Maharashtra State Board 12th Commerce Maths Solutions Chapter 5 Index Numbers Ex 5.1

Find the Price Index Number using the Simple Aggregate Method in each of the following examples.

Question 1.
Use 1995 as the base year in the following problem.

Commodity	P	Q	R	S	T
Price (in Rs.) in 1995	15	20	24	23	28
Price (in Rs.) in 2000	27	38	32	40	45

Solution:

Commodity	Price (₹) p_0 in 1995	Price (₹) p_1 in 2000
P	15	27
Q	20	38
R	24	32
S	22	40
T	28	45
	$\Sigma p_0 = 109$	$\Sigma p_1 = 182$

$$p_{01} = \frac{\sum p_1}{\sum p_0} \times 100$$

$$= \frac{182}{109} \times 100$$

$$= 166.97$$

Question 2.
Use 1995 as the base year in the following problem.

Commodity	A	B	C	D	E
Price (in Rs.) in 1995	42	30	58	70	120
Price (in Rs.) in 2005	60	55	75	110	140

Solution:

Commodity	Price (₹) in 1995 p_0	Price (₹) in 2005 p_1
A	42	60
B	30	55
C	54	74
D	70	110
E	120	140
	$\Sigma p_0 = 316$	$\Sigma p_1 = 439$

$$p = \frac{\sum p_1}{\sum p_0} \times 100$$

$$= \frac{439}{316} \times 100$$

$$= 138.92$$

Question 3.

Commodity	Unit	Base Year Price (in Rs.)	Current Year Price (in Rs.)
Wheat	kg	28	36
Rice	kg	40	56
Milk	litre	32	45
Clothing	meter	82	104
Fuel	litre	58	72

Solution:

Commodity	Unit	Base Year Price (₹) p_0	Current Year Price (₹) p_1
Wheat	Kg	28	36
Rice	Kg	40	56
Milk	litre	35	45
Clothing	Meter	82	104
Fuel	litre	58	72
		$\sum p_0 = 243$	$\sum p_1 = 313$

$$p_{01} = \frac{\sum p_1}{\sum p_0} \times 100$$

$$= \frac{313}{243} \times 100$$

$$= 128.81$$

Question 4.
Use 2000 as the base year in the following problem.

Commodity	Price (in Rs.) for year 2000	Price (in Rs.)for year 2006
Watch	900	1475
Shoes	1800	2300
Sunglasses	600	1040
Mobile	4500	8500

Solution:

Commodity	Price (₹) in 2000 p_0	Price (₹) in 2006 p_1
Watch	900	1475
Shoes	1760	2300
Sunglasses	600	1040
Mobile	4500	8500
	$\sum p_0 = 7760$	$\sum p_1 = 13315$

$$p_{01} = \frac{\sum p_1}{\sum p_0} \times 100$$

$$= \frac{13315}{7760} \times 100$$

$$= 171.59$$

Question 5.
Use 1990 as the base year in the following problem.

Commodity	Unit	Price (in Rs.) for 1990	Price (in Rs.) for 1997
Butter	kg	21	33
Cheese	kg	30	36
Milk	litre	25	29
Bread	loaf	10	14
Eggs	doz	24	36
Ghee	tin	250	320

Solution:

Commodity	Unit	Price (in ₹)for 1990 p_0	Price (in ₹) for 1997 p_1
Butter	Kg	27	33
Cheese	Kg	30	36
Milk	litre	25	29
Bread	Loaf	10	14
Eggs	doz	24	36
Ghee	tin	250	320
		$\sum p_0 = 366$	$\sum p_1 = 468$

$$p_{01} = \frac{\sum p_1}{\sum p_0} \times 100$$

$$= \frac{468}{366} \times 100$$

$$= 127.87$$

Question 6.
Assume 2000 to be a base year in the following problem.

Fruit	Unit	Price (in Rs.) in 2000	Price (in Rs.) in 2007
Mango	doz	250	300
Banana	doz	12	24
Apple	kg	80	110
Peach	kg	75	90
Orange	doz	33	65
Sweet Lime	doz	30	45

Solution:

Fruit	Unit	Price (₹) in 2000 P_0	Price (₹) in 2007 P_1
Mango	doz	250	300
Banana	doz	12	24
Apple	Kg	80	110
Peach	Kg	75	90
Orange	doz	36	65
Sweet Lime	doz	30	45
		$\sum p_0 = 483$	$\sum p_1 = 634$

$$p_{01} = \frac{\sum p_1}{\sum p_0} \times 100$$

$$= \frac{634}{483} \times 100$$

$$= 131.26$$

Question 7.
Use 2005 as a year in the following problem.

Vegetable	Unit	Price (in Rs.) in 2005	Price (in Rs.) in 2012
Ladies Finger	kg	32	38
Capsicum	kg	30	36
Brinjal	kg	40	60
Tomato	kg	40	62
Potato	kg	18	28

Solution:

Vegetable	Unit	Price (₹) in 2005 p_0	Price (₹) in 2012 p_1
Ladies Finger	kg	32	38
Capsicum	kg	30	36
Brinjal	kg	40	60
Tomato	kg	40	62
Potato	kg	16	28
		$\sum p_0 = 158$	$\sum p_1 = 224$

$$p_{01} = \frac{\sum p_1}{\sum p_0} \times 100$$
$$= \frac{224}{158} \times 100$$
$$= 141.77$$

Find the Quantity Index Number using the Simple Aggregate Method in each of the following examples.

Question 8.

Commodity	I	II	III	IV	V
Base Year Quantities	140	120	100	200	220
Current Year Quantities	100	80	70	150	185

Solution:

Commodity	Base Year Quantities q_0	Currant Year Quantities q_1
I	140	100
II	120	80
III	100	70
IV	200	150
V	225	185
	$\sum q_0 = 785$	$\sum q_1 = 585$

$$q_{01} = \frac{\sum q_1}{\sum q_0} \times 100$$
$$= \frac{585}{785} \times 100$$
$$= 74.52$$

Question 9.

Commodity	A	B	C	D	E
Base Year Quantities	360	280	340	160	260
Current Year Quantities	440	320	470	210	300

Solution:

Commodity	Base Year Quantities q_0	Currant Year Quantities q_1
A	360	440
B	280	320
C	340	470
D	160	210
E	260	300
	$\sum q_0 = 1400$	$\sum q_1 = 1740$

$$q_{01} = \frac{\sum q_1}{\sum q_0} \times 100$$

$$= \frac{1740}{1400} \times 100$$

$$= 124.29$$

Find the value Index Number using the Simple Aggregate Method in each of the following examples.

