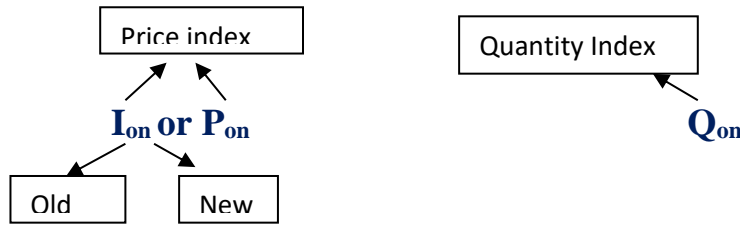


# 1. INDEX NUMBERS

## FORMULAS:



- Simple aggregate price index =  $\frac{\sum P_n}{\sum P_o} \times 100$
- Weighted aggregate price index =  $\frac{\sum P_n \cdot W}{\sum P_o \cdot W} \times 100$
- Price Index no. according to Simple AM to the price related =  $\frac{100}{n} \sum \frac{P_n}{P_o}$  [n = no. of commodity]
- Price Index no. according to weighted AM to the price related =  $\frac{100}{\sum w} \sum \frac{P_n w}{P_o}$
- Link relative or link Index =  $\frac{\text{Price of the year}}{\text{price of the previous year}} \times 100$
- Fisher's Ideal Index =  $\sqrt{\frac{\sum P_n Q_o}{\sum P_o Q_o} \times \frac{\sum P_n Q_n}{\sum P_o Q_n}} \times 100$ .
- Bowley's =  $\frac{1}{2} \left[ \frac{\sum P_n Q_o}{\sum P_o Q_o} \times \frac{\sum P_n Q_n}{\sum P_o Q_n} \right] \times 100$ .
- Laspeyres' Index =  $\frac{\sum P_n Q_o}{\sum P_o Q_o} \times 100$ .
- Paasche's Index =  $\frac{\sum P_n Q_n}{\sum P_o Q_n} \times 100$ .
- Marshall-Edgeworth Index =  $\frac{\sum P_n (q_o + q_n)}{\sum P_o (q_o + q_n)} \times 100$

**Quantity Index Numbers:** Quantity Index formula may be obtained from price index formula replacing  $p$  by  $q$  and  $q$  by  $p$ .

- Price Relative of a commodity =  $\frac{\text{Price of the commodity in the current year}}{\text{price of the commodity in the base year}} \times 100$
- Cost of living index =  $\frac{\sum Iw}{\sum w}$  [I= index and  $w$  =group weight]
- Chain base Index =  $\frac{\text{Link index of the year} \times \text{chain index of the previous year}}{100}$  [use avg. link index for multiple goods]
- Real or Deflated income =  $\frac{\text{Actual income}}{\text{Index of current year}} \times 100$
- Real Income Index no. =  $\frac{\text{Real Income of the year}}{\text{Base year Income}} \times 100$
- Time Reversal Test:  $I_{on} \times I_{no} = 1$  [multiply 100 omitted]
- Factor Reversal Test:  $I_{on} \times Q_{on} = \frac{\sum P_n Q_n}{\sum P_o Q_o}$  [multiply 100 omitted]

## EXERCISES

- The prices of rice per quintal during the period 1975-79 are given below. Find the simple index number relative to the base year 1975.

year	1975	1976	1977	1978	1979
Price (in Rs.)	240	288	312	300	228

- The prices of coal per mound are given below; taking the average price as the base price find the index number of price of coal.

Year	1974	1975	1976	1977	1978
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Price (Rs.)	10.5	12.0	14.4	18.6	19.5
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3. Find by (i) simple (ii) weighted aggregative method the index number from the following data:

Commodity	Rice	Wheat	Oil	Fish	Potato
Base price 1961(in Rs)	32	25	90	120	35
Current price (in Rs.)	50	25	100	140	40
Weight	8	6	7	3	5

4. Calculate price index numbers from the following data, using weighted aggregative formula:

Commodity	Unit	weight	Price per unit (in Rs.)	
			Base year	Current year
A	Quintal	14	90	120
B	Kg	20	10	17
C	Dozen	35	40	60
D	Liter	15	50	95

5. Calculate price index numbers from the following data, using (i) weighted aggregative formula (ii) weighted arithmetic mean of price relatives formula:

Commodity	Unit	Price per unit (in Rs.)		
		Base year	Current year	Weight
A	Quintal	80	110	14
B	Kg	10	15	20
C	Dozen	40	56	35
D	Liter	50	95	15
E	Kg	12	18	16

6. The price quotations of four different commodities for 1972 and 1973 are given below. Calculate the index number for 1973 with 1972 as base using (i) the simple average and (ii) the weighted average of price relative.

