

4

INDEX NUMBERS

Sr. No.	Contents	Page
4.1:	Introduction	108
4.2:	Types of index numbers	108
4.3:	Uses of index numbers	109
4.4:	Limitations of index numbers	109
4.5:	Price index numbers	109
4.6:	Main steps in the construction of price index number	110
4.7:	Fixed base method	112
4.8:	Chain base method	117
4.9:	Weighted aggregative index numbers	121
4.10	Cost of living index numbers.	127
4.10.1	Construction of cost of living index numbers	127
	Exercise	131
	Answers	139

4.1 INTRODUCTION

In previous chapter, we have studied that averages are generally used to compare two or more series, we know that averages can be used to compare only those series, which are expressed in the same units, but if the units of measurements in the two series are different, average can not be used to compare them. In such cases index numbers is used.

Suppose it is required to measure the general changes in the price of certain commodities. Let the commodities be wheat, milk, cement etc. We know that wheat is sold in Rs. Per mound, milk in Rs. Per litter, cement in Rs. Per bag, etc. Obviously these commodities are not comparable directly. In order to have comparison between them, we compute the index numbers of these commodities.

Index numbers are a series of numbers by which we can measure the relative change in a variable or a group of variables for the purpose of comparison. The index numbers is a statistical technique which measure the average change in a variable or a group of variables with respect to time or space. The variable may be prices of commodities, wages of workers, volume of trade, sales, exports and imports, production, unemployment, etc.

According to **Bowley** "Index numbers are used to measure the change in some quantity which we can not observe directly".

According to **Prof. Secrets**, 'Index numbers are a series of numbers by which changes in the magnitudes of a phenomenon are measured from time to time or from place to place".

Index numbers may be constructed for a single commodity, called simple index numbers, or for a group of commodities, called composite index numbers.

4.2 TYPES OF INDEX NUMBERS

Index numbers are of the following types:

- (a) Price index numbers.
- (b) Quantity index numbers.
- (c) Aggregative type of index numbers.

(A) Price index Numbers.

Price index numbers are constructed to measure the relative changes in price of a commodity or a group of commodities.

(B) Quantity Index Numbers.

Quantity index numbers are constructed for measuring the relative change in quantity or volume of commodities imported, exported or produced.

(C) Aggregative Type of Index Numbers.

Aggregative index numbers use price and quantities simultaneously. They are constructed to measure the change in the cost of living in a particular locality for a specified income group of people.

4.3 USES OF INDEX NUMBERS

Following are some important uses of Index Numbers:

- (i) Index numbers are called economic barometers because they reveal the changes in employment, public health, production, cost of living etc.
- (ii) Index numbers are extensively used in economics, social sciences and business because index numbers measure the change in volume of production, sales, stocks and prices.
- (iii) Index numbers are used for comparison with the help of index numbers of prices or volume of production of different periods.
- (iv) Index numbers are used in forecasting.
- (v) Price index numbers show the change in price levels of a period of time.
- (vi) The insurance companies use index numbers in fixing duration of life of insured persons and in fixing the rate premium.
- (vii) The departments of labour, industries, commerce and metrology etc, extensively use index number.
- (viii) The main advantage of index numbers is that of cost of living index numbers in which the change in purchasing power for buying a basket of goods and services. The cost of living index numbers are used by the Government in fixing wage rates.

4.4 LIMITATIONS OF INDEX NUMBERS.

The limitations of index numbers are given below:

- (i) All index numbers can not be used for all purposes. Each index number serves a special purpose.
- (ii) If sufficient care is not taken in selecting the commodities and their price lists, the index numbers may give wrong results.
- (iii) Different methods for calculating index numbers give different results.
- (iv) If a wrong base year is selected, the results will be misleading.
- (v) It is difficult to include all commodities, we select only a sample of commodities, therefore, sampling errors occur in the index numbers.

4.5 PRICE INDEX NUMBERS

Price index numbers are a series of numbers by which relative change in price of a commodity or a group of commodities are measured between two periods. The price index numbers are used of great importance for the Government and private agencies in forming their policies. It should be noted that first of all price index numbers were originated and then other index numbers were developed.

The price index numbers are of two types:

- (a) Simple price index numbers.

(b) General price index numbers.

(A) Simple Price Index Numbers.

Price index numbers are said to be simple price index numbers if they relate to the price of only one commodity at different periods.

(B) General Price Index Numbers.

Price index numbers are said to be general price index numbers if they relate to prices of more than one commodities at different periods.

4.6 MAIN STEPS IN THE CONSTRUCTION OF PRICE INDEX NUMBERS

The following steps are involved in the construction of price index numbers:

- (a) Purpose of index numbers.
- (b) Selection of commodities.
- (c) Collection of price lists.
- (d) Choice of base period.
- (e) Selection of an appropriate average.
- (f) Choice of proper weights.

(A) Purpose of Index Numbers.

Before collecting data and making calculations, it is important to know what we are trying to measure. The first and the most important step in the construction of price index numbers is to specify the purpose of index numbers. Because it is purpose that guides all the relevant decisions and all index numbers are not suitable for all purposes. Therefore, we can say that it is purpose that determine the proper and useful type of index numbers. The definition of the purposes for which the construction of the index number has been taken in hand, is very important and should be made clear.

(B) Selection of Commodities.

When the purpose of the index numbers is specified the next step is to select the commodities to be included in the index numbers. These commodities should be according to habits and customs of the consumers. The quality of these commodities should also be specified. The number of commodities should also be decided. If an index number has more commodities it will be more accurate as compared with those having less commodities. A sufficient number should be used.

(C) Collection of Price Lists.

Prices of selected commodities should be taken from different markets, trade journals, etc. from different places. If we want to construct a whole sale price index numbers, then these prices should be used. On the other hand, if a retail price index number is being constructed the retail prices should be obtained. The price quotations are taken daily, weekly or fortnightly etc. This depends on the purpose of index numbers.

(D) Choice of Base Period.

After collection of prices, we select a base period. The prices of all other years are expressed as percentages or relatives in terms of base period price. There are two methods to select the base period.

- (i) Fixed base method.
- (ii) Chain base method.

(i) Fixed Base Method.

In this method either the price of some chosen year or the average of prices over a period of years is taken as the base period. A base year should be a normal year. A normal year is a year in which the prices are normal. Using the fixed base method, we obtain price relatives. The price relatives are obtained by dividing the prices of current year by the price of base year and expressing the result as percentage.

Thus

$$\text{Price Relative} = P_{0n} = \frac{P_n}{P_0} \times 100$$

Where P_n = Current year price
 P_0 = Base year price

(ii) Chain Base Method.

In chain base method, there is no fixed base year but it changes from year to year. Using the chain base method, we get link relatives. The link relatives are obtained by dividing the prices of current year by the price of the preceding year and expressing the result as percentage.

Thus

$$\text{Link relative} = \frac{P_n}{P_{n-1}} \times 100$$

Where P_n = Price in current year
 P_{n-1} = Price in preceding year

Link relatives are not directly comparable because they have no fixed base. To make them comparable, they are converted to what we call chain indices. The chain index for the first year is taken as 100 and then the chain index for succeeding year is obtained by multiplying its link relative with the chain index of the preceding year and dividing the results by 100. One can note that these chain indices are just the price relatives computed by taking the first year as a base.

$$\text{Chain Indices} = \frac{\text{Link Relative of the Current Year} \times \text{Chain Index of the Previous Year}}{100}$$

(E) Selection of Appropriate Average.

In general price index numbers, the prices of more than one commodities are studied. Price relatives or link relatives for each commodity are calculated for each year. Then their average is taken to get the required index numbers. One of the following averages can be used.

- (i) Arithmetic mean.
- (ii) Median.
- (iii) Geometric mean.

Arithmetic mean is easy to calculate, therefore, it is widely used in index numbers. But the geometric mean is the best of all other measures of central tendency in the construction of price index numbers.

(F) Choice of Proper Weights.

In price index numbers, some commodities are more important than others. Therefore, weights are assigned to different commodities in order to give them their due importance. Weights are of two types.

- (i) Implicit weights.
- (ii) Explicit weights.

Implicit weights are used by including price of commodities in such units so that they become equally important. For example if we want to compare the prices of milk and eggs, we can equate their importance by quoting the price per kilogram and price of eggs per dozen. Explicit weights are assigned according to the relative importance of different commodities. Explicit weights may be their quantities or their money values.

4.7 FIXED BASE METHOD

(i) Simple Price Index Numbers.

Simple index numbers by fixed base method are obtained as follows:

$$\text{Price relative} = \frac{P_n}{P_0} \times 100$$

EXAMPLE 4.1

From the following data, compute index numbers by taking

(a) 1960 as base year			(b) 1965 as base year.		
Year :	1960	1961	1962	1963	1964
Prices :	5	6	8	7	9
Year :	1965	1966	1967	1968	1969
Prices :	10	12	11	13	15

SOLUTION

Year	Price	(a) Index Number 1960 as base year	(b) Index Numbers 1965 base year
1960	5	$\frac{5}{5} \times 100 = 100$	$\frac{5}{10} \times 100 = 50$
1961	6	$\frac{6}{5} \times 100 = 120$	$\frac{6}{5} \times 100 = 60$
1962	8	$\frac{8}{5} \times 100 = 160$	$\frac{8}{10} \times 100 = 80$

Year	Price	(a) Index Number 1960 as base year	(b) Index Numbers 1965 base year
1963	7	$\frac{7}{5} \times 100 = 140$	$\frac{7}{10} \times 100 = 70$
1964	9	$\frac{9}{5} \times 100 = 180$	$\frac{9}{10} \times 100 = 90$
1965	10	$\frac{10}{5} \times 100 = 200$	$\frac{10}{10} \times 100 = 100$
1966	12	$\frac{12}{5} \times 100 = 240$	$\frac{12}{10} \times 100 = 120$
1967	11	$\frac{11}{5} \times 100 = 220$	$\frac{11}{10} \times 100 = 110$
1968	13	$\frac{13}{5} \times 100 = 260$	$\frac{13}{10} \times 100 = 130$
1969	15	$\frac{15}{5} \times 100 = 300$	$\frac{15}{10} \times 100 = 150$

EXAMPLE 4.2

From the following data, compute index numbers by taking

(i) 1930 as base year. (ii) 1935 as base year. (iii) 1938 as base year.