Question 10.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
A	30	22	40	18
B	40	15	60	12
C	10	38	15	24
D	50	12	60	16
E	20	28	25	36

Solution:

Commodity	p_0	q_0	p_1	q_1	$p_0 q_0$	$p_1 q_1$
A	30	22	40	18	660	720
B	40	16	60	12	640	720
C	10	38	15	24	380	360
D	50	12	60	16	600	960
E	20	28	25	36	560	900
					2840	3660

$$\sum p_0 q_0 = 2540, \quad \sum p_1 q_1 = 3660$$

$$V_{01} = \frac{\sum p_1 q_1}{\sum p_0 q_0} \times 100$$

$= \frac{3660}{2840} \times 100$

$= 128.87$

Question 11.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
A	50	22	70	14
B	70	16	90	22
C	60	19	105	14
D	120	12	140	15
E	100	22	155	28

Solution:

Commodity	p_0	q_0	p_1	q_1	p_0q_0	p_1q_1
A	50	22	70	14	1100	980
B	70	16	90	22	1120	1980
C	60	18	105	14	1080	1470
D	120	12	140	15	1440	2100
E	100	22	155	28	2200	4340
					6940	10870

$\sum p_0q_0 = 6940$, $\sum p_1q_1 = 10870$

$$V_{01} = \frac{\sum p_1q_1}{\sum p_0q_0} \times 100$$

$$= 156.63$$

Question 12.
Find x if the Price Index Number by Simple Aggregate Method is 125

Commodity	P	Q	R	S	T
Base Year Price (in Rs.)	8	12	16	22	18
Current Year Price (in Rs.)	12	18	x	28	22

Solution:

Commodity	p_0	p_1
P	8	12
Q	12	18
R	16	x
S	22	28
T	18	22
	76	$x + 80$

$p_{01} = 125$

$$\frac{\sum p_1}{\sum p_0} \times 100 = 125$$

$$\frac{(x + 80)}{76} \times 100 = 125$$

$$x + 80 = \frac{125 \times 76}{100}$$

$$x + 80 = 95$$

$$x = 95 - 80$$

$$x = 15$$

Question 13.
Find y is the Price Index Number by Simple Aggregate Method is 120, taking 1995 as the base year.

Commodity	A	B	C	D
Price (in Rs.) for 1995	95	y	80	35
Price (in Rs.) for 2003	116	74	92	42

Solution:

Commodity	p_0	p_1
A	95	116
B	y	74
C	80	92
D	35	42
	$y + 210$	324

$\sum p_0 = y + 210 \qquad \sum p_1 = 324$

$p_{01} = 120$

$$\frac{\sum p_1}{\sum p_0} \times 100 = 120$$

$\therefore \quad \dfrac{324}{y + 210} \times 100 = 120$

$\therefore \qquad y + 210 = \dfrac{324 \times 100}{120}$

$\therefore \qquad y + 210 = 270$

$\therefore \qquad y = 270 - 210$

$\therefore \qquad y = 60$

Maharashtra State Board 12th Commerce Maths Solutions Chapter 5 Index Numbers Ex 5.2

Calculate Laspeyres, Paasche's, Dorbish-Bowely's, and Marshall-Edegworth's Price Index Numbers in Problems 1 and 2.

Question 1.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
A	8	20	11	15
B	7	10	12	10
C	3	30	5	25
D	2	50	4	35

Solution:

Commodity	p_0	q_0	p_1	q_1	p_0q_0	p_0q_1	p_1q_0	p_1q_1
A	8	20	11	15	160	120	220	165
B	7	10	12	10	70	70	120	120
C	3	30	5	25	90	75	150	125
D	2	50	4	35	100	70	200	140
					420	335	690	550

$$p_{01}(L) = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100 = \frac{690}{420} \times 100 = 164.29$$

$$p_{01}(P) = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100 = \frac{550}{335} \times 100 = 164.18$$

$$p_{01}(D-B) = \frac{p_{01}(L) + p_{01}(P)}{2} = \frac{164.29 + 164.18}{2} = 164.235$$

$$p_{01}(M-E) = \left[\frac{\sum p_1 q_0 + \sum p_1 q_1}{\sum p_0 q_0 + \sum p_0 q_1} \right] \times 100 = \frac{690 + 550}{420 + 335} \times 100 = 164.24$$

Question 2.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
I	10	9	20	8
II	20	5	30	4
III	30	7	50	5
IV	40	8	60	6

Solution:

Commodity	p_0	q_0	p_1	q_1	p_1q_0	p_0q_0	p_1q_1	p_0q_1
I	10	9	20	8	180	90	160	80
II	20	5	30	4	150	100	120	80
III	30	7	50	5	350	210	250	150
IV	40	8	60	6	480	320	360	240
					1160	720	890	550

$$p_{01}(L) = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100 = \frac{1160}{720} \times 100 = 161.11$$

$$p_{01}(P) = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100 = \frac{890}{550} \times 100 = 161.82$$

$$p_{01}(D-B) = \frac{p_{01}(L) + p_{01}(P)}{2} = \frac{161.11 + 161.82}{2} = 161.47$$

$$p_{01}(M-E) = \frac{\sum p_1 q_0 + \sum p_1 q_1}{\sum p_0 q_0 + \sum p_0 q_1} \times 100 = \frac{1160 + 890}{720 + 550} \times 100 = 161.42$$

Calculate Walsh's Price Index Number in Problems 3 and 4.

Question 3.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
L	4	16	3	9
M	6	16	2	4
N	8	28	7	7

Solution:

Commodity	p_0	q_0	p_1	q_1	$\sqrt{q_0 q_1}$	$p_1\sqrt{q_0 q_1}$	$p_0\sqrt{q_0 q_1}$
L	4	16	3	19	17.44	52.32	69.76
M	6	16	8	14	14.97	119.76	89.82
N	8	28	7	32	29.93	209.51	239.44
						381.59	399.02

$$p_{01}(W) = \frac{\sum p_1 \sqrt{q_0 q_1}}{\sum p_0 \sqrt{q_0 q_1}} \times 100 = \frac{381.59}{399.02} \times 100 = 95.63$$

Question 4.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
I	10	16	20	9
II	20	2	25	8
III	30	3	40	27
IV	60	9	75	36

Solution:

Commodity	p_0	q_0	p_1	q_1	$\sqrt{q_0 q_1}$	$p_1\sqrt{q_0 q_1}$	$p_0\sqrt{q_0 q_1}$
I	10	12	20	9	10.39	207.8	103.9
II	20	4	25	8	5.66	141.5	113.2
III	30	13	40	27	18.74	749.6	562.2
IV	60	29	75	36	32.31	2423.25	1938.6
						3522.15	2717.9

$$p_{01}(W) = \frac{\sum p_1 \sqrt{q_0 q_1}}{\sum p_0 \sqrt{q_0 q_1}} \times 100 = \frac{3522.15}{1717.9} \times 100 = 129.59$$

Question asked was Walsh but answers given are $p_{01}(L), p_{01}(P), p_{01}(O-B), p_{01}(M-E)$

Commodity	p_0	q_0	p_1	q_1	$p_0 q_0$	$p_0 q_1$	$p_1 q_0$	$p_1 q_1$
I	10	12	20	9	120	90	240	180
II	20	4	25	8	80	160	100	200
III	30	13	40	27	390	810	520	1080
IV	60	29	75	36	174	216	2175	2700
					2330	3220	3035	4160

$$p_{01}(L) = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100 = \frac{3035}{2330} \times 100 = 130.26$$

$$p_{01}(P) = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100 = \frac{4160}{3220} \times 100 = 129.20$$

$$p_{01}(D-B) = \frac{p_{01}(L) + p_{01}(P)}{2}$$

$$= \frac{397.25 + 326.02}{2}$$

$$= 129.73$$

$$p_{01}(M-E) = \frac{\sum p_1 q_0 + \sum p_1 q_1}{\sum p_0 q_0 + \sum p_0 q_1} \times 100$$

$$= \frac{3035 + 4160}{2230 + 3220} \times 100$$

$$= 129.64$$

Question 5.
If $p_{01}(L)$ = 90, and $p_{01}(P)$ = 40, find $p_{01}(D-B)$ and $p_{01}(F)$

