INDEX NUMBERS
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CHAPTER -8
INDEX NUMBER
$\rightarrow$ An index number is a statistical device designed to measure the relative change in the level of a phenomean with respect to time. geographical location or other characteristics such as income, profession, etc.

Types of Index Number:

1. Price Index Number
2. Quantity index Number
3. Value index Number

Methods of Constructing Index Numbers

1. Unweighted Indices
a. Simple aggregative indices
b. simple average of relative indices
2. Weighted indices
a. Weighted aggregative indices
b. Weighted average of relative indices
3. Unweighted Indices:
a. Simple Aggregative indices

$$
P_{01}=\frac{\Sigma P_{1}}{\sum P_{0}} \times 100
$$

Where,
$P_{01}=$ Price Index number of the current year 'I' with respect to base year ' 0 ':
$P_{1}=$ Price in the current Year
$p_{0}=$ Price in the base year
b. Simple average of relative indices
$P_{01}=\frac{\sum p}{n} \quad$ or $\quad a n t i \log \left[\frac{\sum \log P}{n}\right]$
Where,
$\Sigma p=$ total price relative $=\frac{p_{1}}{p_{0}} \times 100$
$\square n=$ no of items
2. Weighted Index Number
$P_{0}=$ Price in the base Year (Last Year)
$P_{1}=$ Price in the current Year (Present Year)
$90=$ Quantity in the base Year
$q_{1}=$ Quantity in the current year
a. Weighted Aggregative Method:
i. Laspeyre's Price Index Number

$$
P_{01}(L)=\frac{\sum P_{1} 9_{0}}{\sum P_{0} q_{0}} \times 100
$$

ii. Paasche's Price Index Number

$$
P_{01}(p)=\frac{\sum p_{1} q_{1}}{\sum p_{0} q_{1}} \times 100
$$

ii. Fisher's Price Index Number

$$
\begin{aligned}
P_{01}(F) & =\sqrt{P_{01}(L) \times P_{01}(P)} \\
& =\sqrt{\frac{\sum p_{1} q_{0}}{\sum p_{0} q_{0}} \times 100 \cdot \frac{\sum p_{1} q_{1}}{\sum p_{0} q_{1}} \times 100} \\
& =\sqrt{\frac{\sum p_{1} 9_{0}}{\sum p_{0} q_{0}} \times \frac{\sum p_{1} q_{1}}{\sum p_{0} q_{1}}} \times 100
\end{aligned}
$$

b. Weighted average of relatives:

$$
\begin{aligned}
& P_{01}(A \cdot M)=\frac{\Sigma P W}{\sum W} \quad \begin{array}{l}
\text { Where, } \\
W=\text { weight }=P_{0} q_{0} \\
P=\text { Price relative }=\frac{P_{1}}{P_{0}} \times 100
\end{array} \\
& P_{01}(G \cdot M)=\text { Antilog }\left[\frac{\sum W \log P}{\Sigma W}\right]
\end{aligned}
$$

* Fisher's Index is called 'Ideal' Index for the following reasons: 1. It is based on the geometric mean which is the best average for constructing index number.

2. It takes into account both current year as well as base year prices and quantities.
3. It satisfies both the time reversal test and the factor: reversal test.
4. It has no bias (पक्षपाती) in any direction.

* Quantity Index Number

$$
\begin{aligned}
& Q_{01}(\text { simple })=\frac{\sum q_{1}}{\sum q_{0}} \times 100 \\
& Q_{01}(L)=\frac{\sum P_{0} q_{1}}{\sum P_{0} q_{0}} \times 100 \\
& Q_{01}(P)=\frac{\sum P_{1} q_{1}}{\sum P_{1} 9_{0}} \times 100 \\
& Q_{01}(F)=\sqrt{\frac{\sum p_{0} q_{1}}{\sum p_{0} q_{0}} \times \frac{\sum P_{1} q_{1}}{\sum P_{1} q_{0}}} \times 100
\end{aligned}
$$