Year :	1930	1931	1932	1933	1934
Prices :	15	14	19	21	24
Year :	1935	1936	1937	1938	
Prices :	23	25	22	26	

SOLUTION

Year	Price	(i) Index Number (1930 as base)	(ii) Index Number (1945 as base)	(iii) Index Number (1938 as base)
1930	15	$\frac{15}{15} \times 100 = 100$	$\frac{15}{23} \times 100 = 65.22$	$\frac{15}{26} \times 100 = 57.69$
1931	14	$\frac{14}{15} \times 100 = 93.33$	$\frac{14}{23} \times 100 = 60.86$	$\frac{14}{26} \times 100 = 53.58$
1932	19	$\frac{19}{15} \times 100 = 126.67$	$\frac{19}{23} \times 100 = 82.61$	$\frac{19}{26} \times 100 = 73.08$
1933	21	$\frac{21}{15} \times 100 = 140$	$\frac{21}{23} \times 100 = 91.30$	$\frac{21}{26} \times 100 = 80.77$
1934	24	$\frac{24}{15} \times 100 = 160$	$\frac{24}{23} \times 100 = 104.35$	$\frac{24}{26} \times 100 = 92.31$
1935	23	$\frac{23}{15} \times 100 = 153.33$	$\frac{23}{23} \times 100 = 100$	$\frac{23}{26} \times 100 = 88.85$

Year	Price	(i) Index Number (1930 as base)	(ii) Index Number (1945 as base)	(iii) Index Number (1938 as base)
1936	25	$\frac{25}{15} \times 100 = 166.67$	$\frac{25}{23} \times 100 = 108.7$	$\frac{25}{26} \times 100 = 96.15$
1937	22	$\frac{22}{15} \times 100 = 146.67$	$\frac{22}{23} \times 100 = 95.65$	$\frac{22}{26} \times 100 = 84.62$
1928	26	$\frac{26}{15} \times 100 = 173.33$	$\frac{26}{23} \times 100 = 113.04$	$\frac{26}{26} \times 100 = 100$

EXAMPLE 4.3

The price of wheat is given for the year 1980 to 1990. Calculate the index numbers by taking.

- 1980 as base year.
- Average of first four years price as base year price.
- Average of all 11 years price as base year.

Year :	1980	1981	1982	1983	1984	1985
Prices:	24	25	28	31	29	32
Year :	1986	1987	1988	1989	1990	
Price :	35	42	50	51	60	

SOLUTION

$$\text{Mean of first 4 years} = \frac{24 + 25 + 28 + 31}{4} = \frac{108}{4} = 27$$

$$\text{Mean of a 11 years} = \frac{24 + 25 + 28 + 31 + 39 + 32 + 35 + 42 + 50 + 51 + 60}{11} = 37$$

Year	Price	(i) Index Number (1980 as base)	(ii) Index Number (Average of first 4 year as base)	(iii) Index Number (Average of 11 years base (1938 as base)
1980	24	$\frac{24}{24} \times 100 = 100$	$\frac{24}{27} \times 100 = 89.89$	$\frac{24}{37} \times 100 = 64.86$
1981	25	$\frac{25}{24} \times 100 = 104.17$	$\frac{25}{27} \times 100 = 92.59$	$\frac{25}{37} \times 100 = 67.57$
1982	28	$\frac{28}{24} \times 100 = 116.67$	$\frac{28}{27} \times 100 = 103.70$	$\frac{28}{37} \times 100 = 75.68$
1983	31	$\frac{31}{24} \times 100 = 129.67$	$\frac{31}{27} \times 100 = 114.81$	$\frac{31}{37} \times 100 = 83.78$
1984	29	$\frac{29}{24} \times 100 = 120.83$	$\frac{29}{27} \times 100 = 107.41$	$\frac{29}{37} \times 100 = 78.38$

Year	Price	(I) Index Number (1980 as base)	(ii) Index Number (Average of first 4 year as base)	(iii) Index Number (Average of 11 years base (1938 as base)
1985	32	$\frac{32}{24} \times 100 = 133.33$	$\frac{32}{27} \times 100 = 118.52$	$\frac{32}{37} \times 100 = 86.49$
1986	35	$\frac{35}{24} \times 100 = 145.83$	$\frac{35}{27} \times 100 = 129.63$	$\frac{35}{37} \times 100 = 94.59$
1987	42	$\frac{42}{24} \times 100 = 175$	$\frac{42}{27} \times 100 = 155.56$	$\frac{42}{37} \times 100 = 113.51$
1988	50	$\frac{50}{24} \times 100 = 208.33$	$\frac{50}{27} \times 100 = 185.19$	$\frac{50}{37} \times 100 = 135.14$
1989	51	$\frac{51}{24} \times 100 = 212.50$	$\frac{51}{27} \times 100 = 188.89$	$\frac{51}{37} \times 100 = 137.84$
1990	60	$\frac{60}{24} \times 100 = 250.00$	$\frac{60}{27} \times 100 = 222.22$	$\frac{60}{37} \times 100 = 162.16$

(ii) **General Price Index Numbers.**

In general price index numbers the prices of more than one commodities are related. In this method, we use the average of the price relatives.

$$\text{Price relative} = \frac{P_n}{P_0} \times 100$$

EXAMPLE 4.4

From the following data, compute the index numbers of prices taking 1960 as base.

Year	Commodity (Price in Rs.)			
	Wheat	Rice	Sugar	Tobacco
1960	15	30	35	10
1961	18	35	30	8
1962	23	43	40	12
1963	25	50	50	15

SOLUTION

Year	Wheat	Rice	Sugar	Tobacco	Total	Index No
1960	100	100	100	100	400	100
1961	120	116.66	85.71	80	402.37	100.59
1962	153.33	143.33	114.28	120	530.94	132.74
1963	166.66	166.67	145.85	150	629.17	157.29

EXAMPLE 4.5

From the data given below, compute the index numbers of prices taking 1970 as base and using mean and median as averages.

Year	Commodity			
	A	B	C	D
1970	3.25	2.50	0.20	0.06
1971	3.44	2.80	0.22	0.06
1972	3.50	2.00	0.25	0.06
1973	3.75	2.50	0.25	0.06

SOLUTION

The necessary calculations are shown below:

Year	Price Relatives				Index No. (Mean)	Index No. (Median)
	A	B	C	D		
1970	100	100	100	100	100	100
1971	105.85	112	110	100	106.96	107.925
1972	107.69	80	125	100	103.15	103.85
1973	115.38	100	125	100	110.095	107.69

EXAMPLE 4.6

The table below shows average annual prices of a number of commodities for the year (1933-37). Compute indices taking 1933 as base year and using average (i) Mean (ii) Median (iii) Geometric Mean.

Year	Price in Rs.				
	Wheat	Rice	Cotton	Ghee	Soap
1933	52	65	110	36	18
1934	60	76	116	44	22
1935	66	80	122	28	28
1936	56	90	124	32	32
1937	70	92	128	38	38

SOLUTION

Year	Price Relatives					Index Numbers		
	Wheat	Rice	Cotton	Ghee	Soap	(i)	(ii)	(iii)
1933	100	100	100	100	100	100	100	100
1934	115.38	89.41	105.45	122.22	122.22	110.94	115.38	110.20
1935	126.92	94.12	110.91	77.78	155.55	113.06	110.91	109.90
1936	107.69	105.88	112.73	88.89	177.78	118.59	107.69	115.23
1937	134.62	108.23	116.36	105.55	211.11	135.17	116.36	130.45

4.8 CHAIN BASE METHOD

(i) Simple Price Index Numbers.

Simple price index numbers by chain base method are obtained as follows:

$$\text{Link relative} = \frac{P_n}{P_{n-1}} \times 100$$

EXAMPLE 4.7

Calculate the chain index numbers for the data given in example 6.1.

SOLUTION

Year	Price	Link Relative	Chain Index No.
1960	5	= 100	= 100
1961	6	$\frac{6}{5} \times 100 = 120$	$\frac{100 \times 120}{100} = 120$
1962	8	$\frac{8}{6} \times 100 = 133.33$	$\frac{120 \times 133.33}{100} = 160$
1963	7	$\frac{7}{8} \times 100 = 87.5$	$\frac{160 \times 87.5}{100} = 140$
1964	9	$\frac{9}{7} \times 100 = 128.5$	$\frac{140 \times 128.5}{100} = 179.9$
1965	10	$\frac{10}{9} \times 100 = 111.11$	$\frac{179.9 \times 111.11}{100} = 199.89$
1966	12	$\frac{12}{10} \times 100 = 120$	$\frac{199.89 \times 120}{100} = 239.87$
1967	11	$\frac{11}{12} \times 100 = 91.7$	$\frac{239.87 \times 91.7}{100} = 219.96$
1968	13	$\frac{13}{11} \times 100 = 118.18$	$\frac{219.96 \times 118.18}{100} = 259.95$
1969	15	$\frac{15}{13} \times 100 = 115.38$	$\frac{259.95 \times 115.38}{100} = 299.93$

EXAMPLE 4.8

Compute chain indices for the given data.

Year	:	1979	1980	1981	1982	1983
Price Rs.	:	400	500	750	450	250
Year	:	1984	1985	1986	1987	1988
Price Rs.	:	800	125	200	600	700

SOLUTION

The necessary calculations are given below.

Year	Price Rs.	Link Relative	Chain Index No.
1979	400	= 100	= 100
1980	500	$\frac{500}{400} \times 100 = 125$	$\frac{100 \times 125}{100} = 125$
1981	750	$\frac{750}{500} \times 100 = 150$	$\frac{125 \times 150}{100} = 187.50$
1982	450	$\frac{450}{750} \times 100 = 60$	$\frac{187.50 \times 60}{100} = 112.50$
1983	250	$\frac{250}{450} \times 100 = 55.56$	$\frac{112.50 \times 55.56}{100} = 62.51$
1984	800	$\frac{800}{250} \times 100 = 320$	$\frac{62.51 \times 320}{100} = 200.02$
1985	125	$\frac{125}{800} \times 100 = 15.63$	$\frac{200.02 \times 15.63}{100} = 31.26$
1986	200	$\frac{200}{125} \times 100 = 160$	$\frac{31.26 \times 160}{100} = 50.02$
1987	600	$\frac{600}{200} \times 100 = 300$	$\frac{50.02 \times 300}{100} = 150.06$
1988	700	$\frac{700}{600} \times 100 = 166.67$	$\frac{150.06 \times 166.67}{100} = 250.12$

(ii) General Price Index Numbers.

