

EXERCISE NO. 4

-:4.3:-

Year	Price
1930	15
1991	14
1932	19
1935	21
1934	24
1935	23
1936	25
1937	22
1938	26

(a) 1. Nos. (1930 as base)	(b) 1. No. (1935 as base)
$\frac{15}{15} \times 100 = 100$	$\frac{15}{23} \times 100 = 65.22$
$\frac{45}{15} \times 100 = 93.33$	$\frac{14}{23} \times 100 = 60.87$
$\frac{19}{15} \times 100 = 126.67$	$\frac{19}{23} \times 100 = 82.61$
$\frac{21}{15} \times 100 = 140$	$\frac{21}{23} \times 100 = 91.30$
$\frac{24}{15} \times 100 = 160$	$\frac{24}{23} \times 100 = 104.35$
$\frac{23}{15} \times 100 = 153.33$	$\frac{23}{23} \times 100 = 100$
$\frac{25}{15} \times 100 = 166.67$	$\frac{25}{23} \times 100 = 108.7$
$\frac{22}{15} \times 100 = 146.67$	$\frac{22}{23} \times 100 = 95.65$
$\frac{26}{15} \times 100 = 173.33$	$\frac{26}{23} \times 100 = 113.04$

-:4.4:-

(I)	Year	Prices	Index Number (1974 as base year)
	1975	20	= 100
	1975	18	$\frac{18}{20} \times 100 = 90$
	1976	23	$\frac{23}{20} \times 100 = 90$
	1977	24	$\frac{24}{20} \times 100 = 120$
	1978	25	$\frac{25}{20} \times 100 = 125$
	1979	27	$\frac{27}{20} \times 100 = 135$
	1980	28	$\frac{28}{20} \times 100 = 140$
	1981	30	$\frac{30}{20} \times 100 = 150$
	1982	32	$\frac{32}{20} \times 100 = 160$
	1983	33	$\frac{33}{20} \times 100 = 165$

$$\text{Average of first five year} = \frac{20 + 18 + 23 + 24 + 25}{5} = 22$$

$$\text{Average of all 10 years} = \frac{20 + 18 + 23 + 24 + 25 + 27 + 28 + 30 + 32 + 33}{10} = 26$$

(ii) Index Numbers Taking average of first five years as base

$$\frac{20}{22} \times 100 = 90.90$$

$$\frac{18}{22} \times 100 = 81.82$$

$$\frac{23}{22} \times 100 = 104.54$$

$$\frac{24}{22} \times 100 = 109.09$$

$$\frac{25}{22} \times 100 = 113.64$$

Index Numbers Taking average of first five years as base

$$\frac{27}{22} \times 100 = 122.73$$

$$\frac{28}{22} \times 100 = 127.37$$

$$\frac{30}{22} \times 100 = 135.36$$

$$\frac{32}{22} \times 100 = 145.45$$

$$\frac{33}{22} \times 100 = 150.00$$

(iii) Index Numbers Taking average of whole data as base

$$\frac{20}{26} \times 100 = 76.92$$

$$\frac{18}{26} \times 100 = 69.23$$

$$\frac{23}{26} \times 100 = 92.46$$

$$\frac{24}{26} \times 100 = 96.20$$

$$\frac{25}{26} \times 100 = 96.15$$

Index Numbers Taking average of whole data as base

$$\frac{27}{26} \times 100 = 103.85$$

$$\frac{28}{26} \times 100 = 107.69$$

$$\frac{30}{26} \times 100 = 115.38$$

$$\frac{32}{26} \times 100 = 123.07$$

$$\frac{33}{26} \times 100 = 126.92$$

-:4.5:-

Year	Price	I. No. (1953 as base)
1954	122.5	$\frac{122.5}{122.5} \times 100 = 100$
1955	116	$\frac{116}{122.5} \times 100 = 94.69$
1956	120	$\frac{120}{122.5} \times 100 = 97.96$
1957	137	$\frac{137}{122.5} \times 100 = 111.84$
1958	149	$\frac{149}{122.5} \times 100 = 121.63$
1959	156.8	$\frac{156.8}{122.5} \times 100 = 128.0$
1960	162	$\frac{162}{122.5} \times 100 = 132.24$
1961	149	$\frac{149}{122.5} \times 100 = 121.63$
1962	160.6	$\frac{160.6}{122.5} \times 100 = 131.1$
1963	153.1	$\frac{153.1}{122.5} \times 100 = 124.98$