Solution:

$$p_{01}(L) = 90 \qquad p_{01}(P) = 40$$

$$p_{01}(D - B) = \frac{p_{01}(L) + p_{01}(P)}{2}$$

$$= \frac{90 + 40}{2}$$

$$= 65$$

$$p_{01}(F) = \sqrt{P_{01}(L) \times P_{01}(P)}$$

$$= \sqrt{90 \times 40}$$

$$= 60$$

Question 6.
If $\Sigma p_0 q_0$ = 140, $\Sigma p_0 q_1$ = 200, $\Sigma p_1 q_0$ = 350, $\Sigma p_1 q_1$ = 460, find Laspeyre's Paasche's Dorbish-Bowley's and Marshall- Edgeworth's Price Index Numbers.
Solution:

$$\Sigma p_0 q_0 = 140, \ \Sigma p_0 q_1 = 200, \ \Sigma p_1 q_0 = 350,$$
$$\Sigma p_1 q_1 = 460$$

$$p_{01}(L) = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100 = \frac{350}{140} \times 100 = 250$$

$$p_{01}(P) = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100 = \frac{460}{200} \times 100 = 230$$

$$p_{01}(D - B) = \frac{p_{01}(L) + p_{01}(P)}{2}$$

$$= \frac{250 + 230}{2} = 240$$

$$p_{01}(M - E) = \frac{\sum p_1 q_0 + \sum p_1 q_1}{\sum p_0 q_0 + \sum p_0 q_1} \times 100$$

$$= \frac{350 + 460}{140 + 200} \times 100$$

$$= \frac{810}{340} \times 100 = 238.24$$

Question 7.
Given that Laspeyre's and Dorbish-Bowley's Price Index Numbers are 160.32 and 164.18 respectively. Find Paasche's Price Index Number.
Solution:

$$p_{01}(L) = 90 \qquad p_{01}(D - B) = 164.18$$

$$p_{01}(D - B) = \frac{p_{01}(L) + p_{01}(P)}{2}$$

$$p_{01}(P) = 2 \times p_{01}(D - B) - p_{01}(L)$$

$$= 2(164.18) - 160.32$$

$$= 168.04$$

Question 8.
Given that $\Sigma p_0 q_0$ = 220, $\Sigma p_0 q_1$ = 380, $\Sigma p_1 q_1$ = 350 is Marshall-Edgeworth's Price Index Number is 150, find Laspeyre's Price Index Number.

Solution:

$\sum p_0 q_0 = 220, \sum p_0 q_1 = 380, \sum p_1 q_1 = 350$

$p_{01} (M - E) = 150$

$\dfrac{\sum p_1 q_0 + \sum p_1 q_1}{\sum p_0 q_0 + \sum p_0 q_1} \times 100 = 150$

$\therefore \dfrac{\sum p_1 q_0 + 350}{220 + 380} \times 100 = 150$

$\therefore \quad \sum p_1 q_0 + 350 = \dfrac{150 \times 600}{100}$

$\therefore \quad \sum p_1 q_0 + 350 = 900$

$\therefore \quad \sum p_1 q_0 = 900 - 350$

$\therefore \quad \sum p_1 q_0 = 550$

$\therefore \quad p_{01} (L) = \dfrac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$

$\qquad = \dfrac{550}{220} \times 100$

$\qquad = 250$

Question 9.
Find x in the following table if Laspeyres and Paasche's Price Index Numbers are equal.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
A	2	10	2	5
B	2	5	x	2

Solution:

Commodity	p_0	q_0	p_1	q_1	$p_0 q_0$	$p_0 q_1$	$p_1 q_0$	$p_1 q_1$
A	2	10	2	5	20	10	20	10
B	2	5	x	2	10	4	5x	2x
					30	14	5x + 20	2x + 10

$\sum p_0 q_0 = 30, \sum p_0 q_1 = 14, \sum p_1 q_0 = 5x + 20,$
$\sum p_1 q_1 = 2x + 10$

$p_{01} (L) = p_{01} (P)$

$\therefore \dfrac{\sum p_1 q_0}{\sum p_0 q_0} \times 100 = \dfrac{\sum p_1 q_1}{\sum p_0 q_1} \times 100$

$\therefore \quad \dfrac{5x + 20}{30} = \dfrac{2x + 10}{14}$

$\therefore \quad 70x + 280 = 60x + 300$

$\therefore \quad 10x = 20$

$\therefore \quad x = 2$

Question 10.
If Laspeyre's Price Index Number is four times Paasche's Price Index Number, then find the relation between Dorbish-Bowley's and Fisher's Price Index Numbers.

Solution:

Given $p_{01}(L) = 4 \cdot p_{01}(P)$

Now $p_{01}(D-B) = \dfrac{p_{01}(L) + p_{01}(P)}{2}$

$= \dfrac{4p_{01}(p) + 4p_{01}(P)}{2}$

$p_{01}(D-B) = \dfrac{5 \cdot p_{01}(P)}{2}$ (i)

Also, $p_{01}(F) = \sqrt{p_{01}(L) \times p_{01}(P)}$

$= \sqrt{4 \cdot p_{01}(P) \times p_{01}(P)}$

$p_{01}(F) = 2 \cdot p_{01}(P)$

$= \dfrac{2 \times 2 \times p_{01}(D-B)}{5}$ by (i)

$5 \cdot p_{01}(F) = 4 \cdot p_{01}(D-B)$

Question 11.
If Dorbish-Bowley's and Fisher's Price Index Numbers are 5 and 4, respectively, then find Laspeyres and Paasche's Price Index Numbers.
Solution:

$p_{01}(D-B) = 5$ $p_{01}(F) = 4$

$\dfrac{p_{01}(L) + p_{01}(P)}{2} = 5$ and $\sqrt{p_{01}(L) \cdot p_{01}(P)} = 4$

$p_{01}(L) + p_{01}(P) = 10$ (i)

and $p_{01}(L)\, p_{01}(P) = 16$ (ii)

$p_{01}(P) = \dfrac{16}{P_{01}(L)}$

$\therefore p_{01}(L) + \dfrac{16}{P_{01}(L)} = 10$ by (ii)

$\therefore [p_{01}(L)]^2 + 16 = 10\, p_{01}(L)$

$\therefore [p_{01}(L)]^2 - 10\, p_{01}(L) + 16 = 0$

$\therefore [p_{01}(L) - 2]\,[p_{01}(L) - 8] = 0$

$\therefore p_{01}(L) = 2$ or $p_{01}(L) = 8$

From (ii), When $p_{01}(L) = 2$, $p_{01}(P) = 8$

From (ii), When $p_{01}(L) = 8$, $p_{01}(P) = 2$

But as AM > GM

We have $p_{01}(P) = 8$ and $p_{01}(L) = 2$

Maharashtra State Board 12th Commerce Maths Solutions Chapter 5 Index Numbers Ex 5.3

Calculate the cost of living index in problems 1 to 3.

Question 1.

Group	Base Year		Current Year
	Price	Quantity	Price
Food	120	15	170
Clothing	150	20	190
Fuel & Lighting	130	30	220
House Rent	160	10	180
Miscellaneous	200	12	200

Solution:

Group	p_0	q_0	p_1	p_1q_0	p_0q_0
Food	120	15	170	2550	1800
Clothing	150	20	190	3800	3000
Fuel & Lighting	130	30	220	6600	3900
House Rent	160	10	180	1800	1600
Miscellaneous	200	12	200	2400	2400
				17150	12700

$\Sigma p_1q_0 = 17150$, $\Sigma p_0q_0 = 12700$

Cost of living index is

$$CLI = \frac{\sum p_1q_0}{\sum p_0q_0} \times 100$$

$$CLI = \frac{17150}{12700} \times 100$$
$$= 135.04$$

Question 2.