In general price index numbers the link relatives are obtained by the same method as in simple index numbers.

$$\text{Link relative} = \frac{P_n}{P_{n-1}} \times 100$$

EXAMPLE 4.9

Construct index numbers from the following data by chain base method.

Year	Commodity (Price in Rs.)			
	Wheat	Rice	Sugar	Tobacco
1960	15	30	35	10
1961	18	35	30	8
1962	23	43	40	12
1963	25	50	50	15

SOLUTION

Year	Link Relatives			
	Wheat	Rice	Sugar	Tobacco
1960	100	100	100	100
1961	120	116.67	85.71	80
1962	127.77	122.85	133.33	150
1963	108.69	116.28	125	125

Total	Mean	Chain Indices
400	100	= 100
402.37	100.59	$\frac{100 \times 100.59}{100} = 100.59$
533.95	133.49	$\frac{100.59 \times 133.49}{100} = 134.28$
474.97	118.74	$\frac{134.28 \times 118.74}{100} = 159.44$

EXAMPLE 4.10

Construct chain indices from the following data using median as average.

Year	Commodity (Price in Rs.)		
	A	B	C
1976	3.6	640	0.30
1977	4.4	1400	0.32
1978	4.8	560	0.34
1979	4.0	680	0.40
1980	4.4	640	0.40

SOLUTION

Year	Link Relatives			Median	Chain Indices
	A	B	C		
1976	100	100	100	100	= 100
1977	122.2	218.7	106.6	122.2	$\frac{122.2 \times 106.6}{100} = 122.2$
1978	109.1	40	106.2	106.2	$\frac{122.2 \times 106.2}{100} = 129.78$
1979	83.3	121.4	117.6	117.6	$\frac{129.78 \times 117.6}{100} = 152.61$
1980	110.0	94.1	100	110	$\frac{152.61 \times 110}{100} = 167.87$

EXAMPLE 4.11

Calculate the chain indices from the following data using the three averages.

Year	Rice	Wheat	Linseed	Gur	Cotton	Tobacco
1981	7.3	7.5	7.0	6.3	34.1	17.3
1982	7.7	5.5	8.0	7.3	29.8	17.1
1983	5.8	3.6	6.5	6.2	17.3	14.5
1984	4.1	2.7	4.2	4.2	13.3	11.6

SOLUTION

Year	Link Relatives					
	Rice	Wheat	Linseed	Gur	Cotton	Tobacco
1981	100	100	100	100	100	100
1982	105.5	73.3	114.3	115.9	87.4	98.8
1983	75.3	65.5	81.9	84.9	58.1	84.8
1984	70.7	75	64.6	67.6	76.7	80

Chain Indices		Chain Indices		Chain Indices	
A.M		Med		G.M	
100	= 100	100	= 100	100	= 100
99.2	$\frac{100 \times 99.2}{100} = 99.2$	102.15	$\frac{100 \times 102.15}{100} = 102.15$	97.98	$\frac{100 \times 97.98}{100} = 97.98$
75.08	$\frac{99.259 \times 75.08}{100} = 74.4$	78.6	$\frac{102.15 \times 78.6}{100} = 80.29$	74.35	$\frac{97.98 \times 74.35}{100} = 72.85$
72.4	$\frac{74.4 \times 72.4}{100} = 53.85$	72.85	$\frac{80.29 \times 72.85}{100} = 58.49$	72.24	$\frac{72.85 \times 72.24}{100} = 52.62$

EXAMPLE 4.12

The link relatives of four commodities are given below. Calculate chain index numbers.

Year	Link Relatives			
	A	B	C	D
1950	100	100	100	100
1951	105	107	109	106
1952	110	108	107	111
1953	112	120	130	125
1954	115	117	117	119
1955	121	131	137	139
1956	125	132	140	140

SOLUTION

The calculation for chain indices are shown below.

Year	Link Relatives			
	A	B	C	D
1950	100	100	100	100
1951	105	107	109	106
1952	110	108	107	111
1953	112	120	130	125
1954	115	117	117	119
1955	121	131	137	139
1956	125	132	140	140

Total	Mean	Chain Indices
400	100	= 100
427	106.75	$\frac{100 \times 106.75}{100} = 106.75$
436	109	$\frac{106.75 \times 109}{100} = 116.36$
487	121.75	$\frac{116.36 \times 121.75}{100} = 141.67$
468	117	$\frac{141.67 \times 117}{100} = 165.75$
528	132	$\frac{165.75 \times 132}{100} = 218.79$
537	134.25	$\frac{218.79 \times 134.25}{100} = 293.72$

4.9 WEIGHTED AGGREGATIVE INDEX NUMBERS

Some important weighted index numbers are given below:

(1) Laspeyre's Index Numbers.

In Laspeyre's index numbers the prices for current year and base year are needed. The quantities of base year are also needed. The quantities of base year are used as weights. Laspeyre's index number is also called the base year weighted index number. It is defined as:

$$P_{0n} = \frac{\sum P_n q_0}{\sum P_0 q_0} \times 100$$

Where P_n = Current year price.

P_0 = Base year price.

q_0 = Base year quantity.

(2) Paasche's Index Number.

In paasche's index numbers the quantities of current year are used as weights. It is defined as the percentage ratio of current value to base value when quantities of the current year are used. Paasche's index number is also known as current year weighted index number, which is given as:

$$P_{0n} = \frac{\sum P_n q_n}{\sum P_0 q_n} \times 100$$

Where P_n = Current year quantity

P_0 = Base year price

q_n = Current year quantity

(3) Fisher's Ideal Index Number.

Fisher's ideal index number is the geometric mean of Laspeyre's and Paasche's index numbers. It is defined as:

$$P_{0n} = \sqrt{\frac{\sum P_n q_0}{\sum P_0 q_0} \times \frac{\sum P_n q_n}{\sum P_0 q_n}} \times 100$$

$$= \sqrt{\text{Laspeyre's} \times \text{Paasche's}}$$

(4) Marshall Edgeworth Index Number.

In Marshall Edgeworth index number the sum of the base year and current year quantities are used as weights. This method was proposed by the English Economists "Edgeworth and Marshall" and can be defined as:

$$P_{0n} = \frac{\sum P_n (q_0 + q_n)}{\sum P_0 (q_0 + q_n)} \times 100$$

$$P_{0n} = \frac{\sum P_n q_0 + \sum P_n q_n}{\sum P_0 q_0 + \sum P_0 q_n} \times 100$$

EXAMPLE 4.13

Calculate Laspeyre's, Paasche's, Fisher's Ideal and Marshall Edgeworth index numbers for 1981 taking 1980 as base year from the following data.

Commodity	1980		1981	
	Price	Quantity	Price	Quantity
Wheat	30	110	32	112
Rice	40	100	38	110
Jawar	25	50	22	80
Maize	10	40	15	50

SOLUTION

Commodity	1980		1981		$P_0 q_0$	$P_0 q_1$	$P_1 q_0$	$P_1 q_1$
	P_0	q_0	P_1	q_1				
Wheat	30	110	32	112	3300	3360	3520	3584
Rice	40	100	38	110	4000	4400	3800	4180
Jawar	25	50	22	80	1250	2000	1100	1760
Maize	10	40	15	50	400	500	600	750
Total	---	---	---	---	8950	10260	9020	10274

(a) Laspeyre's Index Number

$$P_{0n} = \frac{\sum P_n q_n}{\sum P_0 q_0} \times 100$$

$$\begin{aligned} \text{Laspeyr's Index number for 1981} &= P_{01} = \frac{\sum P_1 q_0}{\sum P_0 q_0} \times 100 \\ &= \frac{9020}{8950} \times 100 = 100.78 \end{aligned}$$

(b) Paasche's Index Number

$$P_{0n} = \frac{\sum P_n q_n}{\sum P_0 q_n} \times 100$$

$$\begin{aligned} \text{Laspeyr's Index number for 1981} &= P_{01} = \frac{\sum P_1 q_1}{\sum P_0 q_1} \times 100 \\ &= \frac{10274}{10260} \times 100 = 100.14 \end{aligned}$$

(c) Fisher's Ideal Index Number

$$P_{0n} = \sqrt{\frac{\sum P_n q_0}{\sum P_0 q_0} \times \frac{\sum P_n q_n}{\sum P_0 q_n}} \times 100$$

Fisher's Ideal index number for 1981

$$P_{01} = \sqrt{\frac{\sum P_1 q_0}{\sum P_0 q_0} \times \frac{\sum P_1 q_1}{\sum P_0 q_1}} \times 100 = \sqrt{\frac{9020}{8950} \times \frac{10274}{10260}} \times 100$$

$$P_{01} = \sqrt{1.0078 \times 1.0014} \times 100 = 100.46$$

(d) Marshall Edgeworth Index Number for 1981

$$P_{0n} = \frac{\sum P_n q_0 + \sum P_n q_n}{\sum P_0 q_0 + \sum P_0 q_n} \times 100$$

Marshall Edgeworth I No for 1981.

$$= \frac{9020 + 10274}{8950 + 10260} \times 100 = \frac{19294}{19210} \times 100 = 100.44$$

EXAMPLE 4.14

Given the following:

Commodity	Price		Quantities	
	1960	1961	1960	1961
A	12	20	50	120
B	10	12	100	80
C	14	15	60	70
D	16	18	30	50
E	18	20	40	40
F	22	15	70	60
G	20	16	90	100
H	15	18	80	80

Find Index numbers for 1961.

