6. Index Numbers

Q. 1. Choose the correct option:

1) Statements that are incorrect in relation to index numbers.

a) Index number is a geographical tool.

b) Index numbers measure changes in the air pressure.

c) Index numbers measure relative changes in an economic variable.

d) Index numbers are specialized averages.

Options :

<u>1) c and d</u>

2) a and b

3) b and c

4) a and d

2) Statements that highlight the significance of index numbers.

a) Index numbers are useful for making future predictions.

b) Index numbers help in the measurement of inflation.

c) Index numbers help to frame suitable policies.

d) Index numbers can be misused,

Options :

1) b, c and d

2) a, c and d

<u>3) a, b and d</u>

4) a, b and c

3) Statements that apply to weighted index numbers.

a) Every commodity is given equal importance.

b) It assigns suitable 'weights' to various commodities

c) In most of the cases, quantities are used as weights.

d) Laaspeyre's and Paasche's method is used in the calculation of weighted index numbers.

Options :

<u>1) b, c and d</u>

2) a, c and d

3) a, b and d

4) a, b, c and d

4) Statements related to limitations of index numbers.

a) Index numbers are not completely reliable.

b) There may be a bias in the data collected.

c) Every formula has some kind of defect.
d) Index numbers ignore changes in the qualities of products.
Options :
1) a, c and d
2) a, b, c and d
3) a, b and d
4) b, c and d

5) Choose the correct pair:

Group A	Group B
1) Price Index	a) $\dfrac{\Sigma p_1 q_1}{\Sigma p_0 q_0} \times 100$
2) Value Index	b) $\dfrac{\Sigma q_1}{\Sigma q_0} \times 100$
3) Quantity Index	c) $\dfrac{\Sigma p_1 q_1}{\Sigma p_0 q_1} \times 100$
4) Paasche's Index	d) $\dfrac{\Sigma p_1}{\Sigma p_0} \times 100$

Options :
1) 1-d, 2-c, 3-, 4-b
2) 1-d, 2-a, 3-b, 4-c
3) 1-b, 2-c, 3-d, 4-a
4) 1-c, 2-d, 3-a, 4-b

Q 2. Complete the Correlation:
1) Price Index : Inflation : : **Agricultural productivity index** : Agricultural production
2) **P0** : Base year prices :: P1 : Current year prices.
(3) Laaspeyre's Index : Base year quantities : : Paasche's Index: Current year quantities.
(4) Univariate index : **Single variable** : : Composite index : Group of variables

Q. 3 Solve the following:
1. Calculate the price index number from given data:

Commodity	A	B	C	D
Price in 2005 (₹)	6	16	24	4
Price in 2010 (₹)	8	18	28	6

Ans:

Commodity	Price in 2005 (₹) (Base Year) P_0	Price in 2010 (₹) (Current year) P_1
A	6	8
B	16	18
C	24	28
D	4	6
Total	₹ $P_0 = 50$	₹ $P_1 = 50$

Price index number

$$P_{01} = \frac{\Sigma P_1}{\Sigma P_0} \times 100$$

$$\therefore P_{01} = \frac{60}{50} \times 100$$

$$\therefore P_{01} = 120$$

∴ Price of index number is $= 120$

(2) Calculate quantity index number from the given data:

Commodity	P	Q	R	S	T
Base Year Quantities	170	150	100	195	205
Current Year Quantities	90	70	75	150	95

Commodity	Base year Quantities (Base Year) q_0	Current year Quantities (Current Year) q_1
P	170	90
Q	150	70
R	100	75
S	195	150
T	205	95
Total	$\Sigma q_0 = 820$	$\Sigma q_1 = 480$

Price Index Number

$$Q_{01} = \frac{\Sigma P_1}{\Sigma P_0} \times 100$$

$$\therefore Q_{01} = \frac{480}{820} \times 100$$

$$\therefore Q_{01} = \frac{24}{41} \times 100$$

$$\therefore Q_{01} = \frac{2400}{41} \times 100$$

$$\therefore Q_{01} = 58.536$$

∴Quantity Index Number = 58.54

3. Calculate Value index number from the given data:

-	Base Year	-	Current year	-
Commodity	Price	Quantity	Price	Quantity
A	40	15	70	20
B	10	12	90	18
C	50	10	60	22
D	20	14	100	16
E	30	13	40	15

Ans:

Base Year			Current Year			
Commodity	p_0	q_0	$p_0 q_0$	P_1	Q_1	$p_1 q_1$
A	40	15	600	70	20	1400
B	10	12	120	60	22	1320
C	50	10	500	90	18	1620
D	20	14	280	100	16	1600
E	30	13	390	40	15	600
Total		$\Sigma p_0 q_0 = 1890$			$\Sigma p_1 q_1 = 6540$	