Group	Base Year		Current Year
	Price	Quantity	Price
Food	40	15	45
Clothing	30	10	35
Fuel & Lighting	20	25	25
House Rent	60	20	70
Miscellaneous	70	20	80

Solution:

Group	p_0	q_0	p_1	p_1q_0	p_0q_0
Food	40	15	45	675	600
Clothing	30	10	35	350	300
Fuel & Lighting	20	17	25	425	340
House rent	60	22	70	1540	1320
Miscellaneous	70	25	80	2000	1750
				4990	4310

$\Sigma p_1q_0 = 4990$ $\Sigma p_0q_0 = 4310$

$$CLI = \frac{\sum p_1q_0}{\sum p_0q_0} \times 100$$
$$= \frac{4990}{4310} \times 100$$
$$= 115.78$$

Question 3.

Group	Base Year		Current Year
	Price	Quantity	Price
Food	130	10	170
Clothing	150	12	160
Fuel & Lighting	162	20	180
House Rent	170	18	195
Miscellaneous	120	5	120

Solution:

Group	p_0	q_0	p_1	$p_1 q_0$	$p_0 q_0$
Food	132	10	170	1700	1320
Clothing	154	12	160	1920	1848
Fuel & Lighting	164	20	180	3600	3280
House rent	175	18	195	3510	3150
Miscellaneous	128	5	120	600	640
				11330	10238

$\sum p_1 q_0 = 11330, \ \sum p_1 q_0 = 10238$

$$CLI = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$$

$$= \frac{11330}{10238} \times 100$$

$$= 110.67$$

Base year weights (W) and current year price relatives (I) are given in problems 4 to 8. Calculate the cost of living index in each case.

Question 4.

Group	Food	Clothing	Fuel & Lighting	House Rent	Miscellaneous
I	70	90	100	60	80
W	5	3	2	4	6

Solution:

Group	I	W	IW
Food	70	5	350
Clothing	90	3	270
Fuel & Lighting	100	2	200
House Rent	60	4	240
Miscellaneous	80	6	480
		20	1540

ΣW = 20, ΣIW = 1540

CLI = ΣIWΣW

= 154020

= 77

Question 5.

Group	Food	Clothing	Fuel & Lighting	House Rent	Miscellaneous
I	400	300	150	120	100
W	3	3	4	5	2

Solution:

Group	I	W	IW
Food	400	3	1200
Clothing	300	3	900
Fuel & Lighting	150	4	600
House Rent	120	5	600
Miscellaneous	100	2	200
		17	3500

$\Sigma W = 17$, $\Sigma IW = 3500$

$CLI = \dfrac{\Sigma IW}{\Sigma W}$

$= \dfrac{3500}{17}$

$= 205.88$

Question 6.

Group	Food	Clothing	Fuel & Lighting	House Rent	Miscellaneous
I	200	150	120	180	160
W	30	20	10	40	50

Solution:

Group	I	W	IW
Food	200	30	6000
Clothing	150	20	3000
Fuel & Lighting	120	10	1200
House Rent	180	40	7200
Miscellaneous	160	50	8000
		150	25400

$\Sigma W = 150$, $\Sigma IW = 25400$

$CLI = \dfrac{\Sigma IW}{\Sigma W}$

$= \dfrac{25400}{150}$

$= 169.33$

Question 7.

Group	Food	Clothing	Fuel & Lighting	House Rent	Miscellaneous
I	180	120	300	100	160
W	4	5	6	x	3

Solution:

Group	I	W	IW
Food	180	4	720
Clothing	120	5	600
Fuel & Lighting	300	6	1800
House Rent	100	x	$100x$
Miscellaneous	160	3	480
		$x + 18$	$100x + 3600$

$\Sigma W = x + 18$, $\Sigma IW = 100x + 3600$

$CLI = 150$

$\therefore \dfrac{\Sigma IW}{\Sigma W} = 150$

$\therefore \dfrac{100x+3600}{x+18} = 150$

$\therefore 100x + 3600 = 150x + 2700$

$\therefore 50x = 900$

$\therefore x = 18$

Question 8.
Find y if the cost of living index is 200

Group	Food	Cloth-ing	Fuel & Light-ing	House Rent	Misce-llane-ous
I	180	120	160	300	200
W	4	5	3	y	2

Solution:

Group	I	W	IW
Food	180	4	720
Clothing	120	5	600
Fuel & Lighting	160	3	480
House Rent	300	y	$300y$
Miscellaneous	200	2	400
		$y+14$	$300y + 2200$

$\Sigma W = y + 18$, $\Sigma IW = 300y + 2200$

CLI = 200

$\therefore \frac{\Sigma IW}{\Sigma W} = 200$

$\therefore \frac{300y+2200}{y+14} = 200$

$\therefore 300y + 2200 = 200y + 2800$

$\therefore 100y = 600$

$\therefore y = 6$

Question 9.

The cost of living Index numbers for years 1995 and 1999 are 140 and 200 respectively. A person earns ₹ 11,200 per month in the year 1995. What should be his monthly earning in the year 1999 in order to maintain his standard of living as in the year 1995?

Solution:

CLI (1995) = 140

CLI (1999) = 200

Income (1995) = 11200

Income (1999) = ?

For year 1995

$\therefore$ Real Income = $\frac{Income}{CLI} \times 100$

$= \frac{11200}{140} \times 100$

= ₹ 8000

For year 1999

$\therefore$ Real Income = $\frac{Income}{CLI} \times 100$

$\therefore 8000 = \frac{Income \times 100}{200}$

$\therefore$ Income = 16000

$\therefore$ Income in 1999 = ₹ 16000

Maharashtra State Board 12th Commerce Maths Solutions Chapter 5 Index Numbers Miscellaneous Exercise 5

(I) Choose the correct alternative.

Question 1.
Price Index Number by Simple Aggregate method is given by

(a) $\sum \dfrac{p_1}{p_0} \times 100$

(b) $\sum \dfrac{p_0}{p_1} \times 100$

(c) $\dfrac{\sum p_1}{\sum p_0} \times 100$

(d) $\dfrac{\sum p_0}{\sum p_1} \times 100$

Answer:

(c) $\dfrac{\Sigma p_1}{\Sigma p_0} \times 100$

Question 2.
Quantity Index Number by Simple Aggregate Method is given by

(a) $\sum \dfrac{q_1}{q_0} \times 100$

(b) $\sum \dfrac{q_0}{q_1} \times 100$

(c) $\dfrac{\sum q_1}{\sum q_0} \times 100$

(d) $\dfrac{\sum q_0}{\sum q_1} \times 100$

Answer:

(c) $\dfrac{\Sigma q_1}{\Sigma q_0} \times 100$

Question 3.
Value Index Number by Simple Aggregate Method is given by

(a) $\sum \dfrac{p_1 q_0}{p_0 q_1} \times 100$

(b) $\sum \dfrac{p_0 q_1}{p_0 q_0} \times 100$

(c) $\dfrac{\sum p_1 q_1}{\sum p_1 q_0} \times 100$

(d) $\dfrac{\sum p_1 q_1}{\sum p_0 q_0} \times 100$

Answer:

(b) $\dfrac{\Sigma p_0 q_1}{p_0 q_0} \times 100$

Question 4.
Price Index Number by Weighted Aggregate Method is given by

(a) $\sum \dfrac{p_1 w}{p_0 w} \times 100$

(b) $\sum \dfrac{p_0 w}{p_1 w} \times 100$

(c) $\dfrac{\sum p_1 w}{\sum p_0 w} \times 100$

(d) $\dfrac{\sum p_0 w}{\sum p_1 w} \times 100$

Answer:

(c) $\frac{\Sigma p_1 w}{\Sigma p_0 w} \times 100$

Question 5.
Quantity Index Number By Weighted Aggregate Method is given by

(a) $\sum \frac{q_1 w}{q_0 w} \times 100$

(b) $\sum \frac{q_0 w}{q_1 w} \times 100$

(c) $\frac{\sum q_1 w}{\sum q_0 w} \times 100$

(d) $\frac{\sum q_0}{\sum q_1} \times 100$

Answer:

(c) $\frac{\Sigma q_1 w}{\Sigma q_0 w} \times 100$

Question 6.
Value Index Number by Weighted aggregate Method is given by

(a) $\sum \frac{p_1 q_0 w}{p_0 q_0 w} \times 100$

(b) $\sum \frac{p_0 q_1 w}{p_0 q_0 w} \times 100$

(c) $\frac{\sum p_1 q_1 w}{\sum p_0 q_1 w} \times 100$

(d) $\frac{\sum p_1 q_1 w}{\sum p_0 q_0 w} \times 100$

Answer:

(d) $\frac{\Sigma p_1 q_1 w}{\Sigma p_0 q_0 w} \times 100$

Question 7.
Laspeyre's Price Index Number is given by

(a) $\frac{\sum p_0 q_0}{\sum p_1 q_0} \times 100$

(b) $\frac{\sum p_0 q_1}{\sum p_1 q_1} \times 100$

(c) $\frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$

(d) $\frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100$

Answer:

(c) $\frac{\Sigma p_1 q_0}{\Sigma p_0 q_0} \times 100$

Question 8.
Paassche's Price Index Number is given by

(a) $\dfrac{\sum p_0 q_0}{\sum p_1 q_0} \times 100$

(b) $\dfrac{\sum p_0 q_1}{\sum p_1 q_1} \times 100$

(c) $\dfrac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$

(d) $\dfrac{\sum p_1 q_1}{\sum p_0 q_1} \times 100$

Answer:

(d) $\dfrac{\Sigma p_1 q_1}{\Sigma p_0 q_1} \times 100$

Question 9.
Dorbish-Bowley's Price Index Number is given by

(a) $\dfrac{\dfrac{\sum p_1 q_0}{\sum p_0 q_1} + \dfrac{\sum p_0 q_1}{\sum p_1 q_0}}{2} \times 100$

(b) $\dfrac{\dfrac{\sum p_1 q_1}{\sum p_0 q_0} + \dfrac{\sum p_0 q_0}{\sum p_1 q_1}}{2} \times 100$

(c) $\dfrac{\dfrac{\sum p_1 q_0}{\sum p_0 q_0} + \dfrac{\sum p_1 q_1}{\sum p_0 q_1}}{2} \times 100$

(d) $\dfrac{\dfrac{\sum p_0 q_0}{\sum p_1 q_0} + \dfrac{\sum p_0 q_1}{\sum p_1 q_1}}{2} \times 100$

Answer:

(c) $\dfrac{\frac{\Sigma p_1 q_0}{\Sigma p_0 q_0} + \frac{\Sigma p_1 q_1}{\Sigma p_0 q_1}}{2} \times 100$

Question 10.
Fisher's Price Number is given by

(a) $\sqrt{\dfrac{\sum p_1 q_0}{\sum p_0 q_0} \times \dfrac{\sum p_1 q_1}{\sum p_0 q_1}} \times 100$

(b) $\sqrt{\dfrac{\sum p_0 q_0}{\sum p_1 q_0} \times \dfrac{\sum p_0 q_1}{\sum p_1 q_1}} \times 100$

(c) $\sqrt{\dfrac{\sum p_0 q_1}{\sum p_0 q_0} \times \dfrac{\sum p_1 q_1}{\sum p_1 q_0}} \times 100$

(d) $\sqrt{\dfrac{\sum p_1 q_0}{\sum p_1 q_1} \times \dfrac{\sum p_0 q_0}{\sum p_0 q_1}} \times 100$

Answer:

(a) $\sqrt{\dfrac{\Sigma p_1 q_0}{\Sigma p_0 q_0} \times \dfrac{\Sigma p_1 q_1}{\Sigma p_0 q_1}} \times 100$

Question 11.
Marshall-Edge worth's Price Index Number is given by

(a) $\dfrac{\sum p_1(q_0+q_1)}{\sum p_0(q_0+q_1)} \times 100$

(b) $\dfrac{\sum p_0(q_0+q_1)}{\sum p_1(q_0+q_1)} \times 100$

(c) $\dfrac{\sum q_1(p_0+p_1)}{\sum q_0(p_0+p_1)} \times 100$

(d) $\dfrac{\sum q_1(p_0+p_1)}{\sum q_0(p_0+p_1)} \times 100$

Answer:

(a) $\dfrac{\sum p_1(q_0+q_1)}{\sum p_0(q_0+q_1)} \times 100$

Question 12.
Walsh's Price Index Number is given by

(a) $\dfrac{\sum p_1\sqrt{q_0 q_1}}{\sum p_0\sqrt{q_0 q_1}} \times 100$

(b) $\dfrac{\sum p_0\sqrt{q_0 q_1}}{\sum p_1\sqrt{q_0 q_1}} \times 100$

(c) $\dfrac{\sum q_1\sqrt{p_0 p_1}}{\sum q_0\sqrt{p_0 p_1}} \times 100$

(d) $\dfrac{\sum q_0\sqrt{p_0 p_1}}{\sum q_1\sqrt{p_0 p_1}} \times 100$

Answer:

(a) $\dfrac{\sum p_1\sqrt{q_0 q_1}}{\sum p_0\sqrt{q_0 q_1}} \times 100$

Question 13.
The Cost of Living Index Number using Aggregate Expenditure Method is given by

(a) $\dfrac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$

(b) $\sum \dfrac{p_1 q_1}{p_0 q_1} \times 100$

(c) $\dfrac{\sum p_1 q_1}{\sum p_0 q_1} \times 100$

(d) $\sum \dfrac{p_1 q_0}{p_0 q_0} \times 100$

Answer:

(a) $\dfrac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$

Question 14.
The Cost of Living Index Number using Weighted Relative Method is given by

(a) $\sum \dfrac{IW}{\sum W}$

(b) $\sum \dfrac{W}{IW}$

(c) $\sum \dfrac{W}{\sum IW}$

(d) $\sum \dfrac{IW}{W}$

Answer:
(a) $\dfrac{\Sigma IW}{\Sigma W}$

(II) Fill in the blanks.

Question 1.
Price Index Number by Simple Aggregate Method is given by _____
Answer:

$\dfrac{\Sigma p_1}{\Sigma p_0} \times 100$

Question 2.
Quantity Index number by Simple Aggregate Method is given by _____
Answer:

$\dfrac{\Sigma q_1}{\Sigma q_0} \times 100$

Question 3.
Value Index Number by Simple Aggregate Method is given by _____
Answer:

$\dfrac{\Sigma p_1 q_1}{\Sigma p_0 q_0} \times 100$

Question 4.
Price Index Number by Weighted Aggregate Method is given by _____
Answer:

$\dfrac{\Sigma p_1 w}{\Sigma p_0 w} \times 100$

Question 5.
Quantity Index Number by Weighted Aggregate Method is given by _____
Answer:

$\dfrac{\Sigma q_1 w}{\Sigma q_0 w} \times 100$

Question 6.
Value Index Number by Weighted Aggregate Method is given by _____
Answer:

$\dfrac{\Sigma p_1 q_1 w}{\Sigma p_0 q_0 w} \times 100$

Question 7.
Laspeyre's Price Index Number is given by _____
Answer:

$\dfrac{\Sigma p_1 q_0}{\Sigma p_0 q_0} \times 100$

Question 8.
Paasche's Price Index Number is given by _____
Answer:

$\dfrac{\Sigma p_1 q_1}{\Sigma p_0 q_1} \times 100$

Question 9.
Dorbish-Bowley's Price Index Number is given by _____
Answer:

$\dfrac{1}{2}\left[\dfrac{\Sigma p_1 q_0}{\Sigma p_0 q_0} + \dfrac{\Sigma p_1 q_1}{\Sigma p_0 q_1}\right] \times 100$

Question 10.
Fisher's Price Index Number is given by _____
Answer:

$$\left[\frac{\Sigma p_1 q_0}{\Sigma p_0 q_0} \times \frac{\Sigma p_1 q_1}{\Sigma p_0 q_1}\right]^{\sqrt{}} \times 100$$

Question 11.
Marshall-Edgeworth's Price Index Number is given my _____
Answer:

$$\frac{\Sigma p_1(q_0+q_1)}{\Sigma p_0(q_0+q_1)} \times 100$$

Question 12.
Walsh's Price Index Number is given by _____
Answer:

$$\frac{\Sigma p_1\sqrt{q_0 q_1}}{\Sigma p_0\sqrt{q_0 q_1}} \times 100$$

(III) State whether each of the following is True or False.

Question 1
$\frac{\Sigma p_1}{\Sigma p_0} \times 100$ is the Price Index Number by Simple Aggregate Method.
Answer:
True

Question 2
$\frac{\Sigma q_0}{\Sigma q_1} \times 100$ is the Quantity Index Number by Simple Aggregate Method.
Answer:
False

Question 3.
$\frac{\Sigma p_0 q_0}{p_1 q_1} \times 100$ is value Index Number by Simple Aggregate Method.
Answer:
False

Question 4.
$\frac{\Sigma p_1 q_0}{p_1 q_1} \times 100$ Paasche's Price Index Number.
Answer:
False

Question 5.
$\frac{\Sigma p_1 q_1}{\Sigma p_0 q_1} \times 100$ is Laspeyre's Price Index Number.
Answer:
False

Question 6.
$\frac{\Sigma p_1 q_0}{\Sigma p_0 q_0} \times \frac{\Sigma p_1 q_0}{\Sigma p_0 q_0} \times 100$ is Dorbish-Bowley's Index Number.
Answer:
False

Question 7.
$\frac{1}{2}\left[\frac{\Sigma p_1 q_0}{\Sigma p_0 q_0}\sqrt{} + \frac{p_1 q_1}{p_0 q_1}\sqrt{}\right] \times 100$ is Fisher's Price Index Number.
Answer:
False

Question 8.
$\frac{\Sigma p_0(q_0+q_1)}{\Sigma p_1(q_0+q_1)} \times 100$ is Marshall-Edgeworth's Index Number.
Answer:
False

Question 9.
$\frac{\Sigma p_0\sqrt{q_0 q_1}}{\Sigma p_1\sqrt{q_0 q_1}} \times 100$ is Walsh's Price Index Number.
Answer:
False

Question 10.

$\sqrt{\frac{\Sigma p_1 q_0}{\Sigma p_0 q_0}} \times \sqrt{\frac{\Sigma p_1 q_1}{\Sigma p_0 q_1}} \times 100$ is Fisher's Price Index Number.

Answer:
True

(IV) Solve the following problems.

Question 1.
Find the price Index Number using simple Aggregate Method Consider 1980 as base year.

Commodity	Price in 1980 (in Rs.)	Price in 1985 (in Rs.)
I	22	46
II	38	36
III	20	28
IV	18	44
V	12	16

Solution:

Commodity	p_0	p_1
I	22	46
II	38	36
III	20	28
IV	18	44
V	12	16
	110	170

$\Sigma p_0 = 110$, $\Sigma P_1 = 170$

$$p_{01} = \frac{\Sigma p_1}{\Sigma p_0} \times 100$$

$$= \frac{170}{110} \times 100$$

$$= 154.55$$

Question 2.
Find the Quantity Index Number using Simple Aggregate Method.

Commodity	Based year quantity	Current year quantity
A	100	130
B	170	200
C	210	250
D	90	110
E	50	150

Solution:

Commodity	q_0	q_1
A	100	130
B	170	200
C	210	250
D	90	110
E	50	150
	620	840

$\Sigma q_0 = 620$, $\Sigma q_1 = 840$

$$q_{01} = \frac{\Sigma q_1}{\Sigma q_0} \times 100$$

$$= \frac{840}{620} \times 100$$

$$= 135.48$$

Question 3.
Find the Value Index Number using Simple Aggregate Method.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
I	20	42	22	45
II	35	60	40	58
III	50	22	55	24
IV	60	56	70	62
V	25	40	30	41

Solution:

Commodity	p_0	q_0	p_1	q_1	p_1q_1	p_0q_0
I	20	42	22	45	990	840
II	35	60	40	58	2320	2100
III	50	22	55	24	1320	1100
IV	60	56	70	62	4340	3360
V	25	40	30	41	1230	1000
					10200	8400

$\Sigma p_1q_1 = 10200 \quad \Sigma p_0q_0 = 8400$

$$V_{01} = \frac{\sum p_1q_1}{\sum p_0q_0} \times 100$$

= $\frac{10200}{8400}$ × 100

= 121.43

Question 4.
Find x if the Price Index Number using Simple Aggregate Method is 200.

Commodity	P	Q	R	S	T
Base Year Price	20	12	22	23	13
Current Year Price	30	x	38	51	19

Solution:

Commodity	p_0	p_1
P	20	30
Q	12	x
R	22	38
S	23	51
T	19	19
	90	$x + 138$

$\Sigma p_0 = 90 \quad \Sigma p_1 = x + 138 \quad p_{01} = 200$

$$p_{01} = \frac{\sum p_1}{\sum p_0} \times 100$$

$\therefore \quad 200 = \frac{x + 138}{90} \times 100$

$\therefore x + 138 = \frac{200 \times 90}{100}$

$\therefore x + 138 = 180$

$\therefore \quad x = 180 - 138$

$\therefore \quad x = 42$

Question 5.
Calculate Laspeyre's and Paasche's Price Index Number for the following data.

Commodity	Base Year		Current Year	
	Price p_0	Quantity q_0	Price p_1	Quantity q_1
A	20	18	30	5
B	25	8	28	4
C	32	5	40	5
D	12	10	18	20

Solution:

Commodity	p_0	q_0	p_1	q_1	$p_1 q_0$	$p_0 q_0$	$p_1 q_1$	$p_0 q_1$
A	20	18	30	15	540	360	450	300
B	25	8	28	5	224	200	140	125
C	32	5	40	7	200	160	280	224
D	12	10	18	10	180	120	180	120
					1144	840	1050	769

$\Sigma p_1 q_0 = 1144$, $\Sigma p_0 q_0 = 840$, $\Sigma p_1 q_1 = 1050$, $\Sigma p_0 q_1 = 769$

$$p_{01}(L) = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100 = \frac{1144}{840} \times 100 = 136.19$$

$$p_{01}(P) = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100 = \frac{1050}{769} \times 100 = 136.54$$

Question 6.
Calculate Dorbish-Bowley's Price Index Number for the following data.

