CHAPTER 18

INDEX NUMBERS

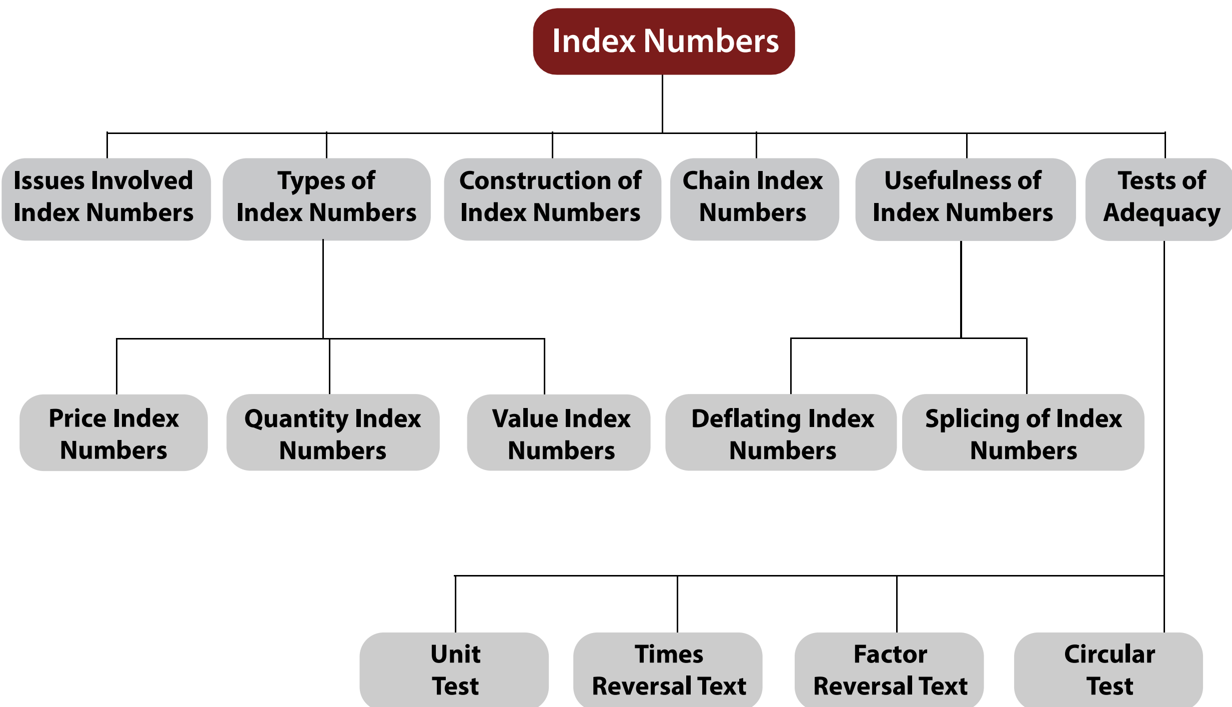
LEARNING OBJECTIVES

Often we encounter news of price rise, GDP growth, production growth, etc. It is important for students of Chartered Accountancy to learn techniques of measuring growth/rise or decline of various economic and business data and how to report them objectively.

After reading the chapter, students will be able to understand:

- Purpose of constructing index number and its important applications in understanding rise or decline of production, prices, etc.
- Different methods of computing index number.

CHAPTER OVERVIEW



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18.1 INTRODUCTION

Index numbers are convenient devices for measuring relative changes of differences from time to time or from place to place. Just as the arithmetic mean is used to represent a set of values, an index number is used to represent a set of values over two or more different periods or localities.

The basic device used in all methods of index number construction is to average the relative change in either quantities or prices since relatives are comparable and can be added even though the data from which they were derived cannot themselves be added. For example, if wheat production has gone up to 110% of the previous year's producton and cotton production has gone up to 105%, it is possible to average the two percentages as they have gone up by 107.5%. This assumes that both have equal weight; but if wheat production is twice as important as cotton, percentage should be weighted 2 and 1. The average relatives obtained through this process are called the index numbers.

Definition: An index number is a ratio of two or more time periods are involved, one of which is the base time period. The value at the base time period serves as the standard point of comparison.

Example: NSE, BSE, WPI, CPI etc.

An index time series is a list of index numbers for two or more periods of time, where each index number employs the same base year.

Relatives are derived because absolute numbers measured in some appropriate unit, are often of little importance and meaningless in themselves. If the meaning of a relative figure remains ambiguous, it is necessary to know the absolute as well as the relative number.

Our discussion of index numbers is confined to various types of index numbers, their uses, the mathematical tests and the principles involved in the construction of index numbers.

Index numbers are studied here because some techniques for making forecasts or inferences about the figures are applied in terms of index number. In regression analysis, either the independent or dependent variable or both may be in the form of index numbers. They are less unwieldy than large numbers and are readily understandable.

These are of two broad types: simple and composite. The simple index is computed for one variable whereas the composite is calculated from two or more variables. Most index numbers are composite in nature.

18.2 ISSUES INVOLVED

Following are some of the important criteria/problems which have to be faced in the construction of index Numbers.

Selection of data: It is important to understand the purpose for which the index is used. If it is used for purposes of knowing the cost of living, there is no need of including the prices of capital goods which do not directly influence the living.

Index numbers are often constructed from the sample. It is necessary to ensure that it is representative. Random sampling, and if need be, a stratified random sampling can ensure this.

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It is also necessary to ensure comparability of data. This can be ensured by consistency in the method of selection of the units for compilation of index numbers.

However, difficulties arise in the selection of commodities because the relative importance of commodities keep on changing with the advancement of the society. More so, if the period is quite long, these changes are quite significant both in the basket of production and the uses made by people.

Base Period: It should be carefully selected because it is a point of reference in comparing various data describing individual behaviour. The period should be normal i.e., one of the relative stability, not affected by extraordinary events like war, famine, etc. It should be relatively recent because we are more concerned with the changes with reference to the present and not with the distant past. There are three variants of the base fixed, chain, and the average.

Selection of Weights: It is necessary to point out that each variable involved in composite index should have a reasonable influence on the index, i.e., due consideration should be given to the relative importance of each variable which relates to the purpose for which the index is to be used. For example, in the computation of cost of living index, sugar cannot be given the same importance as the cereals.

Use of Averages: Since we have to arrive at a single index number summarising a large amount of information, it is easy to realise that average plays an important role in computing index numbers. The geometric mean is better in averaging relatives, but for most of the indices arithmetic mean is used because of its simplicity.

Choice of Variables: Index numbers are constructed with regard to price or quantity or any other measure. We have to decide about the unit. For example, in price index numbers it is necessary to decide whether to have wholesale or the retail prices. The choice would depend on the purpose. Further, it is necessary to decide about the period to which such prices will be related. There may be an average of price for certain time-period or the end of the period. The former is normally preferred.

Selection of Formula: The question of selection of an appropriate formula arises, since different types of indices give different values when applied to the same data. We will see different types of indices to be used for construction succeedingly.

18.3 CONSTRUCTION OF INDEX NUMBER

Notations: It is customary to let $P_n(^1)$, $P_n(^2)$, $P_n(^3)$ denote the prices during n^{th} period for the first, second and third commodity. The corresponding price during a base period are denoted by $P_o(^1)$, $P_o(^2)$, $P_o(^3)$, etc. With these notations the price of commodity j during period n can be indicated by $P_n(^j)$. We can use the summation notation by summing over the superscripts j as follows:

$$\sum_{j=1}^{k} P_n(j) \quad \text{or} \quad \sum P_n(j)$$

We can omit the superscript altogether and write as ΣP_n etc.

Relatives: One of the simplest examples of an index number is a price relative, which is the ratio of the price of single commodity in a given period to its price in another period called the base period or the reference period. It can be indicated as follows:

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$$\text{Price relative} = \frac{P_n}{P_o}$$

It has to be expressed as a percentage, it is multiplied by 100

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

There can be other relatives such as of quantities, volume of consumption, exports, etc. The relatives in that case will be:

$$\text{Quantity relative} = \frac{Q_n}{Q_o}$$

Similarly, there are value relatives:

$$\text{Value relative} = \frac{V_n}{V_o} = \frac{P_n Q_n}{P_o Q_o} = \left(\frac{P_n}{P_o} \times \frac{Q_n}{Q_o}\right)$$

When successive prices or quantities are taken, the relatives are called the link relative,

$$\frac{P_1}{P_o}, \frac{P_2}{P_1}, \frac{P_3}{P_2}, \frac{P_n}{P_{n-1}}$$

When the above relatives are in respect to a fixed base period these are also called the chain relatives with respect to this base or the relatives chained to the fixed base. They are in the form of :

$$\frac{P_1}{P_o}, \frac{P_2}{P_o}, \frac{P_3}{P_o}, \frac{P_n}{P_o}$$

Methods: We can state the broad heads as follows:

- Methods
  - Simple
    - Aggregative
    - Relative
  - Weighted
    - Aggregative
    - Relative

18.3.1 SIMPLE AGGREGATIVE METHOD

In this method of computing a price index, we express the total of commodity prices in a given year as a percentage of total commodity price in the base year. In symbols, we have

$$\text{Simple aggregative price index} = \frac{\Sigma P_n}{\Sigma P_o} \times 100$$

where ΣP_n is the sum of all commodity prices in the current year and ΣP_o is the sum of all commodity prices in the base year.