Commodity	Unit	Weight	Price (in Rs.)	
			1972	1973
A	Fl; g.	5	2.00	4.50
b	Quintal	7	2.50	3.20
C	Dozen	6	3.00	4.50
D	Kg	2	1.00	1.80

7. Calculate the index number from the following data using arithmetic mean of price relative: (i)

Commodity	Rice	Wheat	Oil	Fish	Potato
Base price 1961(in Rs)	32	25	90	120	35
Current price (in Rs.)	50	25	100	140	40

(ii)

Commodity	Rice	Wheat	Fish	Potato	Oil
Base price 1961(in Rs)	30	25	130	35	70
Current price (in Rs.)	52	30	150	49	105
Weight	8	6	3	5	7

8. Find the price relative of the year 1970-74, relative to 1972 as base year from the following data:

Year	1970	1971	1972	1973	1974
Price (Rs.)	255	315	375	345	390

9. The prices of a commodity in the year 1984-1988 are given below; find the link relative for the years.

Year	1984	1985	1986	1987	1988
Price (Rs.)	20	21	28	35	49

10. The following table give weight (base year price X quantity ) and price relatives for 1929 and 1930 with 1928 as base year for four commodities:

Commodity	Price relatives		Weight
	1929	1930	
A	125	$112\frac{1}{2}$	6
B	120	110	10
C	$83\frac{1}{3}$	$91\frac{2}{3}$	6
D	75	125	1

(i) Calculate the index number for 1930, using unweighted AM of price relatives.

(ii) Find also the index number for 1929, using weighted AM of price relatives.

11. Annual production (in million tons) of four commodities are given below:

Commodity	Annual production		Weight
	1950	1960	
A	160	216	20
B	24	45	30
C	50	68	13
D	120	156	17

Calculate quantity index number for the year 1960 with 1950 as base year, using (i) simple AM, and weighted AM of the relatives.

12. From the following data prepare a quantity index number for the year 1953 taking 1948 as the base year (use Fisher's ideal index formula):

Year	Commodity I		Commodity II		Commodity III	
	Price (Rs.)	Quantity (units)	Price (Rs.)	Quantity (units)	Price (Rs.)	Quantity (units)
1948	5	10	8	6	6	3
1953	4	12	7	7	5	4

13. Compute by Fisher's formula the quantity index number from the data given below:

Article	1974		1976	
	Price (Rs.)	Total (Rs.)	Price (Rs.)	Total (Rs.)
A	5	50	4	48
B	8	48	7	49
C	6	18	5	20

14. Using Fisher's ideal index number, calculate the index number for the following data:

Commodity	Base year		Current year	
	Price (Rs.)	Quantity (units)	Price (Rs.)	Quantity (units)
A	4	40	8	24
B	2	18	2	28
C	5	12	5	52
D	1	24	10	46

15. The following table gives the change in the price and consumption of three commodities in the worker's consumption basket. Compute Fisher's ideal price index number:

Commodity	1950		1960	
	Price (Rs.)	Quantity (units)	Price (Rs.)	Quantity (units)

Wheat	100	10	110	6
Rice	150	15	170	18
Cloth	5	50	4	30

16. Construct: (i) Laspeyres' (ii) Paasche's price index number of 1980 with 1970 as base from the following data:

Commodity	Price (Rs. /Kg)		Quantity solid (kg)	
	1970	1980	1970	1980
A	4	5	95	120
B	60	70	118	130
C	35	40	50	70

17. Calculate the price index number for the year 1988 with 1986 as base using Laspeyres' or Paasche's formula, which will be applicable, on the basis of the following data:

Commodity	Price in (Rs.)		Total value ('000 Rs.)
	1988	1986	1988
A	4.5	2.0	31.5
B	3.2	2.5	32.0
C	4.5	8.0	40.5
D	1.8	1.0	10.8

18. From the following data calculate Paasche's quantity index number for the year 1969, with 1951 as base:

Commodity	Quantity		value
	1951	1969	1969
A	54	250	540
B	93	75	825
C	18	56	448
D	6	8	56
E	23	47	141

19. Using the data given below calculate the price index number for the year 1988 by (i) Laspeyres' formula (ii) Paasche's formula and (iii) Fisher's formula, with the year 1979 as base:

Commodity	Price (Rs.)		Quantity solid ('000 kg)	
	1979	1988	1979	1988
Rice	9.3	4.5	100	90
Wheat	6.4	3.7	11	10
Pulses	5.1	2.7	5	3