Commodity	Base Year		Current Year	
	Price p_0	Quantity q_0	Price p_1	Quantity q_1
I	8	25	12	28
II	9	20	12	24
III	10	12	30	16

Solution:

Commodity	p_0	q_0	p_1	q_1	$p_1 q_0$	$p_0 q_0$	$p_1 q_1$	$p_0 q_1$
I	8	30	11	28	330	240	308	224
II	9	25	12	22	300	225	264	198
III	10	15	13	11	195	150	143	110
					825	615	715	532

$\Sigma p_1 q_0 = 825$, $\Sigma p_0 q_0 = 615$, $\Sigma p_1 q_1 = 715$, $\Sigma p_0 q_1 = 532$

$$p_{01}(D-B) = \frac{1}{2} \left[\frac{\sum p_1 q_0}{\sum p_0 q_0} + \frac{\sum p_1 q_1}{\sum p_0 q_1} \right] \times 100$$

$$= \frac{1}{2} \left[\frac{825}{615} + \frac{715}{532} \right] \times 100$$

$$= \frac{1}{2} [1.34146 + 1.34398] \times 100$$

$$= \frac{1}{2} [2.68544] \times 100$$

$$= 1.34272 \times 100$$

$$= 134.27$$

Question 7.
Calculate Marshall-Edge worth's Price Index Number for the following data.

Commodity	Base Year		Current Year	
	Price p_0	Quantity q_0	Price p_1	Quantity q_1
X	12	35	15	25
Y	29	50	30	70

Solution:

Commodity	p_0	q_0	p_1	q_1	q_0+q_1	$p_0(q_0+q_1)$	$p_1(q_0+q_1)$
X	12	35	15	25	60	720	900
Y	29	50	30	70	120	3480	3600
						4200	4500

$\Sigma p_0(q_0+q_1) = 4200, \Sigma p_1(q_0+q_1) = 4500$

$$p_{01} (M - E) = \frac{\sum p_1(q_0+q_1)}{\sum p_0(q_0+q_1)} \times 100$$

$$= \frac{4500}{4200} \times 100$$

$$= 107.14$$

Question 8.
Calculate Walsh's Price Index Number for the following data.

Commodity	Base Year		Current Year	
	Price p_0	Quantity q_0	Price p_1	Quantity q_1
I	8	9	12	25
II	10	4	20	16

Solution:

Commodity	p_0	q_0	p_1	q_1	$\sqrt{q_0 q_1}$	$p_1\sqrt{q_0 q_1}$	$p_0\sqrt{q_0 q_1}$
I	8	30	12	25	27.39	328.68	219.12
II	10	42	20	16	25.92	518.4	259.2
						847.08	478.32

$\sum p_1\sqrt{q_0 q_1} = 847.08, \qquad \sum p_0\sqrt{q_0 q_1} = 478.32$

$$p_{01}(W) = \frac{\sum p_1\sqrt{q_0 q_1}}{\sum p_0\sqrt{q_0 q_1}} \times 100$$

$$= \frac{847.08}{478.32} \times 100$$

$$= 177.10$$

Question 9.
Calculate Laspeyre's Price Index Number for the following data.

Commodity	Base Year		Current Year	
	Price p_0	Quantity q_0	Price p_1	Quantity q_1
I	8	30	12	25
II	10	42	20	16

Solution:

Commodity	p_0	q_0	p_1	q_1	p_1q_0	p_0q_0	p_1q_1	p_0q_1
I.	8	30	12	25	360	240	300	200
II	10	42	20	16	840	420	320	160
					1200	660	620	360

$\Sigma p_1q_0 = 1200$, $\Sigma p_0q_0 = 660$, $\Sigma p_1q_1 = 620$, $\Sigma p_0q_1 = 360$

$$p_{01}(L) = \frac{\sum p_1q_0}{\sum p_0q_0} \times 100 = \frac{1200}{660} \times 100$$
$$= 181.82$$

$$p_{01}(L) = \frac{\sum p_1q_1}{\sum p_0q_1} \times 100 = \frac{620}{360} \times 100$$
$$= 172.22$$

Question 10.
Find x if Laseyre's Price Index Number is same as Paasche's Price Index Number for the following data.

Commodity	Base Year		Current Year	
	Price p_0	Quantity q_0	Price p_1	Quantity q_1
A	3	x	2	5
B	4	6	3	5

Solution:

Commodity	p_0	q_0	p_1	q_1	p_1q_0	p_0q_0	p_1q_1	p_0q_1
A	3	x	2	5	$2x$	$3x$	10	15
B	4	6	3	5	18	24	15	20
					$2x+18$	$3x+24$	25	35

$\Sigma p_1q_0 = 2x + 18$, $\Sigma p_0q_0 = 3x + 24$, $\Sigma p_1q_1 = 25$, $\Sigma p_0q_1 = 35$

$$p_{01}(L) = p_{01}(P)$$

$$\therefore \frac{\sum p_1q_0}{\sum p_0q_0} \times 100 = \frac{\sum p_1q_1}{\sum p_0q_1} \times 100$$

$$\therefore \frac{2x+18}{3x+24} \times 100 = \frac{25}{35} \times 100$$

$$\therefore \frac{2x+18}{3x+24} = \frac{5}{7}$$

$$\therefore 14x + 126 = 15x + 120$$

$$\therefore x = 6$$

Question 11.
Find x if Walsh's Price Index Number is 150 for the following data.

Commodity	Base Year		Current Year	
	Price p_0	Quantity q_0	Price p_1	Quantity q_1
A	5	3	10	3
B	x	4	16	9
C	15	5	23	5
D	10	2	26	8

Solution:

Commodity	p_0	q_0	p_1	q_1	$\sqrt{q_0q_1}$	$p_1\sqrt{q_0q_1}$	$p_0\sqrt{q_0q_1}$
A	5	3	10	3	3	30	15
B	x	4	16	9	6	96	$6x$
C	15	5	23	5	5	115	75
D	10	2	26	8	4	104	40
						345	$6x+130$

$$\sum p_1\sqrt{q_0q_0} = 350 \qquad \sum p_0\sqrt{q_0q_1} = 6x + 130$$

$$\therefore \qquad p_{01}(w) = 150$$

$$\therefore \quad \frac{\sum p_1\sqrt{q_0q_1}}{\sum p_0\sqrt{q_0q_1}} \times 100 = 150$$

$$\therefore \quad \frac{345}{6x + 130} \times 100 = 150$$

$$= 6x + 130 = \frac{345 \times 100}{150}$$

$$= 230$$

$$\therefore \qquad 6x = 100$$

$$\therefore \qquad x = 16.67$$

Question 12.
Find x if Paasche's Price Index Number is 140 for the following data.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
	p_0	q_0	p_1	q_1
A	20	8	40	7
B	50	10	60	10
C	40	15	60	x
D	12	15	15	15

Solution:

Commodity	p_0	q_0	p_1	q_1	p_1q_1	p_0q_1
A	20	8	40	7	280	140
B	50	10	60	10	600	500
C	40	15	60	x	60x	40x
D	12	15	15	15	225	180
					60x + 1105	40x + 820

$$\Sigma p_1q_1 = 60x + 1105, \ \Sigma p_0q_1 = 40x + 820$$

$$\therefore \qquad p_{01}(P) = 140$$

$$\therefore \quad \frac{\sum p_1q_1}{\sum p_0q_1} \times 100 = 140$$

$$\therefore \quad \frac{60x + 1105}{40x + 820} \times 10 =$$

$$\therefore \quad 600x + 11050 = 560x + 11480$$

$$\therefore \qquad 40x = 430$$

$$\therefore \qquad x = 10.75$$

Question 13.
Given that Laspeyre's and Paasche's Index Number are 25 and 16 respectively. Find Dorbish-Bowley's and Fisher's Price Index Number.
Solution:

$$p_{01}(L) = 25, \ p_{01}(P) = 16$$

$$p_{01}(O - B) = \frac{p_{01}(L) + p_{01}(p)}{2}$$

$$= \frac{25 + 16}{2} = 20.5$$

$$p_{01}(F) = \sqrt{p_{01}(L) \times p_{01}(P)}$$

= 25×16------√

= 20

Question 14.
If Laspeyre's and Dorbish Price Index Number are 150.2 and 152.8 respectively, find Paasche's rice Index Number.