-:4.6:-

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

(a) I. No. (1930 as base)	(b) I. No. (1935 as base)
$\frac{4}{4} \times 100 = 100$	$\frac{4}{10} \times 100 = 40$
$\frac{5}{4} \times 100 = 125$	$\frac{5}{10} \times 100 = 50$
$\frac{6}{4} \times 100 = 150$	$\frac{6}{10} \times 100 = 60$
$\frac{7}{4} \times 100 = 175$	$\frac{7}{10} \times 100 = 70$
$\frac{8}{4} \times 100 = 200$	$\frac{8}{10} \times 100 = 80$
$\frac{10}{4} \times 100 = 250$	$\frac{10}{10} \times 100 = 100$
$\frac{9}{4} \times 100 = 225$	$\frac{9}{10} \times 100 = 90$
$\frac{10}{4} \times 100 = 250$	$\frac{10}{10} \times 100 = 100$
$\frac{11}{4} \times 100 = 275$	$\frac{11}{10} \times 100 = 110$

-:4.7:-

Year	Price	Index Nos. (1919 as base)
1919	120	$\frac{120}{120} \times 100 = 100$
1920	122	$\frac{122}{120} \times 100 = 101.7$
1921	116	$\frac{116}{120} \times 100 = 96.7$
1922	120	$\frac{120}{120} \times 100 = 100$
1923	120	$\frac{120}{120} \times 100 = 100$
1924	137	$\frac{137}{120} \times 100 = 114.2$
1925	136	$\frac{136}{120} \times 100 = 113.3$
1926	149	$\frac{149}{120} \times 100 = 124.2$
1927	156	$\frac{156}{120} \times 100 = 130$
1928	137	$\frac{137}{120} \times 100 = 114.2$
1929	162	$\frac{162}{120} \times 100 = 135$
1930	149	$\frac{149}{120} \times 100 = 124.2$
1931	160	$\frac{160}{120} \times 100 = 133.33$
1932	160	$\frac{160}{120} \times 100 = 133.33$

-:4.8:-

Year	Price
1977	22.5
1978	25.0
1979	27.5
1980	30.0
1981	35.0
1982	32.5
1983	37.5
1984	47.5
1984	47.5
1985	45.0

I. Nos.(1977 as base)	I. Nos. (average as base)
$\frac{22.5}{22.5} \times 100 = 100$	$\frac{22.5}{33.61} \times 100 = 66.94$
$\frac{25.0}{22.5} \times 100 = 111.11$	$\frac{25.0}{33.61} \times 100 = 74.38$
$\frac{27.5}{22.5} \times 100 = 122.22$	$\frac{27.5}{33.61} \times 100 = 81.82$
$\frac{30.0}{22.5} \times 100 = 133.33$	$\frac{30.0}{33.61} \times 100 = 89.26$
$\frac{35.0}{22.5} \times 100 = 155.56$	$\frac{35.0}{33.61} \times 100 = 104.14$
$\frac{32.5}{22.5} \times 100 = 144.44$	$\frac{32.5}{33.61} \times 100 = 96.69$
$\frac{37.5}{22.5} \times 100 = 166.67$	$\frac{37.5}{33.61} \times 100 = 111.51$
$\frac{47.5}{22.5} \times 100 = 211.11$	$\frac{47.5}{33.61} \times 100 = 141.33$
$\frac{45.5}{22.5} \times 100 = 200.00$	$\frac{45.5}{33.61} \times 100 = 133.89$

$$\text{Mean of 9 values} = \frac{302.5}{9} = 33.61$$

-:4.9:-

Year	Price	Index Nos. (1970 as base)
1965	10.50	$\frac{10.50}{14.00} \times 100 = 75$
1966	11.75	$\frac{11.75}{14.00} \times 100 = 83.93$
1967	12.00	$\frac{12.00}{14.00} \times 100 = 85.71$
1968	12.75	$\frac{12.75}{14.00} \times 100 = 91.07$
1969	13.00	$\frac{13.00}{14.00} \times 100 = 92.86$
1970	14.00	$\frac{14.00}{14.00} \times 100 = 100$
1971	14.00	$\frac{14.00}{14.00} \times 100 = 100$
1972	15.75	$\frac{15.75}{14.00} \times 100 = 112.5$
1973	16.50	$\frac{16.50}{14.00} \times 100 = 117.86$
1974	18.00	$\frac{18.00}{14.00} \times 100 = 128.57$
1975	20.00	$\frac{20.00}{14.00} \times 100 = 142.86$