(4) Calculate Laaspeyre's Index Number and Paasche's Index Number from the given data:

Base Year			Current Year	
Commodity	Price	Quantity	Price	Quantity
X	8	30	12	25
Y	10	42	20	16

Ans: (A) Laaspeyre's Index Number:

Base Year					Current year	
Commodity	p_0	q_1	P_1	q_1	$p_1\,q_0$	$p_0\,q_0$
A	8	30	12	25	360	240
B	10	42	20	16	840	420
Total					$\Sigma p_1 q_0 = 1200$	$\Sigma p_0 q_0 = 660$

Laaspeyre's Index Number

$$P_{01} = \frac{\Sigma p_1 q_1}{\Sigma p_0 q_0} \times 100$$

$$\therefore P_{01} = \frac{1200}{660} \times 100$$

$$\therefore P_{01} = \frac{120}{66} \times 100$$

$$\therefore P_{01} = \frac{60}{33} \times 100$$

$$\therefore P_{01} = \frac{6000}{33} \times 100$$

$\therefore P_{01} = 181.818$

$\therefore$ Laaspeyre's index number $= 181.82$

(B) Paasche's Index Number:

Commodity	Base Year	-			Current year	
	p_0	q_0	P_1	q_1	$P_1\,q_1$	$p_0\,q_1$
A	8	30	12	25	300	200
B	10	42	20	16	820	160
Total	$\Sigma p_1 q_1 = 620$				$\Sigma p_0 q_1 = 360$	

Q.4. Distinguish between :
1) Simple Index Numbers and Weighted Index Numbers.
Ans:

Simple Index Numbers	Weighted Index Numbers
(1) **Meaning:** Index numbers measured by giving equal importance (weight) to every commodity are known as simple index numbers.	Index numbers measured by giving suitable importance (weight) to every commodity on the basis of their quantity are known as weighted index number.
(2) **Nature:** The measurement of simple index numbers is comparatively simple.	The measurement of weighted index numbers is comparatively complex.

2) Price Index and Quantity Index.
Ans:

Price index	Quantity Index Numbers
(1) **Meaning:** Price index number is a type of index number derived by multiplying the ratio of sum of the prices of various commodities of the current year and sum of the prices of various commodities of the base year by 100.	Quantity index number is a type of index number derived by multiplying the ratio of sum of the quantities of the various goods of the current year and sum of the quantities of various goods of the base year by 100.
(2) **Formula:** Price Index number $$P_{01} = \frac{\Sigma p_1}{\Sigma p_0} \times 100$$	Quantity Index number $$Q_{01} = \frac{\Sigma P_1}{\Sigma P_0} \times 100$$

(3) Laspeyres Index Number and Paasche's Index Number :
Ans:

Laspeyres Index Number	Paasche's Index Number
(1) **Distinctive Feature:** A distinctive feature of Laspeyres index number is that it uses a group of commodities purchased in the base year period as the basis of comparison.	A distinctive feature of Paasche's index number is that it uses a group of commodities purchased in the current year period as the basis of comparison.
2) **Formula:** The formula for measuring Laspeyres index number is as follows: $$P_{01} = \frac{\Sigma p_1 q_0}{\Sigma p_0 q_0} \times 100$$	The formula for measuring Paasche's index number x 100 is as follows $$P_{01} = \frac{\Sigma p_1 q_1}{\Sigma p_0 q_1} \times 100$$

 Q. 5. State with resons whether you agree or disagree with the following statements :

1) Index numbers measure changes in the price level only.
Ans: No, I disagree with this statement.
Reasons :

(1) Index numbers measure the changes in the price level as well as changes in stock market prices, cost of living, industrial and agricultural production, exports and imports, etc.

(2) For example, Labour Productivity Index Number measures the general changes in the labour productivity over a period of time.

(3) Consumer Price Index Number, Wholesale Price Index Number, Index of Service Production, Human Development Index Number, etc. are the special purpose index numbers measuring the changes in various economic variables over a period of time. Thus, index numbers do not measure changes in the price level only, but also measure changes in many other economic variables.

(2) Index numbers are free from limitations.
Ans. No, I disagree with this statement.
Reasons : The limitations of index numbers are as follows:

(1) Based on samples : Index numbers are generally based on samples. While constructing index numbers, we cannot include all the items in the construction of the index numbers. Hence index numbers suffer from sampling errors.

(2) Bias in the data : Index numbers are constructed on the basis of various types of data which may be incomplete. There may be bias in the data collected. This is bound to affect the results of the index numbers adversely.