Solution:

$$p_{01}(L) = 150.2, \quad p_{01}(D - B) = 152.8$$

$$\therefore \quad p_{01}(D - B) = \frac{p_{01}(L) + p_{01}(p)}{2}$$

$$\therefore \quad 152.8 = \frac{150.2 + p_{01}(P)}{2}$$

$$\therefore \quad p_{01}(P) = 2 \times 152.8 - 150.2$$

$$= 155.4$$

Question 15.

If $\Sigma p_0 q_0 = 120$, $\Sigma p_0 q_1 = 160$, $\Sigma p_1 q_1 = 140$, and $\Sigma p_1 q_0 = 200$ find Laspeyre's, Paasche's, Dorbish-Bowley's, and Marshall-Edgeworth's Price Index Numbers.

Solution:

$$P_{01}(L) = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100 = \frac{200}{120} \times 100$$

$$= 166.67$$

$$P_{01}(P) = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100 = \frac{140}{160} \times 100$$

$$= 87.5$$

$$P_{01}(D - B) = \frac{p_{01}(L) + p_{01}(p)}{2}$$

$$= \frac{166.67 + 87.5}{2}$$

$$= 127.085$$

$$P_{01}(M - E) = \frac{\sum p_1 q_0 + \sum p_1 q_1}{\sum p_0 q_0 + \sum p_0 q_1} \times 100$$

$$= \frac{140 + 200}{120 + 160} \times 100$$

$$= \frac{340}{280} \times 100$$

$$= 121.42$$

Question 16.

Given that $\Sigma p_0 q_0 = 130$, $\Sigma p_1 q_1 = 140$, $\Sigma p_0 q_1 = 160$, and $\Sigma p_1 q_0 = 200$, find Laspeyare's, Passche's, Dorbish-Bowely's and Mashall-Edegeworth's Price Inbox Numbers.

Solution:

$$P_{01}(L) = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100 = \frac{200}{130} \times 100$$

$$= 153.85$$

$$P_{01}(P) = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100 = \frac{140}{160} \times 100$$

$$\doteq 87.5$$

$$P_{01}(D - B) = \frac{p_{01}(L) + p_{01}(p)}{2}$$

$$= \frac{153.85 + 87.5}{2} = 120.68$$

$$P_{01}(M - E) = \frac{\sum p_1 q_0 + \sum p_1 q_1}{\sum p_0 q_0 + \sum p_0 q_1} \times 100$$

$$= \frac{140 + 200}{130 + 160} \times 100$$

$$= \frac{340}{160} \times 100$$

$$= 117.24$$

Question 17.

Given that $\Sigma p_1 q_1 = 300$, $\Sigma p_0 q_1 = 140$, $\Sigma p_0 q_0 = 120$, and Marshall-Edegeworth's Price Inbox Number is 120, find Laspeyre's Price Index Number.

Solution:

$p_{01}(P) = \frac{\Sigma p_1 q_1}{\Sigma p_0 q_1} \times 100$

$= \frac{300}{320} \times 100$

$= 93.75$

Question 18.
Calculate the cost of living number for the following data.

Group	Base Year		Current Year
	Price p_0	Quantity q_0	Price p_1
Food	140	13	160
Clothing	120	18	150
Fuel & Lighting	140	10	190
House Rent	160	12	210
Miscellaneous	180	15	260

Solution:

Group	p_0	q_0	p_1	$p_1 q_0$	$p_0 q_0$
Food	150	13	160	2080	1950
Clothing	170	18	150	2700	3060
Fuel & Lighting	175	10	190	1900	1750
House Rent	200	12	210	2520	2400
Miscellaneous	210	15	260	3900	3150
				13100	12310

$\Sigma p_1 q_0 = 13100 \quad \Sigma p_0 q_0 = 12310$

$CLI = \frac{\Sigma p_1 q_0}{\Sigma p_0 q_0} \times 100$

$= \frac{13100}{12310} \times 100$

$= 106.42$

Question 19.
Find the cost living index number by the weighted aggregate method.

Group	Food	Clothing	Fuel & Lighting	House Rent	Miscellaneous
I	78	80	110	60	90
W	5	3	4	2	6

Solution:

Group	I	W	IW
Food	78	5	390
Clothing	80	3	240
Fuel & Lighting	110	4	440
House Rent	60	2	120
Miscellaneous	90	6	540
		20	1750

$\Sigma W = 20 \quad \Sigma IW = 1750$

$CLI = \frac{\Sigma IW}{\Sigma W} = \frac{1750}{20} = 86.5$

Question 20.
Find the cost of living index number by Family Budget Method for the following data. Also, find the expenditure of a person in the year 2008 if his expenditure in the year 2005 was ₹ 10,000.

Group	Base Year (2005) Price	Current Year (2005) Price	Weight
Food	12	60	25
Clothing	10	45	20
Fuel & Lighting	20	35	15
House Rent	25	20	30
Miscellaneous	16	48	10

Solution:

Group	p_0	p_1	W	$I = \dfrac{p_1}{p_0} \times 100$	IW
Food	12	60	25	500	12500
Clothing	10	45	20	450	9000
Fuel & Lighting	20	35	15	175	2625
House Rent	25	20	30	80	2400
Miscellaneous	16	48	10	300	3000
			100		29525

$\sum W = 100 \quad \sum IW = 29525$

$\text{CLI} = \dfrac{\sum IW}{\sum W} = \dfrac{29525}{100} = 295.25$

When CLI = 100, I = 10000

So when CLI = 295.25, I = ?

$I = \dfrac{10000 \times 295.25}{100}$

Income in 2008 = 29525

Question 21.
Find x if cost of living index number is 193 for the following data.

Group	Food	Clothing	Fuel & Lighting	House Rent	Miscellaneous
I	221	198	171	183	161
W	35	14	x	8	20

Solution:

Group	I	W	IW
Food	221	35	7735
Clothing	198	14	2772
Fuel & Lighting	171	x	$171x$
House Rent	183	8	1464
Miscellaneous	161	20	3220
		$x + 77$	$171x + 15191$

$\sum W = x + 77 \quad \sum IW = 171x + 15191$

$\text{CLI} = 193$

$\dfrac{171x + 1591}{x + 77} = 193$

$\therefore \ 171x + 15191 = 193x + 14861$

$\therefore \qquad 22x = 330$

$\therefore \qquad x = 15$

Question 22.
The cost of living number for year 2000 and 2003 are 150 and 210 respectively. A person earns ₹ 13,500 per month in the year 2000. What should be his monthly earning in the year 2003 in order to maintain the same standard of living?
Solution:
CLI (2000) = 150
CLI (2003) = 210

Income (2000) = 13500

Income (2003) = ?

Real Income = $\frac{Income}{CLI} \times 100$

For 2000, Real Income = $\frac{13500}{150} \times 100$ = ₹ 9000

For 2003, Real Income = $\frac{Income}{CLI} \times 100$

∴ 9000 = $\frac{Income}{210} \times 100$

∴ Income = $\frac{9000 \times 210}{100}$ = 18900

∴ Income in 2003 = ₹ 18900