-:4.10:-

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

(a) I. No.	(b) I. No.
$\frac{9}{8} \times 100 = 112.5$	$\frac{9}{11} \times 100 = 81.82$
$\frac{6}{8} \times 100 = 75$	$\frac{6}{11} \times 100 = 54.54$
$\frac{9}{8} \times 100 = 112.5$	$\frac{9}{11} \times 100 = 81.82$
$\frac{11}{8} \times 100 = 137.5$	$\frac{11}{11} \times 100 = 100$
$\frac{10}{8} \times 100 = 125$	$\frac{10}{11} \times 100 = 90.91$
$\frac{13}{8} \times 100 = 162.5$	$\frac{13}{11} \times 100 = 118.19$
$\frac{14}{8} \times 100 = 175$	$\frac{14}{11} \times 100 = 127.27$
$\frac{16}{8} \times 100 = 200$	$\frac{16}{11} \times 100 = 145.45$

$$\text{Mean of first 3 years} = \frac{9+6+9}{3} = \frac{24}{3} = 8$$

$$\text{Mean of all 8 years} = \frac{9+6+9+11+10+13+14+16}{8} = \frac{88}{8} = 11$$

∴ 4.11:-

Year	Price	(i) Link Relative	(ii) Chain Relative
1970	30.5	$\frac{30.5}{30.5} \times 100 = 100$	= 100
1971	32.8	$\frac{32.8}{30.5} \times 100 = 107.54$	$\frac{100 \times 107.54}{100} = 107.51$
1972	40.2	$\frac{40.2}{32.8} \times 100 = 122.56$	$\frac{107.54 \times 122.56}{100} = 131.80$
1973	43.5	$\frac{43.5}{40.2} \times 100 = 108.20$	$\frac{131.80 \times 108.20}{100} = 142.60$
1974	44.5	$\frac{44.5}{43.5} \times 100 = 102.29$	$\frac{142.60 \times 102.29}{100} = 145.87$
1975	48.2	$\frac{48.2}{44.5} \times 100 = 108.31$	$\frac{145.87 \times 108.31}{100} = 157.99$

-:4.12:-

Year	Price	Link Relative	Chain Indices
1994	187	$\frac{187}{187} \times 100 = 100$	= 100
1995	161	$\frac{161}{187} \times 100 = 86.10$	$\frac{100 \times 86.10}{100} = 86.10$
1996	149	$\frac{149}{161} \times 100 = 92.55$	$\frac{86.10 \times 92.55}{100} = 79.69$
1997	142	$\frac{142}{149} \times 100 = 95.30$	$\frac{79.69 \times 95.30}{100} = 75.94$
1998	125	$\frac{125}{142} \times 100 = 88.03$	$\frac{75.94 \times 88.03}{100} = 66.85$
1999	129	$\frac{129}{125} \times 100 = 103.20$	$\frac{66.85 \times 103.20}{100} = 68.99$
2000	133	$\frac{133}{129} \times 100 = 103.10$	$\frac{68.99 \times 103.10}{100} = 71.13$

-:4.13:-

Year	Price	Link Relative	Chain Indices
1990	30	$\frac{30}{30} \times 100 = 100$	= 100
1991	32	$\frac{32}{30} \times 100 = 106.67$	$\frac{100 \times 106.67}{100} = 106.67$
1992	40	$\frac{40}{32} \times 100 = 125$	$\frac{106.67 \times 125}{100} = 133.34$
1993	43	$\frac{43}{40} \times 100 = 107.5$	$\frac{133.34 \times 107.5}{100} = 143.34$
1994	44	$\frac{44}{43} \times 100 = 102.33$	$\frac{143.34 \times 102.33}{100} = 146.68$
1995	48	$\frac{48}{44} \times 100 = 109.09$	$\frac{146.68 \times 109.09}{100} = 160.01$