ILLUSTRATIONS:

Commodities	1998	1999	2000
Cheese (per 100 gms)	12.00	15.00	15.60
Egg (per piece)	3.00	3.60	3.30
Potato (per kg)	5.00	6.00	5.70
Aggregrate	20.00	24.60	24.60
Index	100	123	123

Simple Aggregative Index for 1999 over 1998 = $\frac{\Sigma P_n}{\Sigma P_o} = \frac{24.60}{20.00} \times 100 = 123$

and for 2000 over 1998 = $\frac{\Sigma P_n}{\Sigma P_o} \times 100 = \frac{24.60}{20.00} \times 100 = 123$

The above method is easy to understand but it has a serious defect. It shows that the first commodity exerts greater influence than the other two because the price of the first commodity is higher than that of the other two. Further, if units are changed then the Index numbers will also change. Students should independently calculate the Index number taking the price of eggs per dozen i.e., ₹ 36, ₹ 43.20, ₹ 39.60 for the three years respectively. This is the major flaw in using absolute quantities and not the relatives. Such price quotations become the concealed weights which have no logical significance.

18.3.2 SIMPLE AVERAGE OF RELATIVES

One way to rectify the drawbacks of a simple aggregative index is to construct a simple average of relatives. Under it we invert the actual price for each variable into percentage of the base period. These percentages are called relatives because they are relative to the value for the base period. The index number is the average of all such relatives. One big advantage of price relatives is that they are pure numbers. Price index number computed from relatives will remain the same regardless of the units by which the prices are quoted. This method thus meets criterion of unit test (discussed later). Also quantity index can be constructed for a group of variables that are expressed in divergent units.

ILLUSTRATIONS:

In the proceeding example we will calculate relatives as follows:

Commodities	1998	1999	2000
A	100.0	125.0	130.0
B	100.0	120.0	110.0
C	100.0	120.0	114.0
Aggregate	300.0	365.0	354.0
Index	100.0	121.67	118.0

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Inspite of some improvement, the above method has a flaw that it gives equal importance to each of the relatives. This amounts to giving undue weight to a commodity which is used in a small quantity because the relatives which have no regard to the absolute quantity will give weight more than what is due from the quantity used. This defect can be remedied by the introduction of an appropriate weighing system.

18.3.3 WEIGHTED METHOD

To meet the weakness of the simple or unweighted methods, we weigh the price of each commodity by a suitable factor often taken as the quantity or the volume of the commodity sold during the base year or some typical year. These indices can be classfied into broad groups:

(i) Weighted Aggregative Index.

(ii) Weighted Average of Relatives.

(i) Weighted Aggregative Index: Under this method we weigh the price of each commodity by a suitable factor often taken as the quantity or value weight sold during the base year or the given year or an average of some years. The choice of one or the other will depend on the importance we want to give to a period besides the quantity used. The indices are usually calculated in percentages. The various alternatives formulae in use are:

(The example has been given after the tests).

(a) Laspeyres' Index: In this Index base year quantities are used as weights:

$$\text{Laspeyres Index} = \frac{\Sigma P_n Q_0}{\Sigma P_0 Q_0} \times 100$$

(b) Paasche's Index: In this Index current year quantities are used as weights:

$$\text{Passche's Index} = \frac{\Sigma P_n Q_n}{\Sigma P_o Q_n} \times 100$$

(c) Methods based on some typical Period:

Index $\frac{\Sigma P_n Q_t}{\Sigma P_o Q_t} \times 100$ the subscript t stands for some typical period of years, the quantities of which are used as weight

Note: * Indices are usually calculated as percentages using the given formulae

The Marshall-Edgeworth index uses this method by taking the average of the base year and the current year

$$\text{Marshall-Edgeworth Index} = \frac{\Sigma P_n (Q_o + Q_n)}{\Sigma P_o (Q_o + Q_n)} \times 100$$

(d) Fisher's ideal Price Index: This index is the geometric mean of Laspeyres' and Paasche's.

$$\text{Fisher's Index} = \sqrt{\frac{\Sigma P_n Q_o}{\Sigma P_o Q_o} \times \frac{\Sigma P_n Q_n}{\Sigma P_o Q_n}} \times 100$$

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(ii) **Weighted Average of Relative Method:** To overcome the disadvantage of a simple average of relative method, we can use weighted average of relative method. Generally weighted arithmetic mean is used although the weighted geometric mean can also be used. The weighted arithmetic mean of price relatives using base year value weights is represented by

$$\frac{\Sigma \frac{P_n}{P_o} \times (P_oQ_o)}{\Sigma P_oQ_o} \times 100 = \frac{\Sigma P_nQ_o}{\Sigma P_oQ_o} \times 100$$

Example:

		Price Relatives			*Value Weights*	*Weighted Price Relatives*	
Commodity	Q.	1998	1999	2000	1998	1999	2000
		$\frac{P_n}{P_0}$	$\frac{P_n}{P_0}$	$\frac{P_n}{P_0}$	P_0Q_0	$\frac{P_n}{P_0}P_0Q_0$	$\frac{P_n}{P_0}P_0Q_0$
Butter	0.7239	100	101.1	118.7	72.39	73.19	85.93
Milk	0.2711	100	101.7	126.7	27.11	27.57	34.35
Eggs	0.7703	100	100.9	117.8	77.03	77.72	90.74
Fruits	4.6077	100	96.0	114.7	460.77	442.34	528.50
Vegetables	1.9500	100	84.0	93.6	195.00	163.80	182.52
					832.30	784.62	922.04

Weighted Price Relative

For 1999 : $\frac{784.62}{832.30} \times 100 = 94.3$

For 2000 : $\frac{922.04}{832.30} \times 100 = 110.8$

18.3.4 THE CHAIN INDEX NUMBERS

So far we concentrated on a fixed base but it does not suit when conditions change quite fast. In such a case the changing base for example, 1998 for 1999, and 1999 for 2000, and so on, may be more suitable. If, however, it is desired to associate these relatives to a common base the results may be chained. Thus, under this method the relatives of each year are first related to the preceding year called the link relatives and then they are chained together by successive multiplication to form a chain index.

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The formula is:

$$\text{Chain Index} = \frac{\text{Link relative of current year} \times \text{Chain Index of the previous year}}{100}$$

Example:

The following are the index numbers by a chain base method:

Year (1)	*Price* (2)	*Link Relatives* (3)	*Chain Indices* (4)
1991	50	100	100
1992	60	$\frac{60}{50} \times 100 = 120.0$	$\frac{120}{100} \times 100 = 120.0$
1993	62	$\frac{62}{60} \times 100 = 103.3$	$\frac{103.3}{100} \times 120 = 124.0$
1994	65	$\frac{65}{62} \times 100 = 104.8$	$\frac{104.8}{100} \times 124 = 129.9$
1995	70	$\frac{70}{65} \times 100 = 107.7$	$\frac{107.7}{100} \times 129.9 = 139.9$
1996	78	$\frac{78}{70} \times 100 = 111.4$	$\frac{111.4}{100} \times 139.9 = 155.8$
1997	82	$\frac{82}{78} \times 100 = 105.1$	$\frac{105.1}{100} \times 155.8 = 163.7$
1998	84	$\frac{84}{82} \times 100 = 102.4$	$\frac{102.4}{100} \times 163.7 = 167.7$
1999	88	$\frac{88}{84} \times 100 = 104.8$	$\frac{104.8}{100} \times 167.7 = 175.7$
2000	90	$\frac{90}{88} \times 100 = 102.3$	$\frac{102.3}{100} \times 175.7 = 179.7$

You will notice that link relatives reveal annual changes with reference to the previous year. But when they are chained, they change over to a fixed base from which they are chained, which in the above example is the year 1991. The chain index is an unnecessary complication unless of course where data for the whole period are not available or where commodity basket or the weights have to be changed. The link relatives of the current year and chain index from a given base will give also a fixed base index with the given base year as shown in the column 4 above.