- Base year weighted (Laspeyre's formula)
- Current year weighted (Paasche's formula)

SOLUTION

Commodity	1960		1961		P_1Q_0	P_0Q_0	P_1Q_1	P_0Q_1
	P_0	Q_0	P_1	Q_1				
A	12	50	20	20	600	1000	2400	1440
B	10	100	12	12	1000	1200	960	800
C	14	60	15	15	840	900	1059	980
D	16	30	18	18	480	540	900	800
E	18	40	20	20	720	800	800	720
F	22	70	15	15	1540	1050	900	1320
G	20	99	16	16	1800	1440	1600	2000
H	15	80	18	18	1200	1440	1440	1200
Total	—	—	—	—	8180	8370	10050	92606

- Laspeyre's Index No. for 1961**

$$P_{01} = \frac{\sum P_1Q_0}{\sum P_0Q_0} \times 100 = \frac{8370}{8180} \times 100 = 102.3$$

- Paache's Index No. for 1961**

$$P_{01} = \frac{\sum P_1Q_1}{\sum P_0Q_1} \times 100 = \frac{10050}{9260} \times 100 = 108.53$$

EXAMPLE 4.15

Construct index numbers of prices from the following data using

- Laspeyre's
- paache's
- Fisher's Ideal
- Marshall Edgeworth method.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
A	6	50	10	50
B	2	100	2	120
C	4	61	6	60
D	10	30	12	24

SOLUTION

Commodity	p_0	q_0	p_1	q_1	p_0q_0	p_0q_1	p_1q_0	p_1q_1
A	6	50	10	50	300	336	500	560
B	2	100	2	120	200	240	200	240
C	4	60	6	60	240	240	360	360
D	10	30	12	24	300	240	360	488
---	---	---	---	---	1040	1056	1420	1648

(a) Laspeyre's Index Number

$$P_{0n} = \frac{\sum p_n q_0}{\sum p_0 q_0} \times 100$$

$$P_{01} = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100 = \frac{1420}{1040} \times 100 = 136.54$$

(b) Paasche's Index Number

$$P_{0n} = \frac{\sum p_n q_n}{\sum p_0 q_n} \times 100$$

$$P_{01} = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100 = \frac{1648}{1056} \times 100 = 156.06$$

(c) Fisher's Ideal Index Number

$$P_{0n} = \sqrt{\frac{\sum p_n q_0}{\sum p_0 q_0} \times \frac{\sum p_n q_n}{\sum p_0 q_n}} \times 100$$

$$P_{01} = \sqrt{\frac{\sum p_1 q_0}{\sum p_0 q_0} \times \frac{\sum p_1 q_1}{\sum p_0 q_1}} \times 100 = \sqrt{\frac{1420}{1040} \times \frac{1648}{1056}} \times 100$$

$$= \sqrt{(1.3654)(1.5606)} \times 100 = 145.97$$

(d) Marshall Edgeworth Index Number

$$P_{0n} = \frac{\sum p_n q_0 + \sum p_n q_n}{\sum p_0 q_0 + \sum p_0 q_n} \times 100$$

$$P_{01} = \frac{\sum p_1 q_0 + \sum p_1 q_1}{\sum p_0 q_0 + \sum p_0 q_1} \times 100 = \frac{1420 + 1648}{1040 + 1056} \times 100 = \frac{3068}{2096} = 146.73$$

EXAMPLE 4.16

Calculate index numbers from the following data taking 1971 as base year.

(i) Laspeyre's index number

(ii) Paasche's index number

(iii) Fisher's ideal number

(iv) Marshall Edgeworth index number

Commodity	1971		1972		1973	
	Price	Qty.	Price	Qty.	Price	Qty.
A	18	20	20	27	25	26
B	30	18	36	19	42	24
C	28	8	31	10	42	9

SOLUTION

The calculations are given below.

Commodity	1971		1972		1973	
	P_0	Q_0	P_1	Q_1	P_2	Q_2
A	18	20	20	27	25	26
B	30	18	36	19	42	24
C	28	8	31	10	42	9
Total	---	---	---	---	---	---

P_1Q_0	P_2Q_0	P_1Q_1	P_2Q_1	P_1Q_2	P_2Q_2
360	400	500	486	468	540
540	648	756	570	720	684
224	248	336	280	252	310
1124	1296	1592	1336	1438	1534

(i) Laspeyre's Index Number

$$P_{0n} = \frac{\sum P_n Q_0}{\sum P_0 Q_0} \times 100$$

Laspeyre's Index Number for 1972

$$P_{01} = \frac{\sum P_1 Q_0}{\sum P_0 Q_0} \times 100 = \frac{1296}{1124} \times 100 = 115.30$$

Laspeyre's Index Number for 1973

$$P_{02} = \frac{\sum P_2 Q_0}{\sum P_0 Q_0} \times 100 = \frac{1592}{1124} \times 100 = 141.64$$

(ii) Paasche's Index Number

$$P_{0n} = \frac{\sum P_0 Q_n}{\sum P_n Q_n} \times 100$$

Paasche's Index Number for 1972

$$P_{01} = \frac{\sum P_0 Q_1}{\sum P_1 Q_1} \times 100 = \frac{1534}{1336} \times 100 = 114.82$$

Paasche's Index Number for 1973

$$P_{02} = \frac{\sum P_0 Q_2}{\sum P_2 Q_2} \times 100 = \frac{2036}{1438} \times 100 = 141.59$$

(iii) Fisher's Ideal Index Number

$$P_{01} = \sqrt{\frac{\sum P_n Q_0}{\sum P_0 Q_0} \times \frac{\sum P_n Q_n}{\sum P_0 Q_n}} \times 100$$

Fisher's Ideal index number for 1972

$$P_{01} = \sqrt{\frac{\sum P_1 Q_0}{\sum P_0 Q_0} \times \frac{\sum P_1 Q_1}{\sum P_0 Q_1}} \times 100 = \sqrt{\frac{1296}{1124} \times \frac{1534}{1336}} \times 100 = 115.06$$

Fisher's Ideal index number for 1973

$$P_{02} = \sqrt{\frac{\sum P_2 q_0}{\sum P_0 q_0} \times \frac{\sum P_2 q_2}{\sum P_0 q_2}} \times 100 = \sqrt{\frac{1592}{1124} \times \frac{2036}{1438}} \times 100 = 141.61$$

(iv) **Marshall Edgeworth Index Number**

$$P_{0n} = \frac{\sum P_n q_0 + \sum P_n q_n}{\sum P_0 q_0 + \sum P_0 q_n} \times 100$$

Marshall Edgeworth Index Number for 1972

$$P_{01} = \frac{\sum P_1 q_0 + \sum P_1 q_1}{\sum P_0 q_0 + \sum P_0 q_1} \times 100 = \frac{1296 + 1534}{1124 + 1336} \times 100 = 115.50$$

Marshall Edgeworth Index Number for 1973

$$P_{02} = \frac{\sum P_2 q_0 + \sum P_2 q_2}{\sum P_0 q_0 + \sum P_0 q_2} \times 100 = \frac{1592 + 2036}{1124 + 1438} \times 100 = 141.61$$

4.10 COST OF LIVING INDEX NUMBERS

The index numbers of prices, discussed in the preceding pages are prepared to measure the variation of prices, which fails to measure the effect of increase and decrease or rise and fall in prices on the general standard of living of different income group of people living in society. A change in general price level affects different income of people differently. To overcome this difficulty, cost of living index numbers are used for measuring the effect of price changes on various classes of people. The cost of living index numbers are also called consumer's price index numbers. The major consumption items which are included in a cost of living index number are.

- (i) Food Articles
- (ii) Clothing
- (iii) Fuel and Lighting
- (iv) House Rent
- (v) Miscellaneous

The miscellaneous group includes items such as conveyance, education, medical care, recreation, gifts, newspaper, barber, laundry and other service charges.

4.10.1 Construction of Cost of Living Index Numbers

The following steps are involved in the construction of cost of living index numbers.

- (i) Class of people
- (ii) Family budget inquiry
- (iii) Selection of the commodities
- (iv) Price data
- (v) Computation of the index number

(i) **Class of People**

The first and most important step in the construction of cost of living index number is that the class of people should be defined clearly. It should

be decided whether the cost of living index number is being prepared for clerks, industrial workers, lectures or peons living in a particular area. It is therefore, necessary to specify the class of people and locality where they reside.

(ii) Family Budget Inquiry

The next step in the construction of cost of living index number is that some families should be selected for conducting a family budget inquiry. These families should be selected randomly. These families provide information about food articles, clothing, house rent, fuel and lighting and miscellaneous. The inquiry include questions on family size, income, number of earners, the quality and quantity consumed and the money depend on them. The weights are assigned in proportions to the expenditure on different items.

(iii) Selection of Commodities

The next step in the construction of cost of living index number is the selection of the commodities to be included. We should select those commodities which are largely used by that class of people and have uniform quality.

(iv) Price Data

The fourth step is to collect data on retail prices of the selected commodities for the current period and the base period. These prices should be obtained from the shops situated in that locality for which the index numbers are prepared.

(v) Computation of the Index Number

There are two methods for the construction of cost of living index numbers.

- (a) The aggregate expenditure method
- (b) Family budget method

(a) The aggregate Expenditure Method

In this method the quantities of different commodities consumed in the base year are taken as weight. The quantity $\sum P_0 q_0$ represents total expenditure on the selected commodities in the base year. The quantity $\sum P_n q_0$ represents the total expenditure on the selected commodities during the current year. In symbols.

$$P_{0n} = \frac{\sum P_n q_0}{\sum P_0 q_0} \times 100$$

Which is Laspeyre's formula.

(b) Family Budget Method.

According to this method the aggregate expenditure of the family on various items are used as weights. Current year prices are converted in to price relatives on the basis of base year prices, and these price relatives are multiplied by the respective values of commodities in the base year, and the product is divided by the sum of weights. In symbols.

$$P_{0n} = \frac{\sum \left(\frac{P_n}{P_0} \right) \times W}{\sum W} \times 100 = \frac{\sum \left(\frac{P_n}{P_0} \right)}{\sum W} \times 100 = \frac{\sum W \times I}{\sum W}$$

Where $W = \text{Weight} = P_0 q_n$, $I = \frac{P_n}{P_0} \times 100$

EXAMPLE 4.17

Construct the cost of living index numbers for 1962 on the basis of 1960 from the data given below by aggregate expenditure method and by family budget method.