$\begin{array}{ll}\text { (a) Laspeyre's Method } & \text { (b) Paasche's Method }\end{array}$

$$
\begin{array}{rlrl}
P_{01}(L) & =\frac{\sum P_{1} q_{0}}{\sum P_{0} 9_{0}} \times 100 & P_{01}(P) & =\frac{\sum p_{1} q_{1}}{\sum P_{0} q_{1}} \times 100 \\
& =\frac{19150}{7610} \times 100 & =\frac{23,200}{9200} \times 100
\end{array}
$$

|  | 7610 |
| ---: | :--- |
|  | $=251.64$ |



Fisher's Ideal Index $45 \quad 3+2$

$$
P_{01}(F)=\sqrt{\frac{\sum P_{1} q_{0}}{\sum P_{0} q_{0}} \times \frac{\sum P_{1} q_{1}}{\sum P_{0} q_{1}} \times 100}
$$

$$
=\sqrt{\frac{97}{116} \times \frac{917}{140}} \times 100
$$

$$
=83.59
$$

$\qquad$

2065.Q.N0.7

SO1 ${ }^{n}$


$$
\left.\begin{array}{|c|c|c|}
2059 & 840 & =\frac{840}{650} \times 100=129.23 \\
2060 & 880 & =\frac{880}{650} \times 100=135.38 \\
2061 & 900 & =\frac{900}{650} \times 100=138.46
\end{array} \right\rvert\,
$$

* Test of consistency of Index Number formule:

1. Time Reversal Test
2. Factor Reversal test
3. Time Reversal Test

$$
\begin{aligned}
& P_{01} \times P_{10}=1 \\
& P_{01}(L)= \frac{\sum P_{1} q_{0}}{\sum P_{0} q_{0}} \\
& P_{01}(P)= \frac{\sum P_{1} q_{1}}{\sum P_{0} q_{1}} \quad P_{10}(L)=\frac{\sum P_{0} q_{1}}{\sum P_{1} q_{1}} \\
& P_{01}(F)=\sqrt{\frac{\sum P_{1} q_{0}}{\sum P_{0} q_{0}} \times \frac{\sum P_{1} q_{1}}{\sum P_{0} q_{1}} \quad P_{10}(P)=\frac{\sum P_{0} q_{0}}{\sum P_{1} q_{0}}}=\sqrt{\frac{\sum P_{0} q_{L}}{\sum P_{1} q_{1}} \times \frac{\sum P_{0} q_{0}}{\sum P_{1} q_{0}}}
\end{aligned}
$$

2. Factor Reversal Test

$$
\begin{array}{r}
P_{01} \times Q_{01}=V_{O 1}=\sum P_{1} q_{1} \\
\sum P_{0} 9_{0}^{1}
\end{array}
$$

Note: Time Reversal Test $₹$ Factor Reversal Test गढ़ी Formula HT $\times 100$ नर्गे.

2076 Q. NO. 11

| SOl $^{n}$ |  |  | 2010 | 2012 |  | $q_{0}=p_{0} q_{0}$ | $q_{1}=p_{1} q_{1}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Commodities | $p_{0}$ | $p_{0} q_{0}$ | $p_{1}$ | $p_{1} q_{1}$ | $p_{0}$ | $p_{1}$ | $p_{0} q_{1}$ | $p_{1} q_{0}$ |
| $W$ | 4 | 32 | 5 | 50 | 8 | 10 | 40 | 40 |
| $X$ | 5 | 50 | 6 | 72 | 10 | 12 | 60 | 60 |
| $Y$ | 3 | 18 | 4 | 28 | 6 | 7 | 21 | 24 |
| $z$ | 8 | 40 | 10 | 40 | 5 | 4 | 32 | 50 |
|  |  | $\sum p_{0} 9_{0}$ |  | $\sum p_{1} q_{1}$ |  |  | $\sum p_{0} q_{1}$ | $\sum p_{1} 9_{0}$ |
|  |  | $=140$ |  | $=190$ |  |  | $=153$ | $=174$ |

For Time Reversal Test:

$$
\begin{gathered}
P_{01}(F) \times P_{10}(F)=1 \\
P_{01}(F)=\sqrt{\frac{\sum P_{1} q_{0}}{\sum P_{0} q_{0}} \times \frac{\sum P_{1} q_{1}}{\sum P_{0} q_{1}}}=\sqrt{\frac{174}{140} \times \frac{190}{153}} \\
P_{10}(F)=\sqrt{\frac{\sum P_{0} q_{1}}{\sum P_{1} q_{1}} \times \frac{\sum P_{0} q_{0}}{\sum P_{1} q_{0}}}=\sqrt{\frac{153}{190} \times \frac{140}{174}}
\end{gathered}
$$