-:4.14:-

Year	Price	Index No. (i) $P_0 = 22.50, \left(\frac{P_n}{P_0} \times 100 \right)$	Index No. (ii) $P_0 = 30.07, \left(\frac{P_n}{P_0} \times 100 \right)$
1977	22.50	$\frac{22.50}{22.50} \times 100 = 100$	$\frac{22.50}{30.07} \times 100 = 74.82$
1978	25.00	$\frac{25.00}{22.50} \times 100 = 111.11$	$\frac{25.00}{30.07} \times 100 = 83.13$
1979	27.50	$\frac{27.50}{22.50} \times 100 = 122.22$	$\frac{27.50}{30.07} \times 100 = 91.45$
1980	30.00	$\frac{30.00}{22.50} \times 100 = 1333.33$	$\frac{30.00}{30.07} \times 100 = 99.76$
1981	35.50	$\frac{35.50}{22.50} \times 100 = 157.78$	$\frac{35.50}{30.07} \times 100 = 118.05$
1982	32.50	$\frac{32.50}{22.50} \times 100 = 144.44$	$\frac{32.50}{30.07} \times 100 = 108.08$
1983	37.50	$\frac{37.50}{22.50} \times 100 = 166.67$	$\frac{37.50}{30.07} \times 100 = 124.70$

Average of Prices:

$$\frac{22.50 + 25.00 + 27.50 + 30.00 + 35.50 + 32.50 + 37.50}{7} = \frac{210.5}{7} = 30.07$$

-:4.15:-

Year	Price	Index No. (i) $\left(\frac{P_n}{P_0} \times 100 \right)$	Index No. (ii) $\left(\frac{P_n}{P_0} \times 100 \right)$
1990	65	$\frac{65}{65} \times 100 = 100$	$\frac{65}{70.67} \times 100 = 91.98$
1991	72	$\frac{72}{65} \times 100 = 110.77$	$\frac{72}{70.67} \times 100 = 101.88$
1992	75	$\frac{75}{65} \times 100 = 115.38$	$\frac{75}{70.67} \times 100 = 106.13$
1993	80	$\frac{80}{65} \times 100 = 123.08$	$\frac{80}{70.67} \times 100 = 113.20$
1994	85	$\frac{85}{65} \times 100 = 130.77$	$\frac{85}{70.67} \times 100 = 120.28$
1995	82	$\frac{82}{65} \times 100 = 126.15$	$\frac{82}{70.67} \times 100 = 116.03$

Average of Price of First 3 years:

$$\frac{65 + 72 + 75}{3} = \frac{212}{3} = 70.67$$

-:4.16:-

Year	Price	(i) Price Relatives $\left(\frac{P_n}{P_0} \times 100 \right)$	(ii) Link Relatives $\left(\frac{P_n}{P_{n-1}} \times 100 \right)$
2001	1000	$\frac{1000}{1000} \times 100 = 100$	$\frac{1000}{1000} \times 100 = 100$
2002	1020	$\frac{1020}{1000} \times 100 = 102$	$\frac{1020}{1000} \times 100 = 102$
2003	1050	$\frac{1050}{1000} \times 100 = 105$	$\frac{1050}{1020} \times 100 = 102.94$
2004	1060	$\frac{1060}{1000} \times 100 = 106$	$\frac{1060}{1050} \times 100 = 100.95$
2005	1100	$\frac{1100}{1000} \times 100 = 110$	$\frac{1100}{1060} \times 100 = 103.77$

-:4.17:-

Year	Price	Index Nos. (1962 as base)
1960	50	$\frac{50}{55} \times 100 = 90.91$
1961	52	$\frac{52}{55} \times 100 = 94.55$
1962	55	$\frac{55}{55} \times 100 = 100$
1963	57	$\frac{57}{55} \times 100 = 103.64$
1964	62	$\frac{62}{55} \times 100 = 112.73$
1965	72	$\frac{72}{55} \times 100 = 130.91$
1966	73	$\frac{73}{55} \times 100 = 132.73$

Year	Price	Index Nos. (1962 as base)
1967	75	$\frac{75}{55} \times 100 = 136.36$
1968	71	$\frac{71}{55} \times 100 = 129.09$
1969	70	$\frac{70}{55} \times 100 = 127.27$

-:4.18:-

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

(i) I. No. (1964 as base)	(ii) Average of 5 years as base
$\frac{20}{20} \times 100 = 100$	$\frac{20}{22} \times 100 = 90.9$
$\frac{18}{20} \times 100 = 90$	$\frac{18}{22} \times 100 = 81.8$
$\frac{23}{20} \times 100 = 115$	$\frac{23}{22} \times 100 = 104.5$
$\frac{24}{20} \times 100 = 120$	$\frac{24}{22} \times 100 = 109.1$
$\frac{25}{20} \times 100 = 125$	$\frac{25}{22} \times 100 = 113.6$
$\frac{27}{20} \times 100 = 135$	$\frac{27}{22} \times 100 = 122.7$