Commodity	Quantity Consumed (q_0)	Units	Price in 1960 (P_0)	Price in 1962 (P_1)
Wheat	10 Mds	Per md	25	30
Rice	8 Mds	Per md	36	41
Dal	1 Mds	Per md	50	53
Ghee	15 Seers	Per seer	8	10
Sugar	25 Seers	Per seer	2	3
Salt	1 Sees	Per seer	1	1
Clothing	100 Yards	Per yard	3	4
Vegetable	35 seers	Per seer	1	2
House Rent	-----	Per house	50	70

SOLUTION

Commodity	Quantity Command (q_0)	Units	Price in 1960 (P_0)	Price in 1962 (P_1)
Wheat	10 Mds	Per Md	25	30
Rice	8 Mds	Per Md	36	41
Dal	1 Mids	Per md	50	53
Ghee	15 seers	Per seer	8	10
Sugar	25 seers	Per seer	2	3
Salt	1 seers	Per seer	1	1
Clothing	100 Yards	Pe yard	3	4
Vegetable	35 Seers	Per seer	1	2
House Rent	----	Per house	50	70

Aggregate Expenditure in base year $P_0q_0 = W$	Aggregate Expenditure in current year P_1q_0	Price relative $\frac{P_1}{P_0} \times 100 = I$	$W \times I$
250	300	120.0	30000.0
288	328	113.9	32803.2
50	33	106.0	5300.0
120	150	125.0	15000.0
50	75	150.0	7500.0
1	1	100.0	100.0
300	400	135.3	39990.0
35	70	120.0	7000.0
50	70	140.0	7000.0
1144	1447	---	144693.2

(i) Aggregate Expenditure Method $= P_{0n} = \frac{\sum P_n q_0}{\sum P_0 q_0} \times 100$

$$= P_{01} = \frac{\sum P_1 q_0}{\sum P_0 q_0} \times 100 = \frac{1447}{1144} \times 100 = 126.48$$

(ii) Family Budget Method $= P_{0n} = \frac{\sum W \times I}{\sum W} \times \frac{144693.2}{1144} = 126.48$

EXERCISE NO. 4

- 4.1:- Define an index number. Discuss the problems involved in the construction of index number of prices.
- 4.2:- Define and discuss the following kinds of index numbers.
(a) Fixed base method (b) Chain base method.
- 4.3:- From the following data, compute index number for the years 1930-1938, by taking (a) 1930 as base year (b) 1935 as base year.

Year:	1930	1931	1932	1933	1934	1935	1936	1937	1938
Price:	15	14	19	21	24	23	25	22	26

- 4.4:- Calculate simple index number using (i) 1974 as base (ii) average of prices for the first five years as base (iii) Average of prices of all the 10 years as base.

Year :-	1974	1975	1976	1977	1978
Price :	20	18	23	24	25
Year :	1979	1980	1981	1982	1983
Price :	27	28	30	32	33

- 4.5:- Find index number of prices by taking 1954 as base year.

Year :	1954	1955	1956	1957	1958
Price :	122.5	116	120	137	149
Year :	1959	1960	1961	1962	1963
Price :	156.8	162	149	160.6	153.1

- 4.6:- From the following data, find index numbers by taking (a) 1930 as base year (b) 1935 as base year.

Year:	1930	1931	1932	1933	1934	1935	1936	1937	1938
Price:	4	5	6	7	8	10	9	10	11

- 4.7:- Compute price relatives taking 1919 as base year for the following data.

Year :	1919	1920	1921	1922	1923	1924	1925
Price :	120	122	116	120	120	137	136
Year :	1926	1927	1928	1929	1930	1931	1932
Price :	149	156	137	162	149	160	160

- 4.8:- Find index numbers using (i) 1977 as base (ii) Average of the prices as base.

Year :	1977	1978	1979	1980	1981
Price :	22.50	25.00	27.50	30.00	35.00
Year :	1982	1983	1984	1985	
Price :	32.50	37.50	47.50	45.00	

- 4.9:- Find index numbers of the following price with 1970 as base.

Year :	1965	1966	1967	1968	1969	1970
Price :	10.50	11.75	12.00	12.75	13.00	14.00
Year :	1971	1972	1973	1974	1975	
Price :	14.00	15.75	16.50	18.00	20.00	

4.10:- Find index numbers from the following data. taking.

- (a) Average of first 3 years as base.
(b) Average of all eight years as base.

Year :	1970	1971	1972	1973	1974	1975	1976	1977
Price :	9	6	9	11	10	13	14	16

4.11:- The following table gives prices in rupees for 40 kg for the years 1970 – 1975.

Year :	1970	1971	1972	1973	1974	1975
Price :	30.5	32.8	40.2	43.5	44.5	48.2

Find (i) Link relatives for prices (ii) Chain relatives base 1970.

(Lahore Board, 2008)

4.12:- Compute chain indices for the following data taking 1994 as base.

Year :	1994	1995	1996	1997	1998	1999	2000
Price :	187	161	149	142	125	129	133

(Lahore Board Group I, 2009)

4.13:- The following table gives prices in rupees for the year 1990 – 1995.

Year :	1990	1991	1992	1993	1994	1995
Price :	30	32	40	43	44	48

Find index numbers by chain base method.

(Lahore Board Group II, 2009)

4.14:- Find index number using: (i) 1977 as base (ii) Average of prices as base.

Year :	1977	1978	1979	1980	1981	1982	1983
Price :	22.50	25.00	27.50	30.00	35.50	32.50	37.50

(Lahore Board, 2010)

4.15:- For the following data calculate index number: (i) By taking 1990 as base (ii) By taking average for first 3 years as base.

Year :	1990	1991	1992	1993	1994	1995
Price :	65	72	75	80	85	82

(Gujranwala Board, 2010)

4.16:- Compute (i) Price relatives and (ii) Link relatives using year 2001 as base from the following data.

Year :	2001	2002	2003	2004	2005
Price :	1000	1020	1050	1060	1100

(Rawalpindi Board, 2010)

4.17:- Construct index numbers of prices of the following data taking 1962 as base.

Year :	1960	1961	1962	1963	1964
Price :	50	52	55	57	62
Year :	1965	1966	1967	1968	1969
Price :	72	73	75	71	70

(Sargodha Board, 2010)

- 4.18:-** The price of wheat is given for years 1964 to 1973. Calculate simple index numbers using (i) 1964 as base (ii) Average of the prices for the first five year as base (iii) Average of the prices of all the 10 years as base. (iv) Chain index numbers.

Year :	1964	1965	1966	1967	1968
Price :	20	18	23	24	25
Year :	1969	1970	1971	1972	1973
Price :	27	28	30	32	33

- 4.19:-** Given the following data (a) Using 1953 as base years. Find the price relatives (b) Calculate the chain indices for the year 1953-58

Year :	1953	1954	1955	1956	1957	1958
Price :	14.95	14.95	15.10	15.65	16.28	16.53

- 4.20:-** Convert the following prices into price relatives using chain base method.

Year :	1960	1961	1962	1963	1964	1965
Price :	2.4	2.5	2.8	2.9	3.1	3.3
Year :	1966	1967	1968	1969	1970	
Price :	3.5	4.2	5.1	6.4	5.7	

- 4.21:-** The price of wheat (per maund) are given below. Compute simple index number by chain base method using 1975 as base year.

Year :	1975	1976	1977	1978	1979	1980	1981	1982
Price :	58	62	64	66.5	67	69	67	70

- 4.22:-** Compute chain indices from the following data.

Year :	1970	1971	1972	1973	1974	1975	1976
Price :	9	11	10	13	14.5	16	18

- 4.23:-** The prices of rice are given below. Compute index numbers by chain base method.

Year :	1960	1961	1962	1963	1964	1965	1966	1967
Price :	40	45	48	50	52	54	56	60

- 4.24:-** The average annual prices of four commodities for the year 1960-64 are given. In the following table. Construct price index numbers taking 1960 as base.

Year	Commodity (Price in Rs.)			
	Wheat	Rice	Cotton	Ghee
1960	20	30	120	160
1961	21	32	132	180
1962	22	33	140	200
1963	24	35	144	225
1964	25	36	150	240

- 4.25:- Find index numbers for the years 1965-67 from the following data taking 1964 as base and using (i) Mean (ii) Median as averages.

Commodity	Average Annual (Price in Rs.)			
	1964	1965	1966	1967
A	1.50	1.75	2.00	2.25
B	1.20	1.40	1.50	1.60
C	2.80	3.00	3.25	3.40
D	3.50	4.20	4.50	4.75

- 4.26:- The following table gives the average whole sale prices in rupees per unit of gold, wheat and cotton during the years 1912-17. find index numbers taking 1912 as base year.

Commodity	Average Prices (Rs.)					
	1912	1913	1914	1915	1916	1917
Gold	25.3	30.8	33.4	35.5	35.3	36.0
Wheat	17.3	14.5	4.9	5.7	17.1	11.6
Cotton	7.8	5.4	6.7	5.6	7.2	10.2

- 4.27:- Construct price index numbers taking 1980 as base using.

- (a) Mean, Median as an average.
(b) Geometric mean as an average.

Year	Wheat	Rice	Cotton	Sugar
1980	60	130	420	260
1981	65	150	480	280
1982	72	160	540	300
1983	80	200	584	345
1984	85	240	620	360

- 4.28:- From the data below, compute index numbers of the prices taking 1985 as base and using G.M as average.

Year	A	B	C	D
1985	50	70	80	90
1986	69	82	98	112
1987	102	115	120	128
1988	140	148	150	144

- 4.29:- From the data given below, compute the index numbers taking 1985 as base year.

Year	Commodity Price (Rs.)			
	Blades	Cigarettes	Soap	Salt
1985	3.00	1.20	2.00	1.10
1986	3.05	1.33	2.35	1.19
1987	3.24	1.43	2.48	1.26
1988	3.25	1.41	2.47	1.25
1989	3.45	1.60	2.61	1.35

- 4.30:- (a) From the price data given below, compute the index numbers taking 1970 as base and using median as average. (b) Find chain index numbers.