Now,

$$
\begin{aligned}
P_{01}(F) \times P_{10}(F) & =\sqrt{\frac{174}{140} \times \frac{190}{153}} \times \sqrt{\frac{193}{190}} \times \frac{140}{174} \\
& =\sqrt{\frac{174}{140} \times \frac{190}{153} \times \frac{153}{190} \times \frac{140}{174}}=\sqrt{1}=1
\end{aligned}
$$

Hence, Fisher's Index satisfy Time Reversal Test.

$$
\begin{aligned}
& \text { Factor Reversal Test } \\
& \qquad P_{01}(F) \times Q_{01}(F)=V_{01}=\frac{\sum P_{1} q_{1}}{\sum P_{0} q_{0}}=\frac{190}{140} \\
& Q_{01}(F)=\sqrt{\frac{\sum P_{0} q_{1}}{\sum P_{0} 9_{0}} \times \frac{\sum P_{1} q_{1}}{\sum P_{1} q_{0}}=\sqrt{\frac{153}{140} \times \frac{190}{174}}}
\end{aligned}
$$

Now,

$$
\begin{aligned}
P_{01}(F) \times Q_{01}(F) & =\sqrt{\frac{174}{140} \times \frac{190}{153} \times \sqrt{\frac{153}{140} \times \frac{190}{174}}} \\
& =\sqrt{\frac{174}{140} \times \frac{190}{153} \times \frac{153}{140} \times \frac{190}{174}} \\
& =\sqrt{\frac{(190)^{2}}{(140)^{2}}}=\frac{190}{140}=V_{01}
\end{aligned}
$$

Hence, Fisher's Index satisfies Factor Reversal Test.

calculation of Fisher's Index

$$
\begin{aligned}
P_{01}(F) & =\sqrt{\frac{\sum P_{1} q_{0}}{\sum P_{0} 9_{0}} \times \frac{\sum P_{1} q_{1}}{\sum P_{0_{1} 9_{1}}} \times 100} \\
& =\sqrt{\frac{1025}{1125} \times \frac{980}{1070} \times 100}=91.35
\end{aligned}
$$

Time Reversal Test

$$
\begin{gathered}
P_{01}(F) \times P_{10}(F)=1 \\
P_{01}(F)=\sqrt{\frac{\sum P_{1} q_{0}}{\sum P_{0} q_{0}} \times \frac{\sum P_{1} q_{1}}{\sum P_{0} q_{1}}=\sqrt{\frac{1025}{1125} \times \frac{980}{1070}}} \\
P_{10}(F)=\sqrt{\frac{\sum P_{0} q_{1}}{\sum P_{1} q_{1}} \times \frac{\sum P_{0} q_{0}}{\sum P_{1} q_{0}}=\sqrt{\frac{1070}{980} \times \frac{1125}{1025}}}
\end{gathered}
$$

Now,

$$
\begin{aligned}
P_{11}(F) \times P_{10}(F) & =\sqrt{\frac{1025}{125} \times \frac{980}{1070}} \times \sqrt{\frac{1070}{980} \times \frac{1125}{1025}} \\
& =\sqrt{\frac{1025}{1125} \times \frac{980}{1070} \times \frac{1070}{980} \times \frac{1125}{1025}} \\
& =\sqrt{1}=1
\end{aligned}
$$

Hence, Fisher's Index satifies Time Reversal Test-
2071 Q.N0.18 (Analytical)

| Sol |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Bare Year |  |  | Current Year |  |  |  |  |
| Commodity | $P_{0}$ | $q_{0}$ | $P_{1}$ | $q_{1}$ | $P_{0} q_{0}$ | $P_{1} q_{1}$ | $P_{0} q_{1}$ | $P_{1} q_{0}$ |
| A | 10 | 6 | 12 | 10 | 60 | 120 | 100 | 72 |
| B | 12 | 12 | 15 | 15 | 144 | 225 | 180 | 180 |
| C | 15 | 25 | 18 | 30 | 375 | 540 | 450 | 450 |
| D | 20 | 40 | 25 | 40 | 800 | 1000 | 800 | 1000 |
| E | 13 | 17 | 20 | 15 | 221 | 300 | 195 | 340 |
|  |  |  |  |  | $\sum p_{0} 90$ | $\sum P_{1} q_{1}$ | $\sum P_{0} q_{1}$ | $\sum p_{1} q_{0}$ |