20. Calculate the price index number by (i) Paasche's formula (ii) Laspeyres' formula (iii) Bowley's formula (iv) Fisher's formula and (v) Edgeworth-Marshall's formula:

Commodity	Base year (1979)		Current year (1980)	
	Price (Rs.)	Quantity (kgs.)	Price (Rs.)	Quantity (kgs.)
A	20	8	40	6
B	50	10	60	5
C	40	15	50	10
D	20	20	20	15

21. Given the following data; what index number will you use for purposes of comparison? Give reason.

Commodity	1976		1977	
	Price (Rs.)	Quantity (units)	Price (Rs.)	Quantity (units)
A	9.3	100	4.6	90

B	6.4	11	3.7	10
C	5.1	5	2.7	3

22. Edgeworth-Marshall's index and Fisher's ideal index are very close to each other. Verify this statement from the following data:

Commodity	Base year		Current year	
	Quantity (units)	Price (Rs.)	Quantity (units)	Price (Rs.)
A	12	10	15	12
B	15	7	20	5
C	24	5	20	9
D	5	16	5	14

23. The total value of retained imports into India in 1960 was Rs. 71.5 million per month. The corresponding total for 1967 was Rs. 87.6 million per month. The index of volume of retained import in 1967 compared with 1960 (=100) was 62.0. Calculate the price index for retained imports for 1967 on 1960 as base.
24. The price of rice per quintal was Rs.380, Rs.415 and Rs.502 in the years 1980, 1985 and 1990 respectively. Find the index number of the price of rice of 1990 with base year 1980.
25. Construct the cost of living index number from the following data:

Group	Food	Fuel & light	Clothing	House rent	Miscellaneous
Weight	47	7	8	13	14
Index no.	247	293	289	100	236

26. Find the general cost of living index of 1993 from the following table: (i) (CU(H)'94)

Class	Food	Dress	House rent	Fuel	Miscellaneous
Class index	620	575	325	255	280
Weight	30	20	25	15	10

(ii)

Group	Food	Clothing	fuel	House rent	Miscellaneous
Group index	428	240	200	125	170
Weight	45	15	8	20	12

27. Find the index numbers for the years 1961, 1962, 1963 by the chain base method, with base year 1960, from the following table:

Year	1960	1961	1962	1963
Link index	100	110	95.5	109.5

28. Given the following information; construct chain index number (base 1962=100) for the year 1963-67.

Year	1963	1964	1965	1966	1967
Link index	103	98	105	112	108

29. The following table gives the retail price of the commodities A, B AND C for the years 1976 to 1980. Calculate chain index number with 1976 as base.

Commodity	Retail price				
	1976	1977	1978	1979	1980
A	2	3	4	5	6
B	8	10	12	15	18
C	4	5	8	10	12

30. Using the following data verify that Paasche's formula for index does not satisfy factor reversal test:

Commodity	Base year		Current year	
	Price (Rs.)	Quantity (units)	Price (Rs.)	Quantity (units)
X	4	10	6	15
Y	6	15	4	20

Z	8	5	10	4
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31. Show that Fisher's ideal index number satisfies both the time reversal and factor reversal tests and verify this from the following data:

Commodity	1970		1972	
	Price (Rs.)	Quantity (units)	Price (Rs.)	Quantity (units)
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

32. Calculate the quantity index number using Fisher's formula for the following data and show that it the time reversal test:

Commodity	1973		1974	
	Price (Rs.)	Quantity (units)	Price (Rs.)	Quantity (units)
A	6	70	8	120
B	8	90	10	100
C	12	140	16	280

33. Calculate Fisher's index using the following data and check whether it satisfies the time reversal test:

Commodity	1984		1985	
	Quantity (units)	Price (Rs.)	Quantity (units)	Price (Rs.)
X	60	32	50	30
Y	35	30	40	25
Z	55	16	50	18

34. From the following data on shoe price and quantities , show that Laspeyre's index does not satisfies factor test:

Type of shoe	$P_{1950}$	$Q_{1950}$	$P_{1960}$	$Q_{1960}$
Men's	7	36	10	48
Women's	5	50	9	64
Children's	4	18	6	20

35. Calculate a price index number for 1976 with 1960 as base, making use of the all information available from the table below and verify if it satisfies the time reversal and factor reversal test:

Commodity	Price		Value spent	
	1960	1976	1960	1976
A	4	7	16	35
B	12	20	84	200
C	14	21	560	651
D	8	10	48	70

36. Apply the GM to find the general index from the following group indices, by assigning the given weights:

Group	A	B	C	D	E	F
Group index	118	120	97	107	111	93
Weight	4	1	2	6	5	2

37. In calculating cost of living index the following weights were used:

food-15; Rent-4; Clothing-3; Fuel and Light-2 and Miscellaneous-1.