(3) Misuse of Index Numbers : Index numbers can be misused. They compare a situation in the current year with a situation in the base year.
Hence a person may choose a base year which will be suitable for his purpose. For example, while studying the trends in employment level, if a year of drought or recession is selected as a base year and the level of employment in the current year is checked with reference to employment level in the base year, we may get the misleading results.

(4) Defects in formulae : There is no perfect formula for the construction of an index number. It is only an average and so it has all the limitations of an average.

(5) Changes in the economy: The habits, tastes and expectations of the people in a country always change over a period of time. However, these changes cannot be included in the estimation of index numbers.

(6) Qualitative changes : The price or quantity index numbers may ignore the changes in qualities of the product. A commodity in the current year may have a higher price as well as higher quality than its low priced ordinary version in the base year in the past. However, these changes cannot be included in the estimation

of index numbers.

(7) Arbitrary weights : While constructing the index numbers, the weights assigned to different commodities may be arbitrary.

(8) Limited scope : An index number has limited scope. Index numbers constructed for one purpose cannot be used for any other purpose.

(3) Index numbers can be constructed without the base year.
Ans. No, I disagree with this statement.

Reasons :

(1) Index numbers measures the changes in an economic variable in present times with reference to the year in the past. This year in the past is known as base year.

(2) For the calculation of index numbers, the normal year from the past is selected as the base year. The base year should be normal, i.e. it should be free from natural calamities, warlike conditions, emergencies, etc. Similarly, it should not be too distant in the past.

(3) While preparing index numbers with reference to the base year, it is denoted by the suffix. The base year index of a selected variable is assumed as 100. The index numbers are measured for the current year on the basis of the past year.

Q. 6. Answer the following:
1) Explain the features of index numbers.

Ans. The steps involved in the construction of index numbers are as follows:

(1) Deciding the purpose of index numbers : Deciding the purpose of index numbers is the first important step in the construction of index numbers. The purpose for constructing the index number, its scope as well as which variable is intended to be measured should be clearly decided to achieve fruitful results. For example, if the purpose of constructing index numbers is to find out the changes in the wholesale prices of a particular commodity, then collecting the retail prices of a particular commodity will not be fruitful.

(2) Selecting the base year : Base year is also called the reference year. It is the year against which comparisons are made. The base year should be normal, i.e. it should be free from natural calamities, warlike conditions, emergencies, etc. It should not be too distant in the past.

(3) Selecting Items : It is necessary to select a representative sample of the number of items to be included in the construction of index numbers, The representative sample of number of items should represent the tastes, habits and customs of the people. Similarly, only standardized or graded Items should be included to give better results. For example, while measuring the trends in consumption pattern of poor people, the data related to quantities of essential goods consumed by poor people over a period of time is to be collected. The collection of data related to quantities of luxury goods consumed by rich people will not be fruitful.

(4) Selecting price quotations : Prices of the selected commodities may vary from place to place and shop to shop in the same market. Therefore, while calculating index numbers, it is desirable that price quotations should be obtained from an unbiased price reporting agency. Proper selection of representative places and persons is required to achieve accuracy in the construction of index numbers.

(5) Choosing suitable average : Construction of index numbers requires choice of a suitable average. Generally, Arithmetic mean is used in the construction of index numbers as compared to other averages, it is simple to compute.

(6) Assigning proper weights: Weight refers to the relative importance of the different items in the construction of an index number. Weights are of two types, viz. (1) Quantity weights (q) and (2) Value weights (p xq). Since all items are not of equal importance, while constructing index numbers, specific weights are assigned to various commodities for achieving better results.

(7) Selecting an appropriate formula : Various formulae are devised for the construction of index numbers. According to the purpose of index number and availability of data, a suitable formula is chosen for constructing index numbers.

Q. 7. Answer the following:

1) Explain the features of index numbers.

Ans. The steps involved in the construction of index numbers are as follows:

(1) Deciding the purpose of index numbers : Deciding the purpose of index numbers is the first important step in the construction of index numbers. The purpose for constructing the index number, its scope as well as which variable is intended to be measured should be clearly decided to achieve fruitful results. For example, if the purpose of constructing index numbers is to find out the changes in the wholesale prices of a particular commodity, then collecting the retail prices of a particular

commodity will not be fruitful.

(2) Selecting the base year : Base year is also called the reference year. It is the year against which comparisons are made. The base year should be normal, i.e. it should be free from natural calamities, warlike conditions, emergencies, etc. It should not be too distant in the past.