(i) I. No. (1964 as base)	(ii) Average of 5 years as base
$\frac{28}{20} \times 100 = 140$	$\frac{28}{22} \times 100 = 127.3$
$\frac{30}{20} \times 100 = 150$	$\frac{30}{22} \times 100 = 136.4$
$\frac{32}{20} \times 100 = 160$	$\frac{32}{22} \times 100 = 145.5$
$\frac{33}{20} \times 100 = 165$	$\frac{33}{22} \times 100 = 150$

$$(i) \text{ Mean of first 5 years} = \frac{20 + 18 + 23 + 24 + 25}{5} = \frac{110}{5} = 22$$

$$(ii) \text{ Mean of all values} = \frac{260}{10} = 26$$

(iii) Average of all values as base	(iv) Link Relative	Chain Index Nos.
$\frac{20}{26} \times 100 = 76.9$	$\frac{20}{20} \times 100 = 100$	= 100
$\frac{18}{26} \times 100 = 69.2$	$\frac{18}{20} \times 100 = 90$	$\frac{100 \times 90}{100} = 90$
$\frac{23}{26} \times 100 = 88.5$	$\frac{28}{18} \times 100 = 127.7$	$\frac{90 \times 127.7}{100} = 114.93$
$\frac{24}{26} \times 100 = 92.3$	$\frac{24}{23} \times 100 = 104.3$	$\frac{114.93 \times 104.3}{100} = 119.87$
$\frac{25}{26} \times 100 = 96.2$	$\frac{25}{24} \times 100 = 104.17$	$\frac{119.87 \times 104.17}{100} = 124.87$
$\frac{27}{26} \times 100 = 103.8$	$\frac{27}{25} \times 100 = 108$	$\frac{124.87 \times 108}{100} = 134.49$
$\frac{28}{26} \times 100 = 115.4$	$\frac{28}{27} \times 100 = 103.7$	$\frac{134.49 \times 103.7}{100} = 139.47$
$\frac{30}{26} \times 100 = 115.4$	$\frac{30}{28} \times 100 = 107.14$	$\frac{139.47 \times 107.14}{100} = 149.43$

(iii) Average of all values as base	(iv) Link Relative	Chain Index Nos.
$\frac{32}{26} \times 100 = 123.1$	$\frac{32}{30} \times 100 = 106.69$	$\frac{149.43 \times 106.69}{100} = 159.94$
$\frac{33}{26} \times 100 = 126.9$	$\frac{33}{32} \times 100 = 103.13$	$\frac{159.94 \times 103.13}{100} = 164.95$

-:4.19:-

(a)	Year	Price	I. Nos. (1953 as base)
	1953	14.95	$\frac{14.95}{14.95} \times 100 = 100$
	1954	14.95	$\frac{14.95}{14.95} \times 100 = 100$
	1955	15.10	$\frac{15.10}{14.95} \times 100 = 101$
	1956	15.65	$\frac{15.65}{14.95} \times 100 = 104.7$
	1957	16.28	$\frac{16.28}{14.95} \times 100 = 108.9$
	1958	16.53	$\frac{16.53}{14.95} \times 100 = 110.6$

(b)	Year	Price	Link Relative	Chain Index Nos.
	1953	14.95	= 100	= 100
	1954	14.95	$\frac{14.95}{14.95} \times 100 = 100$	$\frac{100 \times 100}{100} = 100$
	1955	15.10	$\frac{15.10}{14.95} \times 100 = 101$	$\frac{100 \times 101}{100} = 101$
	1956	15.65	$\frac{15.65}{15.10} \times 100 = 103.64$	$\frac{101 \times 103.64}{100} = 104.68$
	1957	16.28	$\frac{16.28}{15.65} \times 100 = 104$	$\frac{104.68 \times 104}{100} = 108.87$
	1958	16.53	$\frac{16.53}{16.28} \times 100 = 101.54$	$\frac{108.87 \times 101.54}{100} = 110.55$