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18.3.5 QUANTITY INDEX NUMBERS

To measure and compare prices, we use price index numbers. When we want to measure and compare quantities, we resort to Quantity Index Numbers. Though price indices are widely used to measure the economic strength, Quantity indices are used as indicators of the level of output in economy. To construct Quantity indices, we measure changes in quantities and weight them using prices or values as weights. The various types of Quantity indices are:

1. Simple aggregate of quantities:

   This has the formula $\frac{\Sigma Q_n}{\Sigma Q_o}$

2. The simple average of quantity relatives:

   This can be expressed by the formula $\frac{\frac{\Sigma Q_n}{\Sigma Q_o}}{N}$

3. Weighted aggregate Quantity indices:

   (i) With base year weight : $\frac{\Sigma Q_n P_o}{\Sigma Q_o P_o}$ (Laspeyre's index)

   (ii) With current year weight : $\frac{\Sigma Q_n P_n}{\Sigma Q_o P_n}$ (Paasche's index)

   (iii) Geometric mean of (i) and (ii) : $\sqrt{\frac{\Sigma Q_n P_o}{\Sigma Q_o P_o} \times \frac{\Sigma Q_n P_n}{\Sigma Q_o P_n}}$ (Fisher's Ideal)

4. Base-year weighted average of quantity relatives. This has the formula $\frac{\Sigma\left(\frac{Q_n}{Q_o} P_o Q_o\right)}{\Sigma P_o Q_o}$

Note : Indices are usually calculated as percentages using the given formulae.

18.1.3.6 VALUE INDICES

Value equals price multiplied by quantity. Thus a value index equals the total sum of the values of a given year divided by the sum of the values of the base year, i.e.,

$$\frac{\Sigma V_n}{\Sigma V_o} = \frac{\Sigma P_n Q_n}{\Sigma P_0 Q_0}$$

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18.4 USEFULNESS OF INDEX NUMBERS

So far we have studied various types of index numbers. However, they have certain limitations. They are :

1. As the indices are constructed mostly from deliberate samples, chances of errors creeping in cannot be always avoided.
2. Since index numbers are based on some selected items, they simply depict the broad trend and not the real picture.
3. Since many methods are employed for constructing index numbers, the result gives different values and this at times create confusion.

In spite of its limitations, index numbers are useful in the following areas :

1. Framing suitable policies in economics and business. They provide guidelines to make decisions in measuring intelligence quotients, research etc.
2. They reveal trends and tendencies in making important conclusions in cyclical forces, irregular forces, etc.
3. They are important in forecasting future economic activity. They are used in time series analysis to study long-term trend, seasonal variations and cyclical developments.
4. Index numbers are very useful in deflating i.e., they are used to adjust the original data for price changes and thus transform nominal wages into real wages.
5. Cost of living index numbers measure changes in the cost of living over a given period.

18.5 DEFLATING TIME SERIES USING INDEX NUMBERS

Sometimes a price index is used to measure the real values in economic time series data expressed in monetary units. For example, GNP initially is calculated in current price so that the effect of price changes over a period of time gets reflected in the data collected. Thereafter, to determine how much the physical goods and services have grown over time, the effect of changes in price over different values of GNP is excluded. The real economic growth in terms of constant prices of the base year therefore is determined by deflating GNP values using price index.

Year	*Wholesale Price Index*	*GNP at Current Prices*	*Real GNP*
1970	113.1	7499	6630
1971	116.3	7935	6823
1972	121.2	8657	7143
1973	127.7	9323	7301

The formula for conversion can be stated as

$$\text{Deflated Value} = \frac{\text{Current Value}}{\text{Price Index of the current year}}$$

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$$\text{or Current Value} \times \frac{\text{Base Price } (P_0)}{\text{Current Price } (P_n)}$$

18.6 SHIFTING AND SPLICING OF INDEX NUMBERS

These refer to two technical points: (i) how the base period of the index may be shifted, (ii) how two index covering different bases may be combined into single series by splicing.

Shifted Price Index

Year	*Original Price Index*	*Shifted Price Index to base 1990*
1980	100	71.4
1981	104	74.3
1982	106	75.7
1983	107	76.4
1984	110	78.6
1985	112	80.0
1986	115	82.1
1987	117	83.6
1988	125	89.3
1989	131	93.6
1990	140	100.0
1991	147	105.0

The formula used is,

$$\text{Shifted Price Index} = \frac{\text{Original Price Index}}{\text{Price Index of the year on which it has to be shifted}} \times 100$$

Splicing two sets of price index numbers covering different periods of time is usually required when there is a major change in quantity weights. It may also be necessary on account of a new method of calculation or the inclusion of new commodity in the index.

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Splicing Two Index Number Series

Year	*Old Price Index [1990 = 100]*	*Revised Price Index [1995 = 100]*	*Spliced Price Index [1995 = 100]*
1990	100.0		87.6
1991	102.3		89.6
1992	105.3		92.2
1993	107.6		94.2
1994	111.9		98.0
1995	114.2	100.0	100.0
1996		102.5	102.5
1997		106.4	106.4
1998		108.3	108.3
1999		111.7	111.7
2000		117.8	117.8

You will notice that the old series upto 1994 has to be converted shifting to the base. 1995 i.e, 114.2 to have a continuous series, even when the two parts have different weights

18.7 TEST OF ADEQUACY

There are four tests:

(i) **Unit Test:** This test requires that the formula should be independent of the unit in which or for which prices and quantities are quoted. Except for the simple (unweighted) aggregative index all other formulae satisfy this test.

(ii) **Time Reversal Test:** It is a test to determine whether a given method will work both ways in time, forward and backward. The test provides that the formula for calculating the index number should be such that two ratios, the current on the base and the base on the current should multiply into unity. In other words, the two indices should be reciprocals of each other. Symbolically,

$$P_{01} \times P_{10} = 1$$

where P_{01} is the index for time 1 on 0 and P_{10} is the index for time 0 on 1.

You will notice that Laspeyres' method and Paasche's method do not satisfy this test, but Fisher's Ideal Formula does.

While selecting an appropriate index formula, the Time Reversal Test and the Factor Reversal test are considered necessary in testing the consistency.

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Laspeyres:

$$P_{01} = \frac{\Sigma P_1 Q_0}{\Sigma P_0 Q_0} \quad , \quad P_{10} = \frac{\Sigma P_0 Q_1}{\Sigma P_1 Q_1}$$

$$P_{01} \times P_{10} = \frac{\Sigma P_1 Q_0}{\Sigma P_0 Q_0} \times \frac{\Sigma P_0 Q_1}{\Sigma P_1 Q_1} \neq 1$$

Paasche's

$$P_{01} = \frac{\Sigma P_1 Q_1}{\Sigma P_0 Q_1} \quad , \quad P_{10} = \frac{\Sigma P_0 Q_0}{\Sigma P_1 Q_0}$$

$$\therefore \quad P_{01} \times P_{10} = \frac{\Sigma P_1 Q_1}{\Sigma P_0 Q_1} \times \frac{\Sigma P_0 Q_0}{\Sigma P_1 Q_0} \neq 1$$

Fisher's:

$$P_{01} = \sqrt{\frac{\Sigma P_1 Q_0}{\Sigma P_0 Q_0} \times \frac{\Sigma P_1 Q_1}{\Sigma P_0 Q_1}} \qquad P_{10} = \sqrt{\frac{\Sigma P_0 Q_1}{\Sigma P_1 Q_1} \times \frac{\Sigma P_0 Q_0}{\Sigma P_1 Q_0}}$$

$$\therefore \quad P_{01} \times P_{10} = \sqrt{\frac{\Sigma P_1 Q_0}{\Sigma P_0 Q_0} \times \frac{\Sigma P_1 Q_1}{\Sigma P_0 Q_1} \times \frac{\Sigma P_0 Q_1}{\Sigma P_1 Q_1} \times \frac{\Sigma P_0 Q_0}{\Sigma P_1 Q_0}} = 1$$

(iii) Factor Reversal Test: This holds when the product of price index and the quantity index should be equal to the corresponding value index, i.e., $\frac{\Sigma P_1 Q_1}{\Sigma P_0 Q_0}$

Symbolically: $P_{01} \times Q_{01} = V_{01}$

Fishers'

$$P_{01} = \sqrt{\frac{\Sigma P_1 Q_0}{\Sigma P_0 Q_0} \times \frac{\Sigma P_1 Q_1}{\Sigma P_0 Q_1}} \qquad Q_{01} = \sqrt{\frac{\Sigma Q_1 P_0}{\Sigma Q_0 P_0} \times \frac{\Sigma Q_1 P_1}{\Sigma Q_0 P_1}}$$

$$P_{01} \times Q_{01} = \sqrt{\frac{\Sigma P_1 Q_0}{\Sigma P_0 Q_0} \times \frac{\Sigma P_1 Q_1}{\Sigma P_0 Q_1} \times \frac{\Sigma Q_1 P_0}{\Sigma Q_0 P_0} \times \frac{\Sigma Q_1 P_1}{\Sigma Q_0 P_1}} = \sqrt{\frac{\Sigma P_1 Q_1}{\Sigma P_0 Q_0} \times \frac{\Sigma P_1 Q_1}{\Sigma P_0 Q_0}}$$

$$= \frac{\Sigma P_1 Q_1}{\Sigma P_0 Q_0}$$

Thus Fisher's Index satisfies Factor Reversal test. Because Fisher's Index number satisfies both the tests in (ii) and (iii), it is called an Ideal Index Number.

(iv) Circular Test: It is concerned with the measurement of price changes over a period of years, when it is desirable to shift the base. For example, if the 1970 index with base 1965 is 200 and 1965 index with base 1960 is 150, the index 1970 on base 1960 will be 300. This property therefore enables us to adjust the index values from period to period without referring each time to the original base. The test of this shiftability of base is called the circular test.