Year	Commodity Price (in Rs.)		
	Wheat	Rice	Maize
1970	60	140	54
1971	56	184	58
1972	68	195	77
1973	79	190	88
1974	80	202	85

- 4.31:- Find the chain indices from the following data using G.M.

Year	Commodity			
	A	B	C	D
1910	81	77	110	55
1911	62	54	128	52
1912	104	87	111	100
1913	93	75	154	96
1914	60	43	165	88

- 4.32:- Compute chain index numbers from the data given using (i) A.M (ii) Median (iii) G.M.

Year	Price (In Rs.)			
	Wheat	Sugar	Ghee	Cotton
1941	16	40	200	50
1942	20	50	250	60
1943	18	70	240	80
1944	25	80	300	100

- 4.33:- Calculate the chain indices for the following data.

Year	Sugar	Milk	Cotton	Tea
1955	81	77	119	55
1956	82	54	128	85
1957	104	87	111	100
1958	93	75	154	96
1959	60	43	165	88
1960	60	44	159	89
1961	62	47	139	84

- 4.34:- The following table gives the average whole sale prices of the commodities A, B and C during the year 1944 to 1951. Find the index numbers by chain base method.

Commo dity	1944	1945	1946	1947	1948	1949	1950	1951
A	50.6	61.6	66.8	71.0	70.6	72.0	72.0	75.6
B	6.8	6.4	5.6	6.2	6.4	7.8	6.0	6.8
C	29.6	25.8	26.4	28.6	28.6	30.2	28.0	34.6

- 4.35:- Construct the following index numbers for the year 1961. (i) Laspeyre's Index (ii) Paasche's Index (iii) Fisher's ideal index (iv) Marshall Edgeworth Index.

Commodity	1960		1961	
	Price	Quantity	Price	Quantity
A	8	50	20	60
B	2	15	6	10
C	1	20	2	25
D	2	10	5	8
E	1	40	3	30

- 4.36:- Calculate index numbers for 1995 using 1985 as base year by Paasche's formula.

Commodity	1985		1995	
	Price	Quantity	Price	Quantity
Wheat	6	45	10	40
Rice	7	50	12	35
Cotton	8	60	16	30

(Faisalabad Board, 2010)

- 4.37:- Calculate Fisher's price index number for 2005 taking 2004 as base year.

Commodity	1985		1995	
	Price	Quantity	Price	Quantity
A	2	50	10	40
B	3	10	8	50
C	4	60	4	80

(Lahore Board, 2010)

- 4.38:- Compute Laspeyre's, Paasche's, Fisher's and Marshall Edgeworth index numbers for the following data using 1973 as base.

Commodity	1973		1975	
	Price	Quantity	Price	Quantity
Wheat	40	180	42	95
Rice	10	75	11	70
Bajra	12	110	14	125

- 4.39:- Construct index number for 1993 using 1983 as base year by (i) Laspeyre's (ii) Paasche's (iii) Fisher's ideal formula.

Commodity	1983		1993	
	Price	Quantity	Price	Quantity
A	2	50	10	40
B	3	10	8	5
C	4	5	4	5

(Faisalabad Board, 2009; Lahore Board, 2008)

- 4.40:- Compute Laspeyre's, Paasche's and Fisher's Ideal index numbers for 1980 taking 1975 as base year for the following.

Commodity	1975		1980	
	Price	Quantity	Price	Quantity
Wheat	55	100	63	130
Jawar	25	55	29	45
Gur	27	130	32	85

(Faisalabad Board, 2008)

- 4.41:- construct Laspeyre's, Paasche's and Fisher's ideal index numbers for 1981 on the base of the year 1980 from the following data.

Year	Article A		Article B		Article C	
	Price	Qty.	Price	Qty.	Price	Qty.
1980	10	25	13	21	4	10
1981	9	27	12	22	3	14

- 4.42:- Compute the weighted price index number for 1964 from the following data with 1960 as base.

(i) Laspeyre's method.

(ii) Paasche's method.

Commodity	Price 1960	Price 1964	Qty. 1960	Qty. 1964
Milk	3.95	4.25	9675	10436
Cheese	34.80	38.90	78	83
Butter	61.56	59.70	118	116

- 4.43:- Compute price index numbers by Laspeyre's, Paasche's and Fisher's ideal formula for the year 1971 and 1972 taking 1970 as base.

Year	Wheat		Gram		Tobacco	
	Price	Qty.	Price	Qty.	Price	Qty.
1970	4	50	3	100	2	500
1971	4	50	8	50	10	400
1972	5	40	5	80	8	200

- 4.44:- Construct index numbers of the following data, taking 1986 as base using. (i) Laspeyre's Index Number, (ii) Paasche's Index Number, (iii) Fisher's Index Number, (iv) Marshall Edgeworth Index Number Formulas.

Item	1986		1987		1988	
	Price	Qty.	Price	Qty.	Price	Qty.
A	5	100	6	120	10	56
B	7	120	10	80	2	120
C	10	80	12	80	6	60
D	4	50	5	60	12	24
E	8	70	8	80	12	36

- 4.45:- Construct the following index numbers for 1950 and 1951 from the following data. (i) Laspeyre's index (ii) Paasche's index (iii) Fisher's ideal index.

Commodity	Price (Rs. per md)			Quantity (Tons)		
	1946	1950	1951	1946	1950	1951
A	64	75	80	270	276	290
B	40	45	41	124	118	144
C	18	21	20	130	121	137
D	58	68	56	185	167	355

- 4.46:- Compute consumer price index number for 1940 on the base of 1939 from the following data using.

Commodity	Quantity Consumed in 1939	Unit of Price	Price in 1939	Price in 1940
Rice	6 mds	Rs. Per md	5.75	6.00
Wheat	6 mds	Rs. Per md	5.00	8.00
Gram	1 mds	Rs. Per md	6.00	9.00
Sugar	1 mds	Rs. Per md	20.00	15.00
Arhar	6 mds	Rs. Per md	8.00	10.00
Ghee	4 seers	Per seer	2.00	1.50

- 4.47:- The following table gives the average annual prices of 8 commodities for the year 1956 and 1962. Compute cost of living index numbers for 1962 on the basis of 1956 using (i) Aggregate expenditure method (ii) Family budget method.

Commodity	Quantity Consumed	Unit of Price	Price in 1956	Price in 1962
Wheat	20 seers	Rs. per md	12	15
Rice	8 seers	Rs. per md	40	45
Sugar	2 seers	Rs. per md	40	50
Ghee	1 seers	Rs. per md	110	120
Milk	25 seers	Per seer	0.50	0.75
Vegetable	16 seers	Per seer	0.25	0.50
Mutton	5 seers	Per seer	3.00	4.00
Fuel	4 md	Per md	2.50	3.00

ANSWERS EXERCISE NO. 4

- 4.3:- (a) 100, 93.33, 126.67, 140, 160, 153.33, 166.67, 146.67, 173.33
(b) 65.22, 60.86, 82.61, 91.30, 104.35, 100, 108.7, 95.65, 113.04
- 4.4:- (i) 100, 90, 115, 120, 125, 135, 140, 150, 160, 165
(ii) 90.90, 81.82, 104.54, 109.09, 113.64, 122.73, 127.37, 136.36, 145.45, 150
(iii) 76.92, 69.23, 92.46, 96.20, 96.15, 103.85, 107.69, 115.38, 123.07, 126.92
- 4.5:- 100, 94.69, 97.96, 111.84, 121.63, 128.0, 132.24, 121.63, 131.1, 124.98
- 4.6:- (a) 100, 125, 150, 175, 200, 250, 225, 250, 275
(b) 40, 50, 60, 70, 80, 100, 90, 100, 110
- 4.7:- 100, 101.7, 96.7, 100, 100, 114.2, 113.3, 124.2, 130, 114.2, 135, 124.2, 133.3, 133.3
- 4.8:- (i) 100, 111.11, 122.22, 133.33, 155.56, 144.44, 166.67, 211.11, 200
(ii) 66.94, 74.38, 81.82, 89.26, 104.14, 96.69, 111.5, 110.09, 141.33, 133.89
- 4.9:- 75, 83.93, 85.71, 91.07, 92.86, 100, 100, 112.5, 117.86, 128.57, 142.86
- 4.10:- (a) 112.5, 65, 112.5, 137.5, 125, 162.5, 175, 200
(b) 81.82, 54.54, 81.82, 100, 90.91, 118.19, 127.27, 145.45
- 4.11:- (i) 100, 107.54, 122.56, 108.20, 102.29, 108.31
(ii) 100, 107.54, 131.80, 142.60, 145.87, 157.99
- 4.12:- 100, 86.10, 79.69, 75.94, 66.85, 68.99, 71.13
- 4.13:- 100, 106.67, 133.34, 143.34, 146.68, 160.01
- 4.14:- (i) 100, 111.11, 122.22, 133.33, 157.78, 144.44, 166.67
(ii) 74.82, 83.13, 91.45, 99.76, 118.05, 108.08, 124.70
- 4.15:- (i) 100, 110.77, 115.38, 123.08, 130.77, 126.15
(ii) 91.98, 101.88, 106.13, 113.20, 120.28, 116.03
- 4.16:- (i) Price Relatives: 100, 102, 105, 106, 110
(ii) Link Relatives: 100, 102, 102.97, 100.95, 103.77
- 4.17:- 90.91, 94.55, 100, 103.64, 112.73, 130.91, 132.73, 136.36, 129.09, 127.27
- 4.18:- (i) 100, 90, 115, 120, 125, 135, 140, 150, 160, 165
(ii) 90.9, 81.8, 104.5, 109.1, 113.6, 122.7, 127.3, 136.4, 145.5, 150
(iii) 76.9, 69.2, 88.5, 92.3, 96.2, 103.8, 107.7, 115.4, 123.1, 126.9
(iv) 100, 90, 114.93, 119.87, 124.87, 134.49, 139.47, 149.43, 159.94, 164.95
- 4.19:- (a) 100, 100, 101, 104.7, 108.9, 110.6
(b) 100, 100, 101, 104.68, 108.87, 110.55
- 4.20:- 100, 104.2, 116.70, 120.90, 129.24, 137.76, 146.16, 175.39, 212.92, 267.21, 238.04
- 4.21:- 100, 106.9, 110.35, 114.67, 115.53, 118.98, 115.53, 120.71
- 4.22:- 100, 122.22, 111.11, 144.44, 161.11, 177.77, 199.99