Time Reversal test
Pot $X P_{10}=1$

For Paasche's

$$
\begin{aligned}
& P_{01}(P)=\frac{\sum P_{1} q_{1}}{\sum P_{0} q_{1}}=\frac{2185}{1725} \\
& P_{10}(P)=\frac{\sum P_{0} q_{0}}{\sum P_{1} q_{0}}=\frac{1600}{2042}
\end{aligned}
$$

Now,

$$
P_{01}(P) \times P_{10}(P)=\frac{2185}{1725} \times \frac{1600}{2042}=0.9924 \neq 1
$$

Hence, paasche's index does not satisfy time reversal test.
For Fisher's

$$
\begin{aligned}
& P_{01}(F)=\sqrt{\frac{\sum P_{1} q_{0}}{\sum P_{0} q_{0}} \times \frac{\sum p_{1} q_{1}}{\sum p_{0} q_{1}}}=\sqrt{\frac{2042}{1600} \times \frac{2185}{1725}} \\
& P_{10}(F)=\sqrt{\frac{\sum p_{0} q_{1}}{\sum P_{1} q_{1}} \times \frac{\sum p_{0} q_{0}}{\sum P_{1} q_{0}}}=\sqrt{\frac{1725}{2185} \times \frac{1600}{2042}}
\end{aligned}
$$

Now,

$$
\begin{aligned}
P_{01}(F) \times P_{10}(F) & =\sqrt{\frac{2042}{1600} \times \frac{2185}{1725}} \times \sqrt{\frac{1725}{2185} \times \frac{1600}{2042}} \\
& =\sqrt{\frac{2042}{1600} \times \frac{2185}{1725} \times \frac{1725}{2185} \times \frac{1600}{2042}=\sqrt{1}=1}
\end{aligned}
$$

Hence, fisher's Index satifies lime Reversal test.

Factor Reversal Test:

$$
P_{01} \times Q_{01}=V_{01}=\frac{\sum p_{1} 9_{1}}{\sum P_{0} q_{0}}=\frac{2185}{1600}=1.365625
$$

For Paasche's

$$
Q_{01}(P)=\frac{\sum P_{1} q_{1}}{\sum P_{1} q_{0}}=\frac{2185}{2042}
$$

Q. Now,

$$
P_{01}(P) \times Q_{01}(P)=\frac{2185}{1725} \times \frac{2185}{2042}=1.3553 \neq V_{01}
$$

Hence, Paasche's index does nor satisfy Factor reversal test-
For Fisher's:

$$
Q_{01}(F)=\sqrt{\frac{\sum p_{0} q_{1}}{\sum p_{0} q_{0}} \times \frac{\sum p_{1} q_{1}}{\sum p_{1} q_{0}}}=\sqrt{\frac{1725}{1600} \times \frac{2185}{2042}}
$$

Now,

$$
\begin{aligned}
P_{01}(F) \times Q_{01}(F) & =\sqrt{\frac{2012}{1600} \times \frac{2185}{1725}} \times \sqrt{\frac{1725}{1600} \times \frac{2185}{2042}} \\
& =\sqrt{\frac{2042}{1600} \times \frac{2185}{1725} \times \frac{1725}{1600} \times \frac{2185}{2041}} \\
& =\sqrt{\left(\frac{(185)^{2}}{(1600)^{2}}\right.}=\frac{2185}{1600}
\end{aligned}
$$

Hence, fishers index satifies factor Reversal Test.


Calculation of Price Index Number

1. $P_{01}(L)=\frac{\sum P_{1} 9_{0}}{\sum P_{0} 9_{0}} \times \pm 00=\frac{202}{91} \times 100=221.98$
2. $P_{01}(F)=\sqrt{\frac{\sum p_{1} q_{0}}{\sum p_{0} q_{0}} \times \frac{\sum P_{1} q_{1}}{\sum P_{0} q_{1}} \times 100}$

$$
=\sqrt{\frac{202}{91} \times \frac{199}{92} \times 100=219.12}
$$

3. $P_{01}(p)=\frac{\sum p_{1} q_{1}}{\sum p_{0} q_{1}} \times 100=\frac{199}{92} \times 100=216.30$

Time Reversal Test:

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

For laspeyre's

$$
\begin{aligned}
& P_{0_{1}}(L)=\frac{\sum P_{1} q_{0}}{\sum P_{0} q_{0}}=\frac{202}{91} \\
& P_{10}(L)=\frac{\sum P_{0} q_{1}}{\sum P_{1} q_{1}}=\frac{92}{199}
\end{aligned}
$$

Now,

$$
P_{01}(L) \times P_{10}(L)=\frac{202}{91} \times \frac{92}{199}=1.026 \neq 1
$$

Hence, Laspeye's does not satisfy time reversal test
For Fisher's

$$
\begin{aligned}
& P_{01}(F)=\sqrt{\frac{\sum p_{1} q_{0}}{\Sigma P_{0} q_{0}} \times \frac{\Sigma p_{1} q_{1}}{\sum P_{0} q_{1}}}=\sqrt{\frac{202}{g_{1}} \times \frac{199}{92}} \\
& P_{10}(F)=\sqrt{\frac{\Sigma p_{0} q_{1}}{\sum p_{1} q_{1}} \times \frac{\Sigma p_{0} q_{0}}{\sum p_{1} q_{0}}}=\sqrt{\frac{92}{199} \times \frac{91}{202}}
\end{aligned}
$$

Now,

$$
P_{01}(F) \times P_{10}(F)=\sqrt{\frac{202}{91} \times \frac{199}{92} \times \frac{92}{199} \times \frac{91}{202}}=\sqrt{1}=1
$$

Hence, Fisher's Index satisfies time reversal test

For Paasches

$$
\begin{aligned}
& P_{01}(P)=\frac{\sum P_{1} q_{1}}{\sum P_{0} q_{1}}=\frac{199}{92} \\
& P_{10}(P)=\frac{\sum P_{0} q_{0}}{\sum P_{1} 9_{0}}=\frac{91}{202}
\end{aligned}
$$

Now,

$$
P_{01}(P) \times P_{10}(P)=\frac{199}{92} \times \frac{91}{202}=0.974 \neq 1
$$

Hence, Paasche's Index does not satisfy time reversal test.
Factor Reversal Test:

$$
P_{01} X Q_{01}=V_{01}=\frac{\sum P_{1} 9_{1}}{\sum P_{0} 9_{0}}=\frac{199}{91}=2.186
$$

For Laspeyre's

$$
Q_{01}(L)=\frac{\Sigma p_{0} q_{1}!}{\Sigma p_{0} 9_{0}}=\frac{92}{91}
$$

Now,

$$
P_{01}(L) \times Q_{01}(L)=\frac{202}{91} \times \frac{92}{91}=2.244 \neq V_{01}
$$

Hence, Laspeyre's index does not satisfy factor reverrai test.

For Fisher's

$$
Q_{01}(F)=\sqrt{\frac{\sum P_{0} q_{1}}{\sum p_{0} q_{0}} \times \frac{\sum p_{1} q_{1}}{\sum P_{1} q_{0}}}=\sqrt{\frac{92}{91} \times \frac{199}{202}}
$$

Now,

$$
\begin{aligned}
& P_{01}(F) \times Q_{01}(F)=\sqrt{\frac{202}{91} \times \frac{199}{92} \times \frac{92}{91} \times \frac{199}{202}} \\
& =\sqrt{\frac{(199)^{2}}{(91)^{2}}}=\frac{199}{91}=V_{01}
\end{aligned}
$$

Hence, fishers Index satifies factor reversal test:
For Paasche's

$$
Q_{01}(p)=\frac{\sum p_{1} q_{1}}{\sum p_{1} q_{0}}=\frac{199}{202}
$$

Now,

$$
P_{01}(P) \times Q_{01}(P)=\frac{199}{92} \times \frac{199}{202}=2.130 \neq V_{01}
$$

Hence. Paasche's Index does not satisfy factor Reversal test.
Features of Laspeyre's Index:

1. It uses only base year quantity as weight while calculating
price Index.
2. If does not satisfy time reversal test and factor reversal
test.

Features of Fisher's Index:

1. It uses both current year and base year price and quantity as weight.
2. It satisfies both time reversal test and factor reversal test.

Features of Paasche's index:

1. It uses only current year price and quantity as weight.
2. It does not satisfy time reversal test and factor reversal test.

