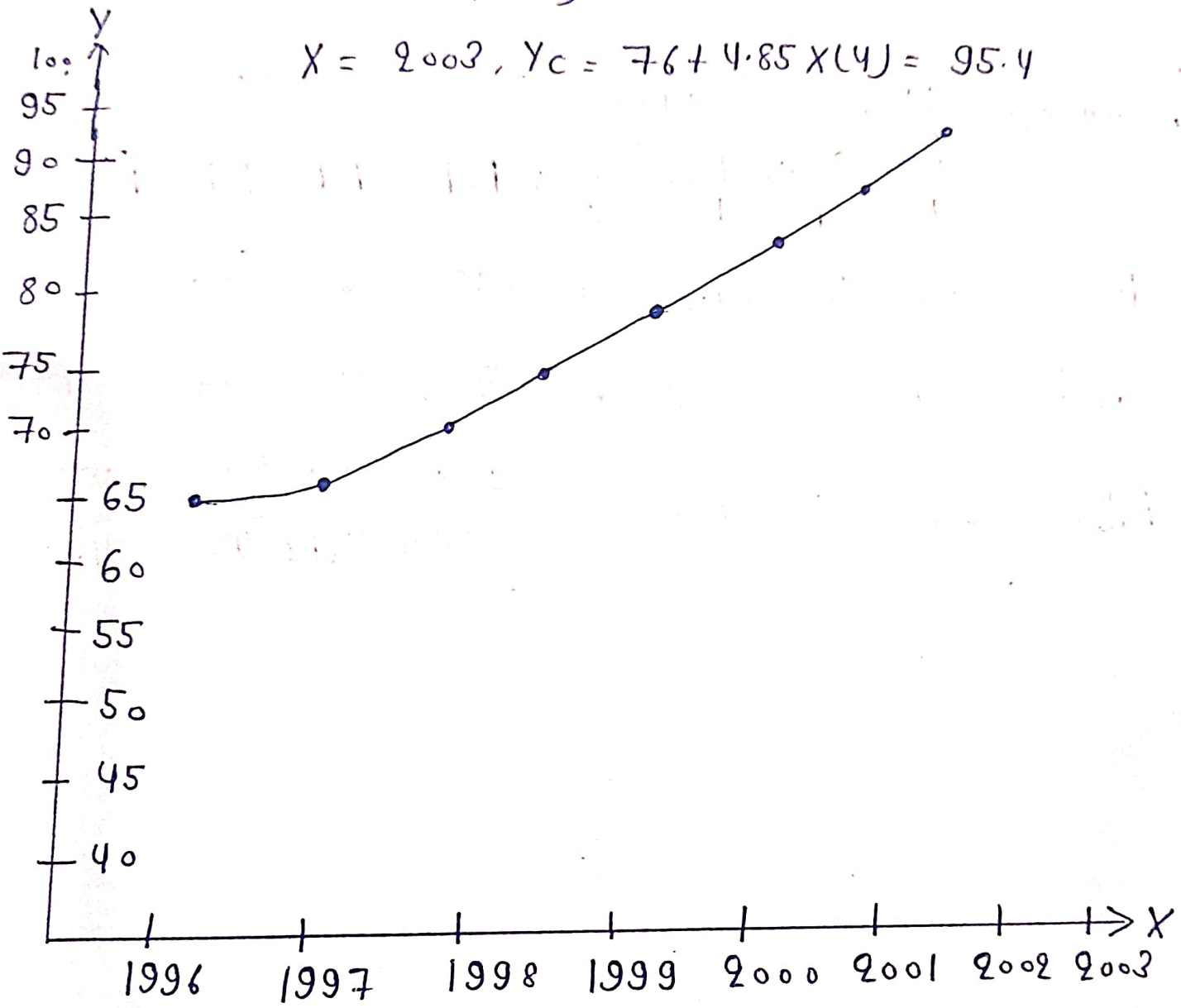
2000 = Y_c = 76 + 4.85 X (1) = 80.85

2001 = Y_c = 76 + 4.85 X (2) = 85.7

2002 = Y_c = 76 + 4.85 X (3) = 90.55

2003 . (2003 - 1999) = 4

X = 2003, Y_c = 76 + 4.85 X (4) = 95.4



Using the data given below calculate the price index number for the year 1998 by (i) Laspeyre's formula (ii) Paasche's formula and (iii) Fischer's formula considering 1989 as the base year.

Commodity	Price (Rs/unit			Quantity (in kg)	
	1989	1998	1998	1989	1998
Rice	9.3	4.5	100	100	90
Wheat	6.4	3.7		11	10
Pulses	5.1	2.7		5	3

Commodity	1989		1998					
	Price P_0	Quantity q_0	Price P_1	Quantity Q_1	P_0q_0	P_1q_0	P_1q_1	P_0q_1
Rice	9.3	100	4.5	90	930	450	405	837
Wheat	6.4	11	3.7	10	70.4	40.7	37	64
Pulses	5.1	5	2.7	3	25.5	13.5	8.1	15.3
					1025.9	504.2	450.1	916.3

Laspeyres' index number $= \frac{\Sigma P_1 q_0}{\Sigma P_0 q_0} \times 100 = \frac{504.2}{1025.9} \times 100 = 49.14$

Paasches' index number $= \frac{\Sigma P_1 q_1}{\Sigma P_0 q_0} \times 100 = \frac{450.1}{1025.9} \times 100 = 43.87$

Fisher' index number $= \sqrt{\frac{\Sigma P_1 q_0}{\Sigma P_0 q_0} \times \frac{\Sigma P_1 q_1}{\Sigma P_0 q_0}} = \sqrt{49.14 \times 43.87} = 46.43$