Calculating the index no. for a data when the percentage increase in prices of the various items over prices of July 1968(=100) were 32, 47, 54, 78, and 58 respectively.

38. Following information relating to workers in an industrial town is given:

Items of consumption	Food, drinks	Clothing	Fuel & lighting	Housing	miscellaneous
Consumer price index in 1970 (1960=100)	225	175	155	250	150
Proportion of expenditure on the items	52%	8%	10%	14%	16%

Average wage per month in 1960 is Rs. 200. What should be the average wage per worker per month in 1970 in that town so that the standard of living of the workers does not fall below 1960 level?

39. In an income –expenditure survey of labour class families in town A and B it is found that average expenditure on food and other items are as follows:

	Town A	Town B
Food	64%	50%
Other items	36%	50%

In 1971 the consumer price index no. for town A was 279 and in town B it was 265 (base 1961=100). It is also known that price increase of all commodities consumed by the labour class is the same. Determine the index numbers for (i) food, (ii) other items.

### C.U. QUESTIONS

1. Using the data given below, calculate price Index no. for the year 2011 by Fisher's formula with the year 2001 as base: [2012,1990]

Commodity	Price(₹)		Quantity ('000 kg)	
	2001	2011	2001	2011
Rice	9.3	4.5	100	90
Wheat	6.4	3.7	11	10
Pulses	5.1	2.7	5	3

2. Consumer price index no. goes up from 110 to 200 and salary of a worker is also raised from ₹325 to ₹500. Does the worker really gain and if so, by how much in real terms. **[ans.:49.134(app.) [2012]**
3. Given the following data: [2003,2012,2016(H),2017(G)]

Commodity	Base year		Current year	
	Price (₹)	Quantity	Price (₹)	Quantity
A	1	10	2	5
B	1	5	x	2

Find x, if the ratio between Laspeyre's and Paasche's index no. is 28:27. **[ans.: x=4]**

4. Calculate price index number for 2012 with 2000 as base year following data by using Fisher's method: [2013]

Commodity	2000		2012	
	Quantity(kg)	Price(₹)	Quantity(kg)	Price (₹)
A	5	2.00	7	4.50
B	7	2.50	10	3.20
C	6	8.00	6	4.50

5. Compare the general cost of living indices for the two year 2006 and 2012 from the following table: [2013]

Group	Weight	Group indices	
		2006	2012
Food	71	370	380
Clothing	3	423	504
House rent	7	110	116
Miscellaneous	10	279	283

6. With the help of the following data show that Fisher's formula satisfies the time reversal test & Paasche's formula does not satisfy factor reversal test: [2010,2013,2014,2016]

Commodity	2011		2012	
	Quantity(kg)	Price(₹)	Quantity(kg)	Price (₹)
Rice	50	32	50	30
Wheat	35	30	40	25
Sugar	55	16	50	18

7. The following information relating to the worker in a town is given: **[2013]**

Items	Consumer's price index in 2011(base year 2000)	Percentage expenditure on the items
Food	225	52
Clothing	175	8
Fuel	155	10
Housing	250	14
Miscellaneous	150	16

The average wage per month in 2000 was ₹12000. What should be the average wage per month in 2011 in that town so that the standard of living in 2011 remains same as that in 2000?

8. From the following data, show that Fisher's price index number satisfies time reversal test: **[2013]**

Commodity	Base year		Current year	
	Price(₹)	Quantity(kg)	Price(₹)	Quantity(kg)
A	8	6	12	5
B	10	5	11	6
C	7	8	5	5

9. Show that the Fisher's ideal index formula factor reversal test & time reversal. **[2012,2013,2014]**

10. Using the data given below, calculate price Index no. for the year 2011 by Laspeyres's & Paasche's formula with the year 2001 as base: **[2014]**

Commodity	Price(₹)		Quantity ('000 kg)	
	2005	2013	2005	2013
Rice	9.3	14.5	100	90
Wheat	6.4	13.7	11	10
Pulses	5.1	12.7	5	3

11. With the help of the following data, show that Fisher's price index number satisfies Factor reversal test: **[2014]**

Commodity	Price (₹) per unit		Unit number	
	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

12. Check whether Laspeyres's Index Formula Factor reversal test and time reversal or not? **[ans.:not]**

**[2014,2015]**

13. Using the data given below, calculate price Index no. for the year 2014 by Laspeyres's formula with the year 2011 as base year: **[2001,2015]**