This test is not met by Laspeyres, or Paasche's or the Fisher's ideal index. **The simple geometric mean of price relatives and the weighted aggregative with fixed weights meet this test.**

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Example: Compute Fisher's Ideal Index from the following data:

	Base Year		Current Year	
Commodities	*Price*	*Quantity*	*Price*	*Quantity*
A	4	3	6	2
B	5	4	6	4
C	7	2	9	2
D	2	3	1	5

Show how it satisfies the time and factor reversal tests.

Solution:

Commodities	P_0	Q_0	P_1	Q_1	P_0Q_0	P_1Q_0	P_0Q_1	P_1Q_1
A	4	3	6	2	12	18	8	12
B	5	4	6	4	20	24	20	24
C	7	2	9	2	14	18	14	18
D	2	3	1	5	6	3	10	5
					52	63	52	59

Fisher's Ideal Index: $P_{01} = \sqrt{\dfrac{\Sigma P_1Q_0}{\Sigma P_0Q_0} \times \dfrac{\Sigma P_1Q_1}{\Sigma P_0Q_1}} \times 100 = \sqrt{\dfrac{63}{52} \times \dfrac{59}{52}} \times 100$

$$= \sqrt{1.375} \times 100 = 1.172 \times 100 = \quad 117.3$$

Time Reversal Test:

$$P_{01} \times P_{10} = \sqrt{\frac{63}{52} \times \frac{59}{52} \times \frac{52}{59} \times \frac{52}{63}} = \sqrt{1} = 1$$

$\therefore$ Time Reversal Test is satisfied.

Factor Reversal Test:

$$P_{01} \times Q_{01} = \sqrt{\frac{63}{52} \times \frac{59}{52} \times \frac{52}{59} \times \frac{52}{63}} = \sqrt{\frac{59}{52} \times \frac{59}{52}} = \frac{59}{52}$$

Since, $\dfrac{\Sigma P_1Q_1}{\Sigma P_0Q_0}$ is also equal to $\dfrac{59}{52}$, the Factor Reversal Test is satisfied.

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Concept Insight

Stock Market Index: It represents the entire stock market. It shows the changes taking place in the stock market. Movement of index is also an indication of average returns received by the investors. With the help of an index, it is easy for an investor to compare performance as it can be used as a benchmark, for e.g. a simple comparison of the stock and the index can be undertaken to find out the feasibility of holding a particular stock.

Each stock exchange has an index. For instance, in India, it is Sensex of BSE and Nifty of NSE. On the other hand, in outside India, popular indexes are Dow Jones, NASDAQ, FTSE etc.

(a) **Bombay Stock Exchange Limited:** It is the oldest stock exchange in Asia and was established as "The Native Share & Stock Brokers Association" in 1875. The Securities Contract (Regulation) Act, 1956 gives permanent recognition to Bombay Stock Exchange in 1956. BSE became the first stock exchange in India to obtain such permission from the Government under the Act. One of the Index as BSE Sensex which is basket of 30 constituent stocks. The base year of BSE SENSEX is 1978-79 and the base value is 100 which has grown over the years and quoted at about 592 times of base index as on date. As the oldest Index in the country, it provides the time series data over a fairly long period of time (from 1979 onward).

(b) **National Stock Exchange:** NSE was incorporated in 1992. It was recognized as a stock exchange by SEBI in April 1993 and commenced operations in 1994.NIFTY50 is a diversified 50 stocks Index of 13 sectors of the economy. The base period of NIFTY 50 Index is 3 November 1995 and base value is 1000 which has grown over years and quoted at 177 times as on date.

Computation of Index

Following steps are involved in calculation of index on a particular date:

- Calculate market capitalization of each individual company comprising the index.
- Calculate the total market capitalization by adding the individual market capitalization of all companies in the index.
- Computing index of next day requires the index value and the total market capitalization of the previous day and is computed as follows:

$$\text{IndexValue}=\text{Index on Previous Day} \times \frac{\text{Total market capitalisation for current day}}{\text{Total market capitalisation for previous day}}$$

- It should also be noted that Indices may also be calculated using the price weighted method. Here, the share price of the constituent companies forms the weight. However, almost all equity indices worldwide are calculated using the market capitalization weighted method.

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- It is very important to note that constituents' companies does not remain the same. Hence , it may be possible the stocks of the company constituting index at the time of index inspection , may not be aprt of index as on date and new companies stock may have replaced them.

CPI- Consumer Price Index/ Cost of living Index or Retail Price Index is the Index which measures the effect of change in prices of basket of goods and services on the purchasing power of specific class of consumer during any current period w.r.t to some base period.

WPI- Whole Sale Price Index - The WPI measures the relative changes in prices of commodities traded in wholesale market.

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SUMMARY

- An index number is a ratio or an average of ratios expressed as a percentage, Two or more time periods are involved, one of which is the base time period.
- Issues Involved in index numbers
  (a) Selection of Data
  (b) Base period
  (c) Selection of Weights:
  (d) Use of Averages:
  (e) Choice of Variables
- Construction of Index Number

  Price Index numbers

  (a) Simple aggregative price index = $\dfrac{\sum P_n}{\sum P_o}\times 100$

  (b) Laspeyres' Index: In this Index base year quantities are used as weights:

  Laspeyres Index = $\dfrac{\sum P_n Q_o}{\sum P_o Q_o}\times 100$

  (c) Paasche's Index: In this Index current year quantities are used as weights:

  Passche's Index = $\dfrac{\sum P_n Q_n}{\sum P_o Q_n}\times 100$

  (d) The Marshall-Edgeworth index uses this method by taking the average of the base year and the current year

  Marshall-Edgeworth Index = $\dfrac{\sum P_n (Q_o + Q_n)}{\sum P_o (Q_o + Q_n)}\times 100$

  (e) Fisher's ideal Price Index: This index is the geometric mean of Laspeyres' and Paasche's.

  Fisher's Index = $\sqrt{\dfrac{\sum P_n Q_o}{\sum P_o Q_o}\times\dfrac{\sum P_n Q_n}{\sum P_o Q_n}}\times 100$

  (g) Weighted Average of Relative Method: $\dfrac{\sum \dfrac{P_n}{P_o}\times(P_o Q_o)}{\sum P_o Q_o}\times 100 = \dfrac{\sum P_n Q_o}{\sum P_o Q_o}\times 100$

  (h) Chain Index = $\dfrac{\text{Link relative of current year} \times \text{Chain Index of the previous year}}{100}$

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Quantity Index Numbers

- Simple aggregate of quantities: $\dfrac{\sum Q_n}{\sum Q_o}$

- The simple average of quantity relatives: $\dfrac{\dfrac{\sum Q_n}{\sum Q_o}}{N}$

- Weighted aggregate quantity indices:

  (i) With base year weight : $\dfrac{\sum Q_n P_o}{\sum Q_o P_o}$ (Laspeyre's index)

  (ii) With current year weight : $\dfrac{\sum Q_n P_n}{\sum Q_o P_n}$ (Paasche's index)

  (iii)Geometric mean of (i) and (ii) : $\sqrt{\dfrac{\sum Q_n P_o}{\sum Q_o P_o} \times \dfrac{\sum Q_n P_n}{\sum Q_o P_n}}$ (Fisher's Ideal)

- Base-year weighted average of quantity relatives. This has the formula $\dfrac{\sum\left(\dfrac{Q_n}{Q_o} P_o Q_o\right)}{\sum P_o Q_o}$

- Value Indices

  $\dfrac{V_n}{V_o} = \dfrac{\sum P_n Q_n}{\sum P_o Q_o}$

- Deflated Value = $\dfrac{\text{Current Value}}{\text{Price Index of the current year}}$

  or Current Value x $\dfrac{\text{Base Price } (P_0)}{\text{Current Price } (P_n)}$ Base Price (P_0)

- Shifted Price Index = $\dfrac{\text{Original Price Index}}{\text{Price Index of the year on which it has to be shifted}} \times 100$

- Test of Adequacy

  (1) Unit test
  (2) Time reversal Test
  (3) Factor reversal test
  (4) Circular Test

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EXERCISE

Choose the most appropriate option (a) (b) (c) or (d).