-:4.20:-

Year	Price	Link Relative	Chain Index Nos.
1960	2.4	$\frac{2.4}{2.4} \times 100 = 100$	= 100
1961	2.5	$\frac{2.5}{2.4} \times 100 = 104.2$	$\frac{100 \times 104.2}{100} = 104.20$
1962	2.8	$\frac{2.8}{2.5} \times 100 = 112$	$\frac{104.2 \times 112}{100} = 116.70$
1963	2.9	$\frac{2.9}{2.5} \times 100 = 103.6$	$\frac{116.70 \times 103.6}{100} = 120.90$
1964	3.1	$\frac{3.1}{2.9} \times 100 = 106.9$	$\frac{120.90 \times 106.9}{100} = 129.24$
1965	3.3	$\frac{3.3}{3.1} \times 100 = 106.5$	$\frac{129.24 \times 106.5}{100} = 137.76$
1966	3.5	$\frac{3.5}{3.3} \times 100 = 106.1$	$\frac{137.76 \times 106.1}{100} = 146.16$
1967	4.2	$\frac{4.2}{3.5} \times 100 = 120$	$\frac{146.16 \times 120}{100} = 175.39$
1968	5.1	$\frac{5.1}{4.2} \times 100 = 121.4$	$\frac{175.39 \times 121.4}{100} = 212.92$
1969	6.4	$\frac{6.4}{5.1} \times 100 = 125.5$	$\frac{212.92 \times 125.5}{100} = 267.21$
1970	5.7	$\frac{5.7}{6.4} \times 100 = 89.1$	$\frac{267.21 \times 89.1}{100} = 238.04$

-:4.21:-

Year	Price	Link Relative	Chain Index Nos. (1975 as base)
1975	58	$\frac{58}{58} \times 100 = 100$	= 100
1976	62	$\frac{62}{58} \times 100 = 106.9$	$\frac{100 \times 106.9}{100} = 106.9$
1977	64	$\frac{64}{62} \times 100 = 103.23$	$\frac{106.9 \times 103.23}{100} = 110.35$
1978	66.5	$\frac{66.5}{64} \times 100 = 103.91$	$\frac{110.35 \times 103.91}{100} = 114.67$

Year	Price	Link Relative	Chain Index Nos. (1975 as base)
1979	67	$\frac{67}{66.5} \times 100 = 100.75$	$\frac{114.67 \times 100.75}{100} = 115.53$
1980	69	$\frac{69}{67} \times 100 = 102.99$	$\frac{115.53 \times 102.99}{100} = 118.98$
1981	67	$\frac{67}{69} \times 100 = 97.10$	$\frac{118.98 \times 97.10}{100} = 115.53$
1982	70	$\frac{70}{67} \times 100 = 104.48$	$\frac{115.53 \times 104.48}{100} = 120.71$

-:4.22:-

Year	Price	Link Relative	Chain Indexes
1970	9	$\frac{9}{9} \times 100 = 100$	= 100
1971	11	$\frac{11}{9} \times 100 = 122.22$	$\frac{100 \times 122.22}{100} = 122.22$
1972	10	$\frac{10}{11} \times 100 = 90.91$	$\frac{122.22 \times 90.91}{100} = 111.11$
1973	13	$\frac{13}{10} \times 100 = 130$	$\frac{111.11 \times 130}{100} = 144.44$
1974	14.5	$\frac{14.5}{13} \times 100 = 111.54$	$\frac{144.44 \times 111.54}{100} = 161.11$
1975	16	$\frac{16}{14.5} \times 100 = 110.34$	$\frac{161.11 \times 110.34}{100} = 177.77$
1976	18	$\frac{18}{16} \times 100 = 112.50$	$\frac{177.77 \times 112.50}{100} = 199.99$

-:4.23:-

Year	Price	Link Relative	Index Nos. (1919 as base)
1960	40	$\frac{40}{40} \times 100 = 100$	= 100
1961	45	$\frac{45}{40} \times 100 = 112.5$	$\frac{100 \times 112.5}{100} = 112.5$
1962	48	$\frac{48}{45} \times 100 = 106.5$	$\frac{112.5 \times 106.5}{100} = 119.81$

Year	Price	Link Relative	Index Nos. (1919 as base)
1963	50	$\frac{50}{48} \times 100 = 104.2$	$\frac{119.81 \times 104.2}{100} = 124.84$
1964	52	$\frac{52}{50} \times 100 = 104.0$	$\frac{124.84 \times 104}{100} = 129.83$
1965	54	$\frac{54}{52} \times 100 = 103.8$	$\frac{129.83 \times 103.8}{100} = 134.76$
1966	56	$\frac{56}{54} \times 100 = 103.7$	$\frac{134.76 \times 103.7}{100} = 139.75$
1967	60	$\frac{60}{56} \times 100 = 107.1$	$\frac{139.75 \times 107.1}{100} = 149.67$