* Cost of Living Index (COLI)/Consumer's Price Index Number:

Methods of constructing cOLI

1. Aggregate Expenditure Method:

$$
\text { COLI }=\frac{\sum P_{1} Q_{0}}{\sum P_{0} 9_{0}} \times 100 \quad[\because \text { Las pyre's index }]
$$

2. Family Budget Method: $\left.\quad\left[\begin{array}{rl}C O L I & =\frac{\Sigma \frac{P_{1}}{P_{0}} \times 100}{P_{0} P_{0} 9_{0}} \\ \text { COLI } & =\frac{\Sigma P W}{\Sigma W} \text { or, } \frac{\Sigma W I}{\Sigma W}\end{array}\right]=\frac{\Sigma P_{1} 9_{0}}{\Sigma P_{0} 9_{0}} \times 100 \quad\right]$

Where, $P=$ price Relative $=\frac{P_{1}}{P_{0}} \times 100$

$$
\begin{aligned}
& W=\text { Weight }=P_{0} q_{0} \\
& I=\text { Index }
\end{aligned}
$$

2077 Q. No. 11
Sol 1

| Calculation of Cost of Living |  |  |  |  |  | Index (COLI) |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| Expenses | Weight $(W)$ | $P_{0}$ | $P_{1}$ | Price Relative $(P)=$ | $\frac{P_{1}}{P_{0}} \times 100$ | $P W$ |
| Food | $35 \%$ | 150 | 74 | 116 | 4060 |  |
| Rent | $15 \%$ | 50 | 60 | 120 | 1800 |  |
| Cloting | $20 \%$ | 100 | 125 | 125 | 2500 |  |
| fuel | $10 \%$ | 20 | 25 | 125 | 1250 |  |
| Misc. | $20 \%$ | 60 | 90 | 150 | 3000 |  |
|  | $\Sigma W=100$ |  |  |  |  |  |

Here,

$$
\text { Cost of Living index }(\text { coL })=\frac{\sum p w}{\sum W}=\frac{12610}{100}=126 \cdot 10
$$

$\therefore$ The cost of living index in 2013 has been increased by
$26.10 \%(126.10-100)$ as compared to base period... $26.10 \%(126.10-100)$ as compared to base period.
Again.
Base period: Salary $(2012)=R 5 \cdot 20,000$
current period salary $(2013)=$ ?
$\therefore$ Salary in $2013=20,000+26 \cdot 10 \%$ of 20,000

$$
\begin{aligned}
& =20,000+5220 \\
& =R \cdot 25.220
\end{aligned}
$$

2071 old $Q \cdot N 0.8$
Sol
Since. both base year and current year price and quantity are given. Fishers index is the suitable index for the given data.


Here,

$$
\begin{aligned}
P_{01}(F) & =\sqrt{\frac{\sum P_{1} q_{0}}{\sum P_{0} q_{0}} \times \frac{\sum P_{1} q_{1}}{\sum P_{0} q_{1}} \times 100} \\
& =\sqrt{\frac{600}{240} \times \frac{480}{192} \times 100}=250
\end{aligned}
$$

cost of
Calculation of living Index (COLI)

$$
\text { COLI }=\frac{\sum p_{1} 9_{0}}{\sum p_{0} q_{0}} \times 100=\frac{600}{240} \times 100=250
$$

$\therefore$ The cost of living Index in 2010 has been increased by $150 \%(250-100)$ as compared to 2008.

$$
\begin{aligned}
& \text { Income in } 2008=\text { Rs. } 10,000 \\
& \text { Income in } 2010=\text { ? } \\
& \text { Here, } \\
& \text { Income in } 2010=10,000+150 \% \text { of } 10,000 \\
&=10,000+15000 \\
&=\{5 \cdot 25,000 .
\end{aligned} \quad \begin{aligned}
2070 \text { Q.NO. } 8(b)
\end{aligned}
$$

Sop

Given:
Calculation of cost of Living index (COLI)


Cost of living index $($ COLL $)=\frac{\Sigma p W}{\Sigma W}=\frac{14575}{100}=1145.75$
$\therefore$ She cost of living Index has been increased by $45.75 \%$ ( $145.75-100$ ) in current period as compared to base period.
soyonerphenerb.
2068 Q $2 \cdot N 0.9$
Sold
Calculation of cost of living index (cols)

| Group | Group Index (t) | $\frac{\text { Group weight (w) }}{40}$ | $\frac{\text { wI }}{16,400}$ |
| :--- | :---: | :---: | :---: |
| Food | 410 | 45 | 6750 |
| Clothing | 450 | 7 | 2100 |
| light | 300 | 10 | 3700 |
| Rent | 370 | 10 | 2000 |
| Fuel | 200 | 18 | $\frac{5040}{}$ |
| Misc. | 280 | $\Sigma w=100$ | $\Sigma w=35990$ |
|  |  |  |  |