1. A series of numerical figures which show the relative position is called
   a) index number b) relative number c) absolute number d) none
2. Index number for the base period is always taken as
   a) 200 b) 50 c) 1 d) 100
3. _________ play a very important part in the construction of index numbers.
   a) weights b) classes c) estimations d) none
4. ________ is particularly suitable for the construction of index numbers.
   a) H.M. b) A.M. c) G.M. d) none
5. Index numbers show _________ changes rather than absolute amounts of change.
   a) relative b) percentage c) both d) none
6. The ________ makes index numbers time-reversible.
   a) A.M. b) G.M. c) H.M. d) none
7. Price relative is equal to
   a) $\dfrac{\text{Price in the given year} \times 100}{\text{Price in the base year}}$ b) $\dfrac{\text{Price in the year base year} \times 100}{\text{Price in the given year}}$
   c) Price in the given year × 100 d) Price in the base year × 100
8. Index number is equal to
   a) sum of price relatives b) average of the price relatives
   c) product of price relative d) none
9. The ________ of group indices gives the General Index
   a) H.M. b) G.M. c) A.M. d) none
10. Circular Test is one of the tests of
    a) index numbers b) hypothesis c) both d) none
11. ___________ is an extension of time reversal test
    a) Factor Reversal test b) Circular test
    c) both d) none
12. Weighted G.M. of relative formula satisfy ________test
    a) Time Reversal Test b) Circular test
    c) Factor Reversal Test d) none
13. Factor Reversal test is satisfied by
    a) Fisher's Ideal Index b) Laspeyres Index
    c) Paasches Index d) none

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14. Laspeyre's formula does not satisfy
    a) Factor Reversal Test
    b) Time Reversal Test
    c) Circular Test
    d) all the above
15. A ratio or an average of ratios expressed as a percentage is called
    a) a relative number
    b) an absolute number
    c) an index number
    d) none
16. The value at the base time period serves as the standard point of comparison
    a) false b) true c) both d) none
17. An index time series is a list of _______ numbers for two or more periods of time
    a) index b) absolute c) relative d) none
18. Index numbers are often constructed from the
    a) frequency b) class c) sample d) none
19. ________ is a point of reference in comparing various data describing individual behaviour.
    a) Sample b) Base period c) Estimation d) none
20. The ratio of price of single commodity in a given period to its price in the preceding year price is called the
    (a) base period (b) price ratio (c) relative price (d) none
21. $\frac{\text{Sum of all commodity prices in the current year} \times 100}{\text{Sum of all commodity prices in the base year}}$ is
    (a) Relative Price Index
    (b) Simple Aggregative Price Index
    (c) both
    (d) none
22. Chain index is equal to
    (a) $\frac{\text{link relative of current year} \times \text{chain index of the current year}}{100}$
    (b) $\frac{\text{link relative of previous year} \times \text{chain index of the current year}}{100}$
    (c) $\frac{\text{link relative of current year} \times \text{chain index of the previous year}}{100}$
    (d) $\frac{\text{link relative of previous year} \times \text{chain index of the previous year}}{100}$
23. P_{01} is the index for time
    (a) 1 on 0 (b) 0 on 1 (c) 1 on 1 (d) 0 on 0
24. P_{10} is the index for time
    (a) 1 on 0 (b) 0 on 1 (c) 1 on 1 (d) 0 on 0

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25. When the product of price index and the quantity index is equal to the corresponding value index then the test that holds is

(a) Unit Test (b) Time Reversal Test
(c) Factor Reversal Test (d) none holds

26. The formula should be independent of the unit in which or for which price and quantities are quoted in

(a) Unit Test (b) Time Reversal Test
(c) Factor Reversal Test (d) none

27. Laspeyre's method and Paasche's method do not satisfy

(a) Unit Test (b) Time Reversal Test
(c) Factor Reversal Test (d) b & c

28. The purpose determines the type of index number to use

(a) yes (b) no (c) may be (d) may not be

29. The index number is a special type of average

(a) false (b) true (c) both (d) none

30. The choice of suitable base period is at best temporary solution

(a) true (b) false (c) both (d) none

31. Fisher's Ideal Formula for calculating index numbers satisfies the _______ tests

(a) Unit Test (b) Factor Reversal Test
(c) both (d) none

32. Fisher's Ideal Formula dose not satisfy _________ test

(a) Unit Test (b) Circular Test (c) Time Reversal Test (d) none

33. _________________ satisfies circular test

a) G.M. of price relatives or the weighted aggregate with fixed weights

b) A.M. of price relatives or the weighted aggregate with fixed weights

c) H.M. of price relatives or the weighted aggregate with fixed weights

d) none

34. Laspeyre's and Paasche's method _________ time reversal test

(a) satisfy (b) do not satisfy (c) are (d) are not

35. There is no such thing as unweighted index numbers

(a) false (b) true (c) both (d) none

36. Theoretically, G.M. is the best average in the construction of index numbers but in practice, mostly the A.M. is used

(a) false (b) true (c) both (d) none

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37. Laspeyre's or Paasche's or the Fisher's ideal index do not satisfy

(a) Time Reversal Test (b) Unit Test
(c) Circular Test (d) none

38. ___________ is concerned with the measurement of price changes over a period of years, when it is desirable to shift the base

(a) Unit Test (b) Circular Test
(c) Time Reversal Test (d) none

39. The test of shifting the base is called

(a) Unit Test (b) Time Reversal Test
(c) Circular Test (d) none

40. The formula for conversion to current value

(a) Deflated value = $\dfrac{\text{Price Index of the current year}}{\text{previous value}}$

(b) Deflated value = $\dfrac{\text{current value}}{\text{Price Index of the current year}}$

(c) Deflated value = $\dfrac{\text{Price Index of the previous year}}{\text{previous value}}$

(d) Deflated value = $\dfrac{\text{Price Index of the previous year}}{\text{previous value}}$

41. Shifted price Index = $\dfrac{\text{Original Price} \times 100}{\text{Price Index of the year on which it has to be shifted}}$

(a) True (b) false (c) both (d) none

42. The number of test of Adequacy is

(a) 2 (b) 5 (c) 3 (d) 4

43. We use price index numbers

(a) To measure and compare prices (b) to measure prices
(c) to compare prices(d) none

44. Simple aggregate of quantities is a type of

(a) Quantity control (b) Quantity indices
(c) both (d) none

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ANSWERS

Exercise

1. (a)	**2.** (d)	**3.** (a)	**4.** (c)	**5.** (b)	**6.** (b)	**7.** (a)	**8.** (b)
9. (c)	**10.** (a)	**11.** (b)	**12.** (a)	**13.** (a)	**14.** (d)	**15.** (c)	**16.** (b)
17. (a)	**18.** (c)	**19.** (b)	**20.** (c)	**21.** (b)	**22.** (c)	**23.** (a)	**24.** (b)
25. (c)	**26.** (a)	**27.** (d)	**28.** (a)	**29.** (b)	**30.** (a)	**31.** (c)	**32.** (b)
33. (a)	**34.** (b)	**35.** (a)	**36.** (b)	**37.** (c)	**38.** (b)	**39.** (c)	**40.** (b)
41. (a)	**42.** (d)	**43.** (a)	**44.** (b)				

ADDITIONAL QUESTION BANK

1. Each of the following statements is either True or False write your choice of the answer by writing T for True
   (a) Index Numbers are the signs and guideposts along the business highway that indicate to the businessman how he should drive or manage.
   (b) "For Construction index number, the best method on theoretical ground is not the best method from practical point of view".
   (c) Weighting index numbers makes them less representative.
   (d) Fisher's index number is not an ideal index number.
2. Each of the following statements is either True or False. Write your choice of the answer by writing F for false.
   (a) Geometric mean is the most appropriate average to be used for constructing an index number.
   (b) Weighted average of relatives and weighted aggregative methods render the same result.
   (c) "Fisher's Ideal Index Number is a compromise between two well known indices – not a right compromise, economically speaking".
   (d) "Like all statistical tools, index numbers must be used with great caution".
3. The best average for constructing an index numbers is
   (a) Arithmetic Mean (b) Harmonic Mean
   (c) Geometric Mean (d) None of these.
4. The time reversal test is satisfied by
   (a) Fisher's index number. (b) Paasche's index number.
   (c) Laspeyre's index number. (d) None of these.

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5. The factor reversal test is satisfied by

(a) Simple aggregative index number. (b) Paasche's index number.

(c) Laspeyre's index number. (d) Fisher's index

6. The circular test is satisfied by

(a) Fisher's index number. (b) Paasche's index number.

(c) Laspeyre's index number. (d) Simple GM price relative.

7. Fisher's index number is based on

(a) The Arithmetic mean of Laspeyre's and Paasche's index numbers.

(b) The Median of Laspeyre's and Paasche's index numbers.

(c) the Mode of Laspeyre's and Paasche's index numbers.

(d) None of these.

8. Paasche index is based on

(a) Base year quantities. (b) Current year quantities.

(c) Average of current and base year. (d) None of these.

9. Fisher's ideal index number is

(a) The Median of Laspeyre's and Paasche's index numbers

(b) The Arithmetic Mean of Laspeyre's and Paasche's index numbers

(c) The Geometric Mean of Laspeyre's and Paasche's index numbers

(d) None of these.

10. Price-relative is expressed in term of

(a) $P = \frac{P_n}{P_o}$ (b) $P = \frac{P_o}{P_n}$

(c) $P = \frac{P_n}{P_o} \times 100$ (d) $P = \frac{P_o}{P_n} \times 100$

11. Paasehe's index number is expressed in terms of :

(a) $\frac{\sum P_n q_n}{\sum P_o q_n}$ (b) $\frac{\sum P_o q_o}{\sum P_n q_n}$

(c) $\frac{\sum P_n q_n}{\sum P_o q_n} \times 100$ (d) $\frac{\sum P_n q_o}{\sum P_o q_o} \times 100$

12. Time reversal Test is satisfied by following index number formula is

(a) Laspeyre's Index number.