-:4.24:-

Year	Price Relatives			
	Wheat	Rice	Cotton	Ghee
1960	100	100	100	100
1961	105	106.67	110	112.5
1962	110	110	116.67	125
1963	120	116.67	120	140.63
1964	125	120	125	150

Total	Index Nos.
400	100
434.17	108.5
461.67	115.4
497.3	124.3
520	130.0

-:4.25:-

The necessary calculations are shown below:

Year	Price Relatives			
	A	B	C	D
1964	100	100	100	100
1965	116.67	116.67	107.14	120
1966	133.33	125	116.07	128.51
1967	150	133.33	121.43	135.71

Index Nos.	
(i)	(ii)
100	100
115.1	116.7
125.8	126.8
135.1	134.5

-:4.26:-

Year	Price Relatives		
	Gold	Wheat	Cotton
1912	100	100	100
1913	121.74	83.82	69.23
1914	132.02	28.32	85.89
1915	140.32	32.95	71.79
1916	139.53	98.84	92.31
1917	142.29	67.1	130.77

Index Nos.	
Total	Mean
300	100
274.79	91.6
241.23	82.1
245.06	81.7
370.68	110.2
340.16	113.4

-:4.27:-

Year	Price Relatives			
	Wheat	Rice	Cotton	Sugar
1980	100	100	100	100
1981	108.33	115.38	114.28	107.69
1982	120	123.08	128.57	115.38
1983	133.33	153.85	139.05	132.69
1984	141.67	184.61	147.62	138.46

Index Nos.		
(i) Mean	(ii) Median	(iii) G.M.
100	100	100
111.42	111.85	111.37
121.75	121.54	121.66
139.73	136.19	139.48
153.09	144.65	152.05

-:4.28:-

Year	Price Relative				Index nos.
	A	B	C	D	G.M.
1985	100	100	100	100	100
1986	128	117.142	122.5	124.44	125.299
1987	204	164.285	150	142.22	163.5
1988	280	211.428	187.5	160	205.26

-:4.29:-

Year	Price Relatives				Index Nos.
	Blades	Cigarettes	Soap	Salt	Mean
1985	100	100	100	100	100
1986	101.67	110.33	117.52	108.18	110
1987	108	119.17	124	114.54	117
1988	108.33	117.52	123.5	113.64	116
1869	115	133.33	130.5	122.73	124

-:4.30:-

(a)

Year	Price Relatives			Index Nos.
	Wheat	Rice	Maize	Med.
1970	100	100	100	100
1971	93.3	131.4	107.4	107.4
1972	133.3	139.3	142.6	139.3
1973	131.7	135.7	162.9	135.7
1974	133.3	144.3	157.4	144.3

(b)

Year	Link Relatives		
	Wheat	Rice	Maize
1970	100	100	100
1971	93.3	131.4	107.4
1972	121.45	105.98	132.76
1973	116.17	97.44	114.86
1974	101.26	106.32	96.59

Mean	Chain Index Nos.
100	= 100
110.6	$\frac{100 \times 110.6}{100} = 110.6$
120.1	$\frac{110.6 \times 120.1}{100} = 132.8$
109.49	$\frac{132.8 \times 109.49}{100} = 145.4$
101.39	$\frac{101.39 \times 145.49}{100} = 147.0$

-:4.31:-

Year	Link Relatives			
	A	B	C	D
1910	100	100	100	100
1911	76.54	70.13	116.36	94.55
1912	167.74	161.11	86.72	192.31
1913	89.42	86.20	138.73	96.00
1914	64.52	57.33	107.14	91.66

G.M.	Chain Index Nos.
100	= 100
87.66	$\frac{100 \times 87.66}{100} = 87.66$
145.7	$\frac{87.66 \times 145.7}{100} = 127.72$
100.66	$\frac{127.72 \times 100.06}{100} = 128.56$
77.63	$\frac{128.56 \times 77.63}{100} = 99.8$

-:4.32:-

Year	Link Relatives			
	Wheat	Sugar	Ghee	Cotton
1941	100	100	100	100
1942	125	125	125	120
1943	90	140	96	133.331
1944	138.89	114.29	25	125

(i)

A.M.	Chain Index Nos.
100	= 100
123.75	$\frac{100 \times 123.75}{100} = 124$
114.33	$\frac{124 \times 114.33}{100} = 114.67$
125.86	$\frac{114.67 \times 125.86}{100} = 125$