$\therefore \operatorname{Cost}$ of living index (COLI) $=\frac{\Sigma W I}{\Sigma W}=\frac{35990}{100}=359.90$
Therefore, the cost of living index has been increased by
$259.90 \%(359.90-100)$ in 2003 as compared to base period 1995. So, salary should also increase in the same ratio.

Salary in $1995=R 5.5000$
Salary in $2003=5000+259.90 \%$ of 5000

$$
\begin{aligned}
& =5000+12.995 \\
& =R S \cdot 17995
\end{aligned}
$$

* Real wage:

$$
\begin{aligned}
& \text { Real wage }=\frac{\text { wage }}{\text { Pice Index }} \times 100 \\
& \text { Real wage Index }=\frac{\text { Real wage for Current Year }}{\text { Real wage for Base Year }} \times 100
\end{aligned}
$$

$$
\begin{aligned}
& 2064 Q \cdot N 0.9 \text { (old) } \\
& \text { Son }
\end{aligned}
$$

Calculation of Real wage


The real wage was highest and lowest in the year 1997 and 2000 respectively.

2072 ord $Q \cdot$ No. 10
Sojn
Real wage $=\frac{\text { wage }}{\text { Price Index }} \times 100$
Real wage index $=\frac{\text { Real wage for current Year }}{\text { Real wage for Base year }} \times 100$

CaIn of Real wage index.
$\frac{\text { Year wage (in } 8 \text { s.) Price indices Real wage Rear wage Index }}{2000(s a s)}$

| $2000(3015)$ | 180 | 100 | $\frac{180}{100} \times 100=180$ | $\frac{180}{180} \times 100=100$ |
| :--- | :--- | :--- | :--- | :--- |
| 2001 | 230 | 170 | $\frac{230}{170} \times 100=135.29$ | $\frac{135.29}{180} \times 100=75.16$ |
| 2002 | 340 | 300 | $\frac{340}{300} \times 100=113.33$ | $\frac{113.33}{180} \times 100=62.96$ |
| 2003 | 360 | 320 | $\frac{360}{320} \times 100=112.5$ | $\frac{112.5}{180} \times 100=62.5$ |
| 2004 | 365 | 330 | $\frac{365}{330} \times 100=110.61$ | $\frac{110.61}{180} \times 100=61.45$ |
| 2005 | 370 | 340 | $\frac{370}{340} \times 100=108.82$ | $\frac{108.82}{280} \times 100=60.45$ |
| 2006 | 375 | 350 | $\frac{375}{350} \times 100=107.14$ | $\frac{107.14}{180} \times 100=59.52$ |



2074 Q.N0. 5 Son

$$
\begin{array}{ll}
\text { Base Index }=100 & \text { Base year wage }=R: 300 \\
\text { current Index }=200 & \text { Current year wage }=R s \cdot 500
\end{array}
$$

Since, the index in current year has been increased by $100 \%$ (200-100) as compared to base period, the wage should also increase in the same ratio.

Cument wage $=300+100 \%$ of $300=$ RS. 600
the wages given to the worker is pr.500 but the required wage is ks.600, the worker does not gain.
$20722^{\circ}$ Q No. 9
Sol'
Given:

$$
\begin{aligned}
& \Sigma P W=A M 12,610 \\
& \Sigma W=100
\end{aligned}
$$

cost of living Index (COLI) $=\frac{\Sigma P W}{\sum W}=\frac{12610}{100}=126.10$
Base period salany $=R s \cdot 50,000$
current period salary = ?
She cost of living standard has been increased by $26.10 \%$
$(126 \cdot 10-100)$ so, the salary should also increase i $\Omega$
the same ratio.

$$
\begin{aligned}
\therefore \text { current period salay } & =50,000+26 \cdot 10 \% \text { of } 50,000 \\
& =R s \cdot 63,050
\end{aligned}
$$

$$
=R S \cdot 63.050
$$