(3) Selecting Items : It is necessary to select a representative sample of the number of items to be included in the construction of index numbers, The representative sample of number of items should represent the tastes, habits and customs of the people. Similarly, only standardized or graded Items should be included to give better results. For example, while measuring the trends in consumption pattern of poor people, the data related to quantities of essential goods consumed by poor people over a period of time is to be collected. The collection of data related to quantities of luxury goods consumed by rich people will not be fruitful.

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(7) Selecting an appropriate formula : Various formulae are devised for the construction of index numbers. According to the purpose of index number and availability of data, a suitable formula is chosen for constructing index numbers.

Q. 6. Answer the following:

1) Explain the features of index numbers.

Ans: The features of index numbers are as follows:

(1) Statistical device : Index numbers are statistical devices.

(2) Specialized averages : Index numbers are specialized averages. Index numbers are capable of being expressed in percentage.

(3) Helpful to measure changes in the variables : Index numbers are helpful in measuring the net changes in one or more related variables over a period of time or between two different time periods or two different localities.

(4) Computed for a single variable or a group of variables : Index numbers are computed for measuring a net change in a single variable or a group of variables over a period of time. Index number which is computed from a single variable is called a 'univariate index'. An index number which is constructed from a group of variables is called a 'composite index'.

(5) Prepared for a current year : Index numbers are prepared for a current year. Index numbers measure a net change in a particular variable from the base year to the current year.

(6) Based on the base year : Index numbers are prepared with reference to the base year. Index numbers measure a net change in a particular variable by taking into account the values of a particular variable in the selected base year.

(7) Assumptions of base year index as 100 : While calculating the net change in the values of a particular variable, the base year index of a selected variable is assumed as 100 and accordingly the value of the selected variable for the current year is calculated.

(8) Barometers of economic activity : Index numbers are also referred to as 'barometers of economic activity', since they are used to measure the trends and changes in the economy.

(2) Explain the significance of index numbers in economics.
Ans. The significance of index numbers in economics can be explained as follows:
(1) Helpful in framing suitable policies: Index numbers provide guidelines to policy makers in framing suitable economic policies. Index numbers are helpful in framing the economic policies such as agricultural policy and industrial policy. Index numbers also help in the fixation of wages and dearness allowance in accordance with the cost of living, etc.

(2) Helpful in studying trends and tendencies : Index numbers are widely used to measure changes in various economic variables such as production, prices, exports, imports, etc. over a period of time. For example, by examining the index of industrial

production for the last five years, important conclusions about the trend of industrial production, 1.e. whether the industrial production shows an upward tendency or a downward tendency can be drawn

(3) Helpful in forecasting future economic activity : Index numbers help in making predictions on the basis of analysing the past and present trends in the economic activities. For example, by examining the data pertaining to exports of alphonso mangoes from the year 2009 to 2014 and from the year 2014 to 2019, if it is noticed that the export of alphonso mangoes has been increasing. It can be predicted that an increase in exports will continue in future.

(4) Helpful in measurement of inflation : Index numbers are also used to measure changes in the price level from time to time. The measurement of inflation enables the government to undertake appropriate anti-inflationary measures. For example, there is a legal provision to pay the D.A. (dearness allowance) to the employees in organised sector on the basis of changes in Dearness Index. Thus, with the help of the Dearness Index, the government can increase the D.A. from time to time.

(5) Useful to present financial data in real terms : Rise in money supply over a period of time leads to inflation in an economy. Inflation has its effects on various economic variables such as total production, national income, price level, wage level, etc. Index numbers can exclude the effects of inflation by deflating the values of these various economic variables on the basis of their constant prices. Thus, index numbers can measure the changes in the values of various economic variables in real terms.

Q. 7. Answer in detail:
1) Explain the steps involved in the construction of index numbers.
Ans. The steps involved in the construction of index numbers are as follows:
(1) Deciding the purpose of index numbers : Deciding the purpose of index numbers is the first important step in the construction of index numbers. The purpose for constructing the index number, its scope as well as which variable is intended to be measured should be clearly decided to achieve fruitful results. For example, if the purpose of constructing index numbers is to find out the changes in the wholesale prices of a particular commodity, then collecting the retail prices of a particular commodity will not be fruitful.

(2) Selecting the base year : Base year is also called the reference year. It is the year against which comparisons are made. The base year should be normal, i.e. it should be free from natural calamities, warlike conditions, emergencies, etc. It should not be too distant in the past.

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(1) Quantity weights (q) and
(2) Value weights (p x q). Since all items are not of equal importance, while constructing index numbers, specific weights are assigned to various commodities for achieving better results.

(7) Selecting an appropriate formula : Various formulae are devised for the construction of index numbers. According to the purpose of index number and availability of data, a suitable formula is chosen for constructing index numbers.