- 4.23:- 100, 112.5, 119.81, 124.84, 129.83, 134.76, 139.75, 149.67
- 4.24:- 100, 108.6, 115.4, 124.3, 130
- 4.25:- (i) 100, 115.1, 125.8, 135.1
(ii) 100, 116.7, 126.8, 134.5
- 4.26:- 100, 91.6, 82.1, 81.7, 110.7, 113.4
- 4.27:- (a) (i) 100, 111.42, 121.75, 139.33, 153.09
(ii) 100, 111.83, 121.53, 136.19, 144.65
(b) 100, 111.37, 121.66, 139.48, 152.05
- 4.28:- 100, 125.29, 163.5, 205.26
- 4.29:- 100, 110, 117, 116, 126
- 4.30:- (a) 100, 107, 139, 136, 144
(b) 100, 110.6, 132.8, 144.6, 147
- 4.31:- 100, 87.66, 127.72, 128.56, 99.8
- 4.32:- (i) 100, 124, 142, 178
(ii) 100, 125, 155.13, 193.91
(iii) 100, 123.7, 139.4, 175.2
- 4.33:- 100, 108.37, 133.38, 136.84, 109.70, 107.54
- 4.34:- 100, 101.01, 100.42, 108.9, 109.87, 120.66, 108.22, 123.60
- 2.35:- Laspeyre's = 254.9 Paasche's Index = 252.19
Fisher's Index = 253.54 Marshall Index = 253.47
- 4.36:- $P_{01} = 179.31$
- 4.37:- $P_{01} = 211.66$
- 4.38:- Laspeyre's = 107.07 Paasche's Index - 108.5
Fisher's Index - 107.8 Marshall Index - 107.6
- 4.39:- Laspeyre's = 400 Paasche's Index = 400
Fisher's Index = 400
- 4.40:- Laspeyre = 116.08 Paasche = 115.56 Fisher = 115.82
- 4.41:- Laspeyre = 90.05 Paasche = 89.71 Fisher = 89.88
- 4.42:- Laspeyre = 106.23 Paasche = 106.35 Fisher = 109.09
- 4.43:- Laspeyre = 400, 316.67, Paasche = 400, 275, Fisher = 400, 295
- 4.44:- (i) $P_{01} = 123.10$, $P_{02} = 108.96$
(ii) $P_{01} = 120.92$, $P_{02} = 119.66$
(iii) $P_{01} = 121.93$, $P_{02} = 114.18$
(iv) $P_{01} = 121.95$, $P_{02} = 112.45$
- 4.45:- (i) $P_{01} = 116.5$ $P_{02} = 112.3$ (ii) $P_{01} = 116.6$ $P_{02} = 109.2$
(iii) $P_{01} = 116.5$ $P_{02} = 110.7$
- 4.46:- $P_{01} = 118.8$
 $P_{01} = 118.8$
- 4.47:- $P_{01} = 136$
 $P_{01} = 136$

4

INDEX NUMBERS

QUESTION NO. 1

Possible answers are given to each statement. Tick (✓) the correct one.

S#	Questions	Answers			
1)	In chain base method the base year is	Variable	Fixed	Both variable & fixed	None of these
		(Faisalabad Board, 2008)			
2)	If $\Sigma P_1 q_0 = 403$, $\Sigma P_0 q_0 = 283$, then IN is	152.40	130.40	122.4	142.4
		(Faisalabad Board, 2008)			
3)	Index number are called the barometers of	Statistics	Economics	Mathematics	None of these
		(Lahore Board, 2008; Faisalabad Board, 2009)			
4)	Index number for base period is	100	Always 100	Never 100	None of these
		(Lahore Board, 2008; Gujranwala Board, 2009)			
5)	Price relative is percentage ratio of current year price and	Base year price	Base year quantity	Preceding year price	None of these
		(Lahore Base 2008)			
6)	For averaging the relatives, we never use	A.M.	G.M.	Median	Mode
		(Lahore Board, 2008)			
7)	Link relative are used in	Fixed base method	Chain base method	Both fixed and chain	None of these
		(Gujranwala Board, 2009)			
8)	Index number for base period is	100	One	Fix	None of these
		(Faisalabad & Lahore Boards, 2009)			
9)	In chain base method, the base period is	Fixed	Constant	Not fixed	Zero
		(Lahore Board, 2009)			

S#	Questions	Answers			
10)	The most suitable average, in connection with index number	A.M.	Median	Mode	G.M.
	(Lahore Board, 2009)				
11)	Laspeyre's index number is also called	Base year weight	Current year weight	Ideal index number	None of these
	(Lahore Board, 2009; Faisalabad Board, 2010)				
12)	Index number for base period is	100	200	150	50
	(Faisalabad Board, 2010)				
13)	Current year weighted index number is also called	Paache's	Marshall's	Fisher's	Laspyre's
	(Lahore Board, 2010)				
14)	In chain base method the base year is	Fixed year	Next year	Previous year	Same year
	(Lahore Board, 2010)				
15)	In chain base method the base period is	Fixed	Changed	Constant	None of these
	(Lahore Board, 2010)				
16)	$\frac{P_n}{P_0} \times 100$ is equal to	Link relative	Chain indices	Price relative	None of these
	(Lahore Board, 2010)				
17)	Which is considered to be the most suitable average for computing index number?	Median	Mean	Mode	None
	(Gujranwala Board, 2010)				
18)	Fisher's index number is	$\sqrt{\frac{P}{L}}$	$\sqrt{\frac{L}{P}}$	$\sqrt{L \times P}$	None of these
	(Gujranwala Board, 2010)				

S#	Questions	Answers			
19)	Index numbers are called	Statistical barometer	Economic barometer	Mathematical barometer	Physical barometer
(Rawalpindi Board, 2010)					
20)	In fixed base method the base period should be	For away	Abnormal	Normal	Unreliable
(Rawalpindi Board, 2010)					
21)	Price index number calculate changes is	Price	Quantity	Price and quantity	None of these
(Sargodha Board, 2010)					

QUESTION NO. 2

Possible answers are given to each statement. Tick (✓) the correct one.

S#	Questions	Answers			
1)	Index number are divided into two types:	Price and quantity index numbers	Simple and composite index numbers	Weighted and un-weighted index number	None of these
2)	An index number is called a simple index number when it deal with:	Single variable	Two variables	More than two variables	None of these
3)	If all the values of equal importance, the index numbers are called:	Un-weighted	Weighted	Composite	None of these
4)	An index number, which indicates a relative change in a single variable with respect to a base, is called:	Weighted index number	Composite index number	Simple index number	None of these
5)	The most suitable average in connection with index numbers is:	Arithmetic mean	Median	Geometric mean	H.M.
6)	Price relative is the percentage ratio of current year price and:	Base year price	Preceding year price	Both base & current	None of these

S#	Questions	Answers			
7)	Link relative is the percentage ratio of current year price and:	Base year price	Preceding year price	Both base & preceding year price	None of these
8)	An index number constructed to measure the relative changes in price of a commodity or a group of commodities are:	Price index numbers	Quantity index numbers	Consumer's index numbers	All of these
9)	Index number constructed to measure the relative change in quantity or volume are:	Price index numbers	Quantity index numbers	Consumer's index numbers	Laspeyre Index number
10)	In aggregative index numbers we use:	Only price	Only quantity	Both price and quantity	None of these
11)	When all the values are not of equal importance, we assign certain values and index numbers are called:	Weighted index numbers	Un-weighted index numbers	Simple index number	Composite index number
12)	Index number for base period is always taken:	100	200	300	400
13)	The prices of wheat are to be compared by:	Quantity index numbers	Aggregative index numbers	Price index numbers	None of these
14)	Import and export of Pakistan is an example of:	Composite index number	Whole sale price index number	Simple index number	None of these
15)	In chain base method, the base period is:	Fixed	Not fixed	Constant	Zero
16)	Other name of consumer's price index number is:	Cost of living index number	Whole sale price index number	Composite index number	Simple index number
17)	Index numbers are called:	Statistical barometer	Mathematical barometer	Economic barometer	All of these
18)	A normal year should be free from:	War	Floods	Strikes	All of the above

S#	Questions	Answers			
19)	The formula used in fixed base method is:	$\frac{P_n}{P_0} \times 100$	$\frac{P_{n-1}}{P_n} \times 100$	$\frac{P_n}{P_{n-1}} \times 100$	$\frac{P_n - 1}{P_0}$
20)	The formula used in chain base method is:	$\frac{P_n}{P_0} \times 100$	$\frac{P_{n-1}}{P_n} \times 100$	$\frac{P_n}{P_{n-1}} \times 100$	$\frac{P_n - 1}{P_0}$
21)	If a price of current year is divided by the price of a fixed particular year, the result will be:	Link relative	Chain relative	Simple relative	All of the above
22)	Price relatives computed by chain base method is called:	Price relatives	Chain indices	Link relative	Non of them
23)	Consumer price index numbers are obtained by:	Laspeyre's formula	Paache's formula	Fisher's formula	Marshal formula
24)	Consumer price index numbers are obtained by:	Laspeyre's formula	Family budget method formula	Both Laspeyre & Family budget method	None of these
25)	Aggregative expenditure method and family budget method always give:	Same results	Different results	Approximate results	Zero results
26)	Laspeyre's index number is also called:	Base year weighted index number	Current year weighted index number	Ideal index numbers	All of the above
27)	Paache's index number is also called:	Base year weighted index number	Current year weighted index number	Ideal index number	Non of the above
28)	Laspeyre's and Paache's index number are:	Simple index numbers	Weighted index numbers	Composite index number	All of these
29)	Current year quantities are used as weighted in:	Laspeyre's index number	Paache's index number	Composite index number	None of these
30)	Which one is the ideal index number	Laspeyre's index number	Paache's index number	Marshall Edgeworth index number	Fisher's index number

S#	Questions	Answers			
31)	Fisher's ideal index number is also obtained by:	Calculating A.M. of Laspeyre's and Paache's index number	Calculating G.M. of Laspeyre's and Paache's index number	Median of Laspeyre's and Paache's index number	None of these

QUESTION NO. 3

Write the short answer to the following questions in the space provided

Q. 1: Define an index numbers.

(Lahore Board, 2008 & 2010)

(Rawalpindi Board, 2010;

Sargodha Board, 2010)

Ans: An index number is a series of numbers which measures relative change in a variable or a group of variables with respect to time or space.