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(b) Simple Arithmetic Mean of price relative formula

(c) Marshall-Edge worth formula.

(d) None of these.

13. Cost of Living Index number (C. L. I.) is expressed in terms of :

(a) $\frac{\sum P_n q_o}{\sum P_o q_o} \times 100$ (b) $\frac{\sum P_n q_n}{\sum P_o q_o}$

(c) $\frac{\sum P_o q_n}{\sum P_n q_n} \times 100$ (d) None of these.

14. If the ratio between Laspeyre's index number and Paasche's Index number is 28 : 27. Then the missing figure in the following table P is :

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
X	L	10	2	5
Y	L	5	P	2

(a) 7 (b) 4 (c) 3 (d) 9

15. If the prices of all commodities in a place have increased 1.25 times in comparison to the base period, the index number of prices of that place now is

(a) 125 (b) 150 (c) 225 (d) None of these.

16. If the index number of prices at a place in 1994 is 250 with 1984 as base year, then the prices have increased on average by

(a) 250% (b) 150% (c) 350% (d) None of these.

17. If the prices of all commodities in a place have decreased 35% over the base period prices, then the index number of prices of that place is now

(a) 35 (b) 135 (c) 65 (d) None of these.

18. Link relative index number is expressed for period n is

(a) $\frac{P_n}{P_{n+1}}$ (b) $\frac{P_0}{P_{n-1}}$

(c) $\frac{P_n}{P_{n-1}} \times 100$ (d) None of these.

19. Fisher's Ideal Index number is expressed in terms of :

(a) $(P_{on})^F = \sqrt{\text{Laspeyre's Index} \times (\text{Paasche's Index})}$

(b) $(P_{on})^F$ = Laspeyre's Index X Paasche's Index

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(c) $(P_{on})^F = \sqrt{\text{Marshall Edge worth Index} \times \text{Paasche's}}$

(d) None of these.

20. Factor Reversal Test According to Fisher is $P_{01} \times Q_{01} =$

(a) $\dfrac{\sum P_o q_o}{\sum P_n q_n}$ (b) $\dfrac{\sum P_n q_n}{\sum P_o q_o}$

(c) $\dfrac{\sum P_o q_n}{\sum P_n q_n}$ (d) None of these.

21. Marshall-edge worth Index formula after interchange of p and q is expressed in terms of :

(a) $\dfrac{\sum q_n (p_0 + p_n)}{\sum q_0 (p_0 + p_n)}$ (b) $\dfrac{\sum P_n (q_0 + q_n)}{\sum q P_0 (q_0 + q_n)}$

(c) $\dfrac{\sum P_0 (q_0 + q_n)}{\sum P_n (P_0 + P_n)}$ (d) None of these.

22. If $\sum P_n q_n = 249$, $\sum P_o q_o = 150$, Paasche's Index Number = 150 and Drobiseh and Bowely's Index number = 145, then the Fisher's Ideal Index Number is

(a) 75 (b) 60 (c) 145.97 (d) None of these.

23. Consumer Price index number for the year 1957 was 313 with 1940 as the base year. The Average Monthly wages in 1957 of the workers into factory be ₹ 160/- their real wages is

(a) ₹ 48.40 (b) ₹ 51.12 (c) ₹ 40.30 (d) None of these.

24. If $\sum P_o q_o = 3500$, $\sum P_n q_o = 3850$, then the Cost of living Index (C.L.I.) for 1950 w.r. to base 1960 is

(a) 110 (b) 90 (c) 100 (d) None of these.

25. From the following table by the method of relatives using Arithmetic mean the price Index number is

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

(a) 140.35 (b) 148.25 (c) 140.75 (d) None of these.

From the Q.No. 26 to 29 each of the following statements is either True or False with your choice of the answer by writing F for False.

26. (a) Base year quantities are taken as weights in Laspeyre's price Index number.

(b) Fisher's ideal index is equal to the Arithmetic mean of Laspeyre's and Paasche's index numbers.

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(c) Laspeyre's index number formula does not satisfy time reversal test.

(d) None of these.

27. (a) Current year quantities are taken as weights in Paasche's price index number.

(b) Edge worth Marshall's index number formula satisfies Time, Reversal Test.

(c) The Arithmetic mean of Laspeyre's and Paasche's index numbers is called Bowely's index numbers.

(d) None of these.

28. (a) Current year prices are taken as weights in Paasche's quantity index number.

(b) Fisher's Ideal Index formula satisfies factor Reversal Test.

(c) The sum of the quantities of the base period and current period is taken as weights in Laspeyre's index number.

(d) None of these.

29. (a) Simple Aggregative and simple Geometric mean of price relatives formula satisfy circular Test.

(b) Base year prices are taken as weights in Laspeyre's quantity index numbers.

(c) Fisher's Ideal Index formula obeys time reversal and factor reversal tests.

(d) None of these.

30. In 1980, the net monthly income of the employee was ₹ 800/- p. m. The consumer price index number was 160 in 1980. It rises to 200 in 1984. If he has to be rightly compensated. The additional D. A. to be paid to the employee is

(a) ₹ 175/- (b) ₹ 185/- (c) ₹ 200/- (d) ₹ 125.

31. The simple Aggregative formula and weighted aggregative formula satisfy is

(a) Factor Reversal Test (b) Circular Test

(c) Unit Test (d) None of these.

32. "Fisher's Ideal Index is the only formula which satisfies"

(a) Time Reversal Test (b) Circular Test

(c) Factor Reversal Test (d) a & c.

33. "Neither Laspeyre's formula nor Paasche's formula obeys" :

(a) Time Reversal and factor Reversal Tests of index numbers.

(b) Unit Test and circular Tests of index number.

(c) Time Reversal and Unit Test of index number.

(d) None of these.

34. Bowley's index number is 150. Fisher's index number is 149.95. Paasche's index number is

(a) 146.13 (b) 154 (c) 148 (d) 156

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35. With the base year 1960 the C. L. I. in 1972 stood at 250. x was getting a monthly Salary of ₹ 500 in 1960 and ₹ 750 in 1972. In 1972 to maintain his standard of living in 1960 x has to receive as extra allowances of

(a) ₹ 600/- (b) ₹ 500/- (c) ₹ 300/- (d) none of these.

36. From the following data base year :-

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
A	4	3	6	2
B	5	4	6	4
C	7	2	9	2
D	2	3	1	5

Fisher's Ideal Index is

(a) 117.3 (b) 115.43 (c) 118.35 (d) 116.48

37. Which statement is False?

(a) The choice of suitable base period is at best a temporary solution.

(b) The index number is a special type of average.

(c) Those is no such thing as unweighted index numbers.

(d) Theoretically, geometric mean is the best average in the construction of index numbers but in practice, mostly the arithmetic mean is used.

38. Factor Reversal Test is expressed in terms of

(a) $\frac{\Sigma P_1Q_1}{\Sigma P_0Q_0}$ (b) $\frac{\Sigma P_1Q_1}{\Sigma P_0Q_0} \times \frac{\Sigma P_1Q_1}{\Sigma P_0Q_1}$

(c) $\frac{\Sigma P_1Q_1}{\Sigma Q_0P_1}$ (d) $\frac{\Sigma Q_1P_0}{\Sigma Q_0P_0} \times \frac{\Sigma P_1Q_1}{\Sigma Q_0P_1}$

39. Circular Test is satisfied by

(a) Laspeyre's Index number.

(b) Paasche's Index number

(c) The simple geometric mean of price relatives and the weighted aggregative with fixed weights.

(d) None of these.

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40. From the following data for the 5 groups combined

Group	Weight	Index Number
Food	35	425
Cloth	15	235
Power & Fuel	20	215
Rent & Rates	8	115
Miscellaneous	22	150

The general Index number is

(a) 270 (b) 269.2 (c) 268.5 (d) 272.5

41. From the following data with 1966 as base year

Commodity	Quantity Units	Values (₹)
A	100	500
B	80	320
C	60	150
D	30	360

The price per unit of commodity A in 1966 is

(a) ₹ 5 (b) ₹ 6 (c) ₹ 4 (d) ₹ 12

42. The index number in whole sale prices is 152 for August 1999 compared to August 1998. During the year there is net increase in prices of whole sale commodities to the extent of

(a) 45% (b) 35% (c) 52% (d) 48%

43. The value Index is expressed in terms of

(a) $\frac{\sum P_1Q_1}{\sum P_0Q_0} \times 100$ (b) $\frac{\sum P_1Q_1}{\sum P_0Q_0}$

(c) $\frac{\sum P_0Q_0}{\sum P_1Q_1} \times 100$ (d) $\frac{\sum P_0Q_1 \times \sum P_1Q_1}{\sum P_0Q_0 \times \sum P_1Q_0}$

44. Purchasing Power of Money is

(a) Reciprocal of price index number. (b) Equal to price index number.