Commodity	Price (₹)		Quantity(kg.)	
	2011	2014	2011	2014
A	4	5	95	120
B	60	70	118	130
C	35	40	50	70

**[ans.:116.56 (app.)]**

14. calculate the Fisher's Ideal Index Number from the following data: **[2015]**

Commodity	2005	2010
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	Price (₹)	Quantity(unit)	Price (₹)	Quantity(unit)
Wheat	100	10	110	6
Rice	150	15	170	18
Cloth	5	50	4	30

**[ans.:110.65]**

15. Determine the weight for the food group with cost of living index number for 2014 with 2010 as base is 175 from: **[2015]**

Group	% Increase in expenditure	Weight
Food	95	-
Clothing	90	12
Fuel etc.	20	18
Rent etc.	150	20
Miscellaneous	70	10

16. Find price index number by the method of relative using arithmetic mean from the following data **[2015]**

Commodity	Wheat	Milk	Fish	Sugar
Base price	5	8	25	6
Current price	7	10	32	12

**[ans.:148.25]**

17. From the following data, calculate the cost of living index number: **[1992, 2000,2016]**

Group	Weight	Index number (base: 2004-05=100)
Food	50	241
Clothing	2	221
Fuel & light	3	204
Rent	16	256
Miscellaneous	29	179

**[ans.:223.91]**

18. Calculate the quantity index for 2015 from the following data using Laspeyre's formula with 2005 as the base year: **[ans.:81.132]** **[2016]**

Commodity	2005		2015	
	Price (₹)	Quantity(unit)	Price (₹)	Quantity(unit)
A	1	6	5	4
B	3	5	8	5
C	4	8	10	6

19. Using the following data verify that Paasche's formula for index does not satisfy Factor Reversal Test: **[2016,2017]**

Commodity	Base year		Current year	
	Price (₹)	Quantity(unit)	Price (₹)	Quantity(unit)
X	4	10	6	15
Y	6	15	4	20
Z	8	5	10	4

20. The CLI for a certain consumer group goes up from 110 in 2010 to 220 in 2015 and the salary of a worker ₹3,250 in 2010 to ₹8,000 in 2015. Does the worker really gain and if so, by how much in real forms. **[ans.: real wage in 2010 ₹2954.55(app.) & real wage in 2015 ₹3636.36 and Gain= ₹681.81]**

**[2016]**

21. Construct the cost of living index number from the following data: **[ans.:230.36]**

**[2016,2010]**

Group	Food	Fuel & Light	Clothing	House rent	Miscellaneous
Weight	47	7	8	14	24
Index	247	293	289	100	236

22. When the cost of rice was increased by 60%, a person, who maintain his former consumption scale, said that the rise had increased his cost of living by 70%. What percentage of his cost of living was due to buying rice before the change in price? [ans.:11.67%] [2016]

23. Calculate the seasonal index from the following data using the simple average method: [2016]

Year	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>	Q <sub>4</sub>
2011	72	68	80	70
2012	76	70	82	74
2013	74	66	84	80
2014	76	74	84	78
2015	78	74	86	82

[ans.:Q<sub>1</sub>=98.43; Q<sub>2</sub>=92.15; Q<sub>3</sub>=108.90; Q<sub>4</sub>=100.52, ∴Total=400]

24. From the following data, show that Fisher's ideal formula satisfies both Factor reversal test & time reversal test: [2017]

Commodity	Base year		Current year	
	Price (₹)	Quantity(unit)	Price (₹)	Quantity(unit)
A	4	20	6	18
B	5	15	6	12
C	2	30	3	30
D	3	25	5	28

25. Find the price index number by the method of arithmetic mean of price relatives from the following:

Commodity	Wheat	Milk	Fish	Sugar
Base price	5	8	25	6
Current year	7	10	32	12

[ans.:148.25] [2017]

26. Find the general cost living index of 2016 from the following table: [ans.:448.5] [2017]

Class	Food	Clothing	House rent	Fuel	Miscellaneous
Group index	620	575	325	255	280
Weight	30	20	25	15	10

27. Compute the seasonal index quarterly average for the following data: [2017]

Year	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>	Q <sub>4</sub>
2010	75	60	54	59
2011	86	65	63	80
2012	90	72	66	85
2013	100	78	72	93

[ans.:Q<sub>1</sub>=117.785; Q<sub>2</sub>=91.304; Q<sub>3</sub>=85.284; Q<sub>4</sub>=106.02; Av. Of averages=74.75]