Q. 2: Define price index number.

(Lahore Board, 2008 & 2010)

Ans: An index number, which measure the relative change in the price of a commodity or an average relative change in the price of group of commodities with respect to a base is called price index number.

Q. 3: What is the purpose of index number?

(Gujranwala Board, 2010)

Ans: Index number is a statistical measure designed to show changes in a variable or a group of related variables for the purpose of comparison.

Q. 4: Define simple index number.

Ans: An index number is called simple index number if it measure a relative change in a single variable with respect to a base.

Q. 5: Give two examples of simple index number.

Ans: Index number for wages of employees, index number of sugar prices.

Q. 6: Define composite price index number.

(Lahore Board, 2008)

(Faisalabad Board, 2010)

Ans: An index number, which indicates an average relative change in the prices of a group of related commodities with respect to a base.

Q. 7: What are the types of index number as regard to base?

Ans: These are two types of index number.

(i) Fixed base index

(ii) Chain base index

Q. 8: Define fixed base method.

(Lahore Board, 2009)

(Gujranwala & Sargodha Boards, 2010)

Ans: In fixed base method, the base period remains fixed from time to time. The formula for fixed base method is as

$$P_{0n} = \frac{P_n}{P_0} \times 100$$

Where P_n = Current year price &
 P_0 = Base year price

Q. 9: Define chain base method.

(Lahore Board, 2008)

(Rawalpindi Board, 2010)

Ans: In chain base method base period does not remain fixed but price (quantity) of each year is compared with preceding year. The formula for chain base method is as:

$$P_{0n} = \frac{P_n}{P_{n-1}} \times 100$$

Where P_n = Current year price &
 P_{n-1} = Preceding year price to current year price

Q. 10: What is price relative? Also give its formula.

(Lahore Board, 2010)

Ans: Price relative is the percentage ratio of the price in current year and the price in a base year.

$$P_{0n} = \frac{P_n}{P_0} \times 100$$

Q. 11: Define link relative.

(Faisalabad & Lahore Boards, 2008 & 2010)

Ans: Link relative is the percentage ratio of the price in current year and the price in the preceding year.

Q. 12: What are the various methods of averaging that can be used in constructing index numbers?

Ans: Following methods are used:

- (i) Arithmetic mean
- (ii) Median
- (iii) Geometric mean

Q. 13: What average is considered to be the most suitable in connection with index number?

Ans: Geometric mean is the most suitable average for measuring the average ratio of change in prices, but arithmetic mean is mostly used.

Q. 14: What is weighted aggregative price index number?

(Faisalabad Board, 2009)

(Lahore Board, 2008 & 2010)

(Rawalpindi Board, 2010)

Ans: An index number that measures the change in the prices (or quantities) of a group of commodities when the relative importance of commodities has been taken into account is called weighted aggregative index number.

Q. 15: What are the important weighted aggregative price index number?

(Faisalabad Board, 2008)

- Ans:** (i) Laspeyre's index number
(ii) Paache's index number
(iii) Fisher's ideal index number
(iv) Marshall Edgeworth index number

Q. 16: What is the base year weighted index number?

(Faisalabad Board, 2010)

Ans: Laspeyre's index number is called base year weighted index number.

$$P_{0n} = \frac{\sum P_n q_0}{\sum P_0 q_0} \times 100$$

Q. 17: What is the current year weighted index number?

(Sargodha Board, 2010)

Ans: Paache's index number is called current year weighted index number.

$$P_{0n} = \frac{\sum P_n q_n}{\sum P_0 q_n} \times 100$$

Q. 18: Write the name of '3' types of index number OR describe the main types of index number.

(Lahore Board, 2008 & 2010)

Ans: Following are the three types of index number.

- (i) Prince Index Number (ii) Quantity Index Number
(iii) Value Index Number

Q. 19: What is quantity index number?

(Lahore Board, 2008)

Ans: An index number which measures the change in the quantity of goods produced, or goods exported or imported or goods consumed is called quantity index number.

Q. 20: Define a Laspeyre's index number.

(Lahore Board, 2009)

Ans: An index number in which base year prices / quantities are used as weight is called Laspeyre's index number.

$$P_{0n} = \frac{\sum P_n q_0}{\sum P_0 q_0} \times 100 \quad \text{OR} \quad Q_{0n} = \frac{\sum P_n q_0}{\sum P_0 q_0} \times 100$$

Q. 21: Give Marshall index number formula (Lahore Board, 2010)

Ans: The formula for Marshall index number is given below:

$$P_{0n} = \frac{\sum P_n q_0 + \sum P_n q_n}{\sum P_0 q_0 + \sum P_0 q_n} \times 100$$

Q. 22: Why Fisher's index number is called an ideal index number?

Ans: Fisher's index number is called ideal because it confirms to certain tests of consistent that is time reversal test and factor reversal test.

Q. 23: Define Fisher's ideal index number.

(Faisalabad Board, 2009)

Ans: It is the geometric mean of the Laspeyre's and Paache's index number.

$$P_{0n} = \sqrt{L \times P} = \sqrt{\frac{\sum P_n q_0}{\sum P_0 q_0} \times \frac{\sum P_n q_n}{\sum P_0 q_n}} \times 100$$

Q. 24: For what does C.P.I. stand for?

Ans: C.P.I. stand for consumer price index number.

Q. 25: Define consumer's price index number.

(Lahore Board, 2009)

Ans: Index number which measures the changes in prices of a specified basket of goods and services consumed in the given period relative to the base period.

Q. 26: What do you mean by 'basket' of goods?

Ans: The basket of goods and services contains:

- | | |
|-----------------|-----------------|
| (i) Food | (ii) Clothing |
| (iii) Education | (iv) House rent |
| (v) Misc. etc. | |

Q. 27: What are the other names of consumer's price index number?

Ans: Consumer's price index number is also called cost of living index number, retail price index number.

Q. 28: How we calculate consumer's index number?

Ans: We calculate the consumer's index number by the following two methods.

(a) Aggregate expenditure method

$$P_{0n} = \frac{\sum P_n q_0}{\sum P_0 q_0} \times 100$$

(b) Family budget method

$$P_{0n} = \frac{\sum (W \times I)}{\sum W}$$

Q. 29: Give three uses of index number.

(Faisalabad Board, 2008)

- Ans:**
- Index number are used as economic barometers.
 - Index numbers are used in forecasting
 - Several economic and business policies are guided by index number.

Q. 30: Write two limitations of index number.

(Faisalabad Board, 2009)

(Lahore Board, 2010)

- Ans:**
- All index numbers are not used for all purposes.
 - If a wrong base year is selected the results will be misleading.

Q. 31: What is the base period?

(Lahore & Rawalpindi Boards, 2010)

Ans: The period with which prices of other periods to be compared is called the base period.

Q. 32: Laspeyre's index number = 120, Fisher index = 115. Find Paache's index number.

(Gujranwala Board, 2010)

Ans:

$$\text{Fisher's Index Number} = \sqrt{\text{Laspeyre} \times \text{Paache}}$$

$$115 = \sqrt{120 \times \text{Paache's Index Number}}$$

Taking square of both sides

$$120 \times \text{Paache's} = (115)^2 = 13225$$

$$\text{Paache's} = \frac{13225}{120} = 110.21$$

Q. 33: If Laspeyre's price index number is 119.89 and Paache's index number is 119.65. Find Fisher's ideal index .

(Faisalabad Board, 2010)

Ans: Laspeyre Index Number = 119.89

Paache's Index Number = 119.65

We know that

$$\text{Fisher's Index Number} = \sqrt{\text{Laspeyre} \times \text{Paache}}$$

$$= \sqrt{119.89 \times 119.65} = \sqrt{14344.8385} = 119.77$$

ANSWERS

QUESTION NO. 1

- | | |
|-------------------------|-------------------------|
| 1) Variable | 2) 142.4 |
| 3) Economics | 4) Always 100 |
| 5) Base year price | 6) Mode |
| 7) Chain base method | 8) 100 |
| 9) Not fixed | 10) G.M. |
| 11) Base year weight | 12) 100 |
| 13) Paache's | 14) Previous year |
| 15) Changed | 16) Price relative |
| 17) None | 18) $\sqrt{L \times P}$ |
| 19) Economics barometer | 20) Normal |
| 21) Price and quantity | |

QUESTION NO. 2

- | | |
|---|----------------------------------|
| 1) Simple and composite index number | 3) Un-weighted |
| 2) Single variable | 5) Geometric mean |
| 4) Simple index number | 7) Preceding year price |
| 6) Base year price | 9) Quantity index numbers |
| 8) Price index numbers | 11) Weighted index numbers |
| 10) Both price and quantity | 13) Price index numbers |
| 12) 100 | 15) Not fixed |
| 14) Composite index number | 17) Economic barometer |
| 16) Cost of living index number | 19) $\frac{P_n}{P_0} \times 100$ |
| 18) All of the above | 21) Simple relative |
| 20) $\frac{P_n}{P_{n-1}} \times 100$ | 23) Laspeyre's formula |
| 22) Link relatives | 25) Same |
| 24) Both Laspeyre and family business method results | |
| 26) Base year weighted index number | |
| 27) Current year weighted index number | |
| 28) Weighted index numbers | 29) Paache's index numbers |
| 30) Fisher's index number | |
| 31) Calculating G.M. of Laspeyre's & Paache's index numbers | |

www.Perfect24u.com