(c) Unequal to price index number. (d) None of these.

45. The price level of a country in a certain year has increased 25% over the base period. The index number is

(a) 25 (b) 125 (c) 225 (d) 2500

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46. The index number of prices at a place in 1998 is 355 with 1991 as base. This means
    (a) There has been on the average a 255% increase in prices.
    (b) There has been on the average a 355% increase in price.
    (c) There has been on the average a 250% increase in price.
    (d) None of these.
47. If the price of all commodities in a place have increased 1.25 times in comparison to the base period prices, then the index number of prices for the place is now
    (a) 100 (b) 125 (c) 225 (d) None of the above.
48. The wholesale price index number or agricultural commodities in a given region at a given date is 280. The percentage increase in prices of agricultural commodities over the base year is :
    (a) 380 (b) 280 (c) 180 (d) 80
49. If now the prices of all the commodities in a place have been decreased by 35% over the base period prices, then the index number of prices for the place is now (index number of prices of base period = 100)
    (a) 100 (b) 135 (c) 65 (d) None of these.
50. From the data given below

Commodity	Price Relative	Weight
A	125	5
B	67	2
C	250	3

Then the suitable index number is
(a) 150.9 (b) 155.8 (c) 145.8 (d) None of these.
51. Bowley's Index number is expressed in the form of :
    (a) $\frac{\text{Laspeyre's index + Paasche's index}}{2}$ (b) $\frac{\text{Laspeyre's index} \times \text{Paasche's index}}{2}$
    (c) $\frac{\text{Laspeyre's index - Paasche's index}}{2}$ (d) None of these.
52. From the following data

Commodity	Base Price	Current Price
Rice	35	42
Wheat	30	35
Pulse	40	38
Fish	107	120

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The simple Aggregative Index is

(a) 115.8 (b) 110.8 (c) 112.5 (d) 113.4

53. With regard to Laspeyre's and Paasche's price index numbers, it is maintained that "If the prices of all the goods change in the same ratio, the two indices will be equal for them the weighting system is irrelevant; or if the quantities of all the goods change in the same ratio, they will be equal, for them the two weighting systems are the same relatively". Then the above statements satisfy.

(a) Laspeyre's Price index ≠ Paasche's Price Index.

(b) Laspeyre's Price Index = Paasche's Price Index.

(c) Laspeyre's Price Index may be equal Paasche's Price Index.

(d) None of these.

54. The quantity Index number using Fisher's formula satisfies :

(a) Unit Test (b) Factor Reversal Test.
(c) Time Reversal Test. (d) All the three

55. For constructing consumer price Index is used :

(a) Marshall Edge worth Method. (b) Paasche's Method.
(c) Dorbish and Bowley's Method. (d) Laspeyre's Method.

56. The cost of living Index (C.L.I.) is always :

(a) Weighted index (b) Price Index.
(c) Quantity Index. (d) None of these.

57. The Time Reversal Test is not satisfied to :

(a) Fisher's ideal Index. (b) Marshall Edge worth Method.
(c) Laspeyre's and Paasche Method. (d) None of these.

58. Given below are the data on prices of some consumer goods and the weights attached to the various items. Compute price index number for the year 1985 (Base 1984 = 100)

Items	Unit	1984	1985	Weight
Wheat	Kg.	0.50	0.75	2
Milk	Litre	0.60	0.75	5
Egg	Dozen	2.00	2.40	4
Sugar	Kg.	1.80	2.10	8
Shoes	Pair	8.00	10.00	1

Then weighted average of price Relative Index is :

(a) 125.43 (b) 123.3 (c) 124.53 (d) 124.52

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59. The Factor Reversal Test is as represented symbolically is :

(a) $P_{01} \times Q_{01} = \frac{\sum P_1Q_1}{\sum P_0Q_0}$ (b) $I_{01} \times I_{10}$

(c) $\frac{\sum P_0Q_0}{\sum P_1Q_1}$ (d) $\sqrt{\frac{\sum P_1Q_1}{\sum P_0Q_0} \times \frac{\sum P_0Q_1}{\sum Q_{10}P_0}}$

60. If the 1970 index with base 1965 is 200 and 1965 index with base 1960 is 150, the index 1970 on base 1960 will be :

(a) 700 (b) 300 (c) 500 (d) 600

61. Circular Test is not met by :

(a) The simple Geometric mean of price relatives.

(b) The weighted aggregative with fixed weights.

(c) Laspeyre's or Paasche's or the fisher's Ideal index.

(d) None of these.

62. From the following data

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
A	4	3	6	2
B	5	4	6	4
C	7	2	9	2
D	2	3	1	5

Then the value ratio is:

(a) $\frac{59}{52}$ (b) $\frac{49}{47}$ (c) $\frac{41}{53}$ (d) $\frac{47}{53}$

63. The value index is equal to :

(a) The total sum of the values of a given year multiplied by the sum of the values of the base year.

(b) The total sum of the values of a given year Divided by the sum of the values of the base year.

(c) The total sum of the values of a given year plus by the sum of the values of the base year.

(d) None of these.

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64. Time Reversal Test is represented symbolically by :

(a) $P_{01} \times P_{10}$ (b) $P_{01} \times P_{10} = 1$

(c) $P_{01} \times P_{10} \neq 1$ (d) None of these.

65. In 1996 the average price of a commodity was 20% more than in 1995 but 20% less than in 1994; and more over it was 50% more than in 1997 to price relatives using 1995 as base (1995 price relative 100). Reduce the data is :

(a) 150, 100, 120, 80 for (1994–97) (b) 135, 100, 125, 87 for (1994–97)

(c) 140, 100, 120, 80 for (1994–97) (d) None of these.

66. From the following data

Commodities	Base Year 1922 Price (₹)	Current Year 1934 Price
A	6	10
B	2	2
C	4	6
D	11	12
E	8	12

The price index number for the year 1934 is :

(a) 140 (b) 145 (c) 147 (d) None of these.

67. From the following data

Commodities	Base Price 1964	Current Price 1968
Rice	36	54
Pulse	30	50
Fish	130	155
Potato	40	35
Oil	110	110

The index number by unweighted methods :

(a) 116.8 (b) 117.25 (c) 115.35 (d) 119.37

68. The Bowley's Price index number is represented in terms of :

(a) A.M. of Laspeyre's and Paasche's Price index number.

(b) G.M. of Laspeyre's and Paasche's Price index number.

(c) A.M. of Laspeyre's and Walsh's price index number.

(d) None of these.

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69. Fisher's price index number equal is :

(a) G.M. of Kelly's price index number and Paasche's price index number.

(b) G.M. of Laspeyre's and Paasche's Price index number.

(c) G.M. of Bowley's price index number and Paasche's price index number.

(d) None of these.

70. The price index number using simple G.M. of the n relatives is given by :

(a) $\log I_{on} = 2 - \frac{1}{n}\sum \log \frac{P_n}{P_o}$ (b) $\log I_{on} = 2 + \frac{1}{n}\sum \log \frac{P_n}{P_o}$

(c) $\log I_{on} = \frac{1}{2n}\sum \log \frac{P_n}{P_o}$ (d) None of these.

71. The price of a number of commodities are given below in the current year 1975 and base year 1970.

Commodities	A	B	C	D	E	F
Base Price	45	60	20	50	85	120
Current Price	55	70	30	75	90	130

For 1975 with base 1970 by the Method of price relatives using Geometrical mean, the price index is :

(a) 125.3 (b) 124.3 (c) 128.8 (d) None of these.

72. From the following data

Group	A	B	C	D	E	F
Group Index	120	132	98	115	108	95
Weight	6	3	4	2	1	4

The general Index I is given by :

(a) 111.3 (b) 113.45 (c) 117.25 (d) 114.75

73. The price of a commodity increases from ₹ 5 per unit in 1990 to ₹ 7.50 per unit in 1995 and the quantity consumed decreases from 120 units in 1990 to 90 units in 1995. The price and quantity in 1995 are 150% and 75% respectively of the corresponding price and quantity in 1990. Therefore, the product of the price ratio and quantity ratio is :

(a) 1.8 (b) 1.125 (c) 1.75 (d) None of these.

74. Test whether the index number due to Walsh given by :

$I = \frac{\sum P_1\sqrt{Q_0Q_1}}{\sum P_0\sqrt{Q_0Q_1}} \times 100$ Satisfies is :-

(a) Time reversal Test. (b) Factor reversal Test.

(c) Circular Test. (d) None of these.

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75. From the following data

Group	Weight	Index Number Base : 1952–53 = 100
Food	50	241
Clothing	2	21
Fuel and Light	3	204
Rent	16	256
Miscellaneous	29	179

The Cost of living index numbers is :

(a) 224.5 (b) 223.91 (c) 225.32 (d) None of these.

76. Consumer price index number goes up from 110 to 200 and the Salary of a worker is also raised from ₹ 325 to ₹ 500. Therefore, in real terms, to maintain his previous standard of living he should get an additional amount of :

(a) ₹ 85 (b) ₹ 90.91 (c) ₹ 98.25 (d) None of these.

77. The prices of a commodity in the year 1975 and 1980 were 25 and 30 respectively taking 1980 as base year the price relative is :

(a) 109.78 (b) 110.25 (c) 113.25 (d) None of these.

78. The average price of certain commodities in 1980 was ₹ 60 and the average price of the same commodities in 1982 was ₹ 120. Therefore, the increase in 1982 on the basis of 1980 was 100%. 80. The decrease in 1980 with 1982 as base is: using 1982, comment on the above statement is :

(a) The price in 1980 decreases by 60% using 1982 as base.

(b) The price in 1980 decreases by 50% using 1982 as base.

(c) The price in 1980 decreases by 90% using 1982 as base.

(d) None of these.

79. Cost of Living Index (C.L.I.) numbers are also used to find real wages by the process of

(a) Deflating of Index number. (b) Splicing of Index number.

(c) Base shifting. (d) None of these.

80. From the following data

Commodities		A	B	C	D
1992 Base	Price	3	5	4	1
	Quantity	18	6	20	14
1993 Current Year	Price	4	5	6	3
	Quantity	15	9	26	15

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The Passche price Index number is :

(a) 146.41 (b) 148.25 (c) 144.25 (d) None of these.

81. From the following data

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
A	7	17	13	25
B	6	23	7	25
C	11	14	13	15
D	4	10	8	8

The Marshall Edge Worth Index number is :

(a) 148.25 (b) 144.19 (c) 147.25 (d) 143.78

82. The circular Test is an extension of

(a) The time reversal Test. (b) The factor reversal Test.
(c) The unit Test. (d) None of these.

83. Circular test, an index constructed for the year 'x' on the base year 'y' and for the year 'y' on the base year 'z' should yield the same result as an index constructed for 'x' on base year 'z' i.e. $I_{01} \times I_{12} \times I_{20}$ equal is :

(a) 3 (b) 2 (c) 1 (d) None of these.

84. In 1976 the average price of a commodity was 20% more than that in 1975 but 20% less than that in 1974 and more over it was 50% more than that in 1977. The price relatives using 1975 as base year (1975 price relative = 100) then the reduce data is :

(a) 8,.75 (b) 150,80 (c) 75,125 (d) None of these.

85. Time Reversal Test is represented by symbolically is :

(a) $P_{01} \text{ x } Q_{01} = 1$ (b) $I_{01} \text{ x } I_{10} = 1$
(b) $I_{01} \text{ x } I_{12} \text{ x } I_{23} \text{ x } \ldots. I_{(n-1)n} \text{ x } I_{n0} = 1$ (d) None of these.

86. The prices of a commodity in the years 1975 and 1980 were 25 and 30 respectively, taking 1975 as base year the price relative is :

(a) 120 (b) 135 (c) 122 (d) None of these.

87. From the following data

Year	1992	1993	1995	1996	1997
Link Index	100	103	105	112	108

(Base 1992 = 100) for the years 1993–97. The construction of chain index is :

(a) 103, 100.94, 107, 118.72 (b) 103, 108.15, 121.3, 130.82
(c) 107, 100.25, 104, 118.72 (d) None of these.

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88. During a certain period the cost of living index number goes up from 110 to 200 and the salary of a worker is also raised from ₹ 330 to ₹ 500. The worker does not get really gain. Then the real wages decreased by :

(a) ₹ 45.45 (b) ₹ 43.25 (c) ₹ 100 (d) None of these.

89. Net monthly salary of an employee was ₹ 3000 in 1980. The consumer price index number in 1985 is 250 with 1980 as base year. If the has to be rightly compensated then, 7^{th} dearness allowances to be paid to the employee is :

(a) ₹ 4.800.00 (b) ₹ 4,700.00 (c) ₹ 4,500.0 (d) None of these.

90. Net Monthly income of an employee was ₹ 800 in 1980. The consumer price Index number was 160 in 1980. It is rises to 200 in 1984. If he has to be rightly compensated. The additional dearness allowance to be paid to the employee is :

(a) ₹ 240 (b) ₹ 275 (c) ₹ 250 (d) None of these.

91. When the cost of Tobacco was increased by 50%, a certain hardened smoker, who maintained his formal scale of consumption, said that the rise had increased his cost of living by 5%. Before the change in price, the percentage of his cost of living was due to buying Tobacco is

(a) 15% (b) 8% (c) 10% (d) None of these.

92. If the price index for the year, say 1960 be 110.3 and the price index for the year, say 1950 be 98.4, then the purchasing power of money (Rupees) of 1950 in 1960 is

(a) ₹ 1.12 (b) ₹ 1.25 (c) ₹ 1.37 (d) None of these.

93. If $\sum P_0Q_0 = 1360$, $\sum PnQ_0 = 1900$, $\sum P_0Q_n = 1344$, $\sum P_nQ_n = 1880$ then the Laspeyre's Index number is

(a) 0.71 (b) 1.39 (c) 1.75 (d) None of these.

94. The consumer price Index for April 1985 was 125. The food price index was 120 and other items index was 135. The percentage of the total weight index given to food is

(a) 66.67 (b) 68.28 (c) 90.25 (d) None of these.

95. The total value of retained imports into India in 1960 was ₹ 71.5 million per month. The corresponding total for 1967 was ₹ 87.6 million per month. The index of volume of retained imports in 1967 composed with 1960 (= 100) was 62.0. The price index for retained inputs for 1967 our 1960 as base is

(a) 198.61 (b) 197.61 (c) 198.25 (d) None of these.

96. During the certain period the C.L.I. goes up from 110 to 200 and the Salary of a worker is also raised from 330 to 500, then the real terms is

(a) Loss by ₹ 50 (b) Loss by 75 (c) Loss by ₹ 90 (d) None of these.

[Hint : Real Wage = (Actual wage/Cost of Living Index) * 100]

97. From the following data

Commodities	Q_0	P_0	Q_1	P_1
A	2	2	6	18
B	5	5	2	2
C	7	7	4	24

Then the fisher's quantity index number is

(a) 87.34 (b) 85.24 (c) 87.25 (d) 78.93

98. From the following data

Commodities	Base year	Current year
A	25	55
B	30	45

Then index numbers from G. M. Method is :

(a) 181.66 (b) 185.25 (c) 181.75 (d) None of these.

99. Using the following data

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
X	4	10	6	15
Y	6	15	4	20
Z	8	5	10	4

the Paasche's formula for index is :

(a) 125.38 (b) 147.25 (c) 129.8 (d) 99.06

100. Group index number is represented by

(a) $\dfrac{\text{Price Relative for the year}}{\text{Price Relative for the previous year}} \times 100$ (b) $\dfrac{\Sigma(\text{Price Relative} \times w)}{\Sigma w}$

(c) $\dfrac{\Sigma(\text{Price Relative} \times w)}{\Sigma w} \times 100$ (d) None of these.

ANSWERS

1.	(a)	**2.**	(c)	**3.**	(c)	**4.**	(a)	**5.**	(d)
6.	(d)	**7.**	(d)	**8.**	(b)	**9.**	(c)	**10.**	(c)
11.	(c)	**12.**	(c)	**13.**	(a)	**14.**	(b)	**15.**	(c)
16.	(b)	**17.**	(c)	**18.**	(c)	**19.**	(a)	**20.**	(b)
21.	(a)	**22.**	(d)	**23.**	(b)	**24.**	(a)	**25.**	(b)
26.	(b)	**27.**	(d)	**28.**	(c)	**29.**	(d)	**30.**	(c)
31.	(b)	**32.**	(d)	**33.**	(a)	**34.**	(a)	**35.**	(b)
36.	(a)	**37.**	(c)	**38.**	(a)	**39.**	(c)	**40.**	(b)
41.	(a)	**42.**	(c)	**43.**	(a)	**44.**	(a)	**45.**	(b)
46.	(a)	**47.**	(c)	**48.**	(c)	**49.**	(c)	**50.**	(a)
51.	(a)	**52.**	(b)	**53.**	(b)	**54.**	(d)	**55.**	(d)
56.	(a)	**57.**	(c)	**58.**	(b)	**59.**	(a)	**60.**	(b)
61.	(c)	**62.**	(a)	**63.**	(b)	**64.**	(b)	**65.**	(a)
66.	(d)	**67.**	(a)	**68.**	(a)	**69.**	(b)	**70.**	(b)
71.	(b)	**72.**	(a)	**73.**	(b)	**74.**	(a)	**75.**	(d)
76.	(b)	**77.**	(d)	**78.**	(b)	**79.**	(a)	**80.**	(a)
81.	(b)	**82.**	(a)	**83.**	(c)	**84.**	(b)	**85.**	(b)
86.	(a)	**87.**	(b)	**88.**	(c)	**89.**	(c)	**90.**	(d)
91.	(c)	**92.**	(a)	**93.**	(b)	**94.**	(a)	**95.**	(b)
96.	(a)	**97.**	(d)	**98.**	(a)	**99.**	(d)	**100.**	(b)

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