(ii)

Median	Chain Index Nos.
100	= 100
125	$\frac{100 \times 125}{100} = 125$
114.33	$\frac{125 \times 114.67}{100} = 112.67$
125	$\frac{112.67 \times 125}{100} = 125.5$

(iii)

G.M.	Chain Index Nos.
100	= 100
123.7	$\frac{100 \times 123.7}{100} = 123.7$
112.67	$\frac{123.7 \times 112.67}{100} = 139.4$
125.5	$\frac{139.4 \times 125.5}{100} = 174.9$

-:4.33:-

Year	Link	Relatives		
	Sugar	Milk	Coffee	Tea
1955	100	100	100	100
1956	101.23	70.13	107.56	154.55
1957	126.83	161.11	86.72	117.65
1958	89.42	86.21	138.74	96.00
1959	64.52	57.33	107.14	91.67
1960	100.00	102.33	96.36	101.14
1961	103.33	106.82	87.74	94.38

Mean	Chain Indexes
100	= 100
108.37	$\frac{100 \times 108.37}{100} = 108.37$
123.08	$\frac{108.37 \times 123.08}{100} = 133.38$
102.59	$\frac{133.38 \times 102.59}{100} = 136.84$
80.17	$\frac{136.84 \times 80.17}{100} = 109.70$
99.96	$\frac{109.70 \times 99.96}{100} = 109.66$
98.07	$\frac{109.66 \times 98.07}{100} = 107.54$

-:4.34:-

Year	Link Relatives		
	A	B	C
1944	100	100	100
1945	121.74	94.12	87.16
1946	108.44	87.50	102.33
1947	106.29	110.71	108.33
1948	99.44	103.23	100.00
1949	101.98	121.88	105.59
1950	100.00	76.92	92.72
1951	105.00	113.33	123.57

Mean	Chain Indices
100	= 100
101.1	$\frac{100 \times 101.1}{100} = 101.1$
99.42	$\frac{101.1 \times 99.42}{100} = 100.42$
108.44	$\frac{108.90 \times 100.89}{100} = 109.87$
100.89	$\frac{108.90 \times 100.89}{100} = 109.87$

Mean	Chain Indices
109.82	$\frac{109.87 \times 109.82}{100} = 120.66$
89.88	$\frac{120.66 \times 89.88}{100} = 108.45$
123.57	$\frac{108.45 \times 123.57}{100} = 123.60$

-:4.35:-

Commodity	1960		1961	
	p_0	q_0	p_1	q_1
A	8	50	20	60
B	2	15	6	10
C	1	20	2	25
D	2	10	5	8
E	1	40	3	30

$p_1 q_0$	$p_0 q_0$	$p_1 q_1$	$p_0 q_1$
1000	400	1200	480
90	30	60	20
40	20	50	25
50	20	40	16
120	40	90	30
1300	510	1440	571

(i) Laspeyre's Index No.

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

Laspeyre's Index No. for 1961.

$$P_{01} = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100 = \frac{1300}{510} \times 100 = 254.9$$

(ii) Paasche's Index No.

$$P_{0n} = \frac{\sum p_n q_n}{\sum p_0 q_1} \times 100$$

Paasche's Index No. for 1961.

$$P_{01} = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100 = \frac{1440}{571} \times 100 = 252.19$$

(iii) Fisher's Ideal Index No.

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

Fisher's Ideal Index No. for 1961.

$$P_{01} = \sqrt{\frac{\sum P_1 q_0}{\sum P_0 q_0} \times \frac{\sum P_1 q_1}{\sum P_0 q_1}} \times 100 = P_{01} = \sqrt{\frac{1300}{510} \times \frac{1440}{571}} \times 100$$

$$P_{01} = \sqrt{2.5490 \times 2.5219} \times 100 = 253.54$$

(iv) **Marshall Edgeworth Index No.**

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

Marshall Edgeworth Index No for 1961.

$$P_{01} = \frac{\sum P_1 q_0 + \sum P_1 q_1}{\sum P_0 q_0 + \sum P_0 q_1} \times 100 = \frac{1300 + 1440}{510 + 571} \times 100$$

$$= \frac{274000}{1081} = 253.47$$

:-4.36:-

Commodity	1985		1995		$P_1 q_1$	$P_0 q_1$
	Price	Quantity	Price	Quantity		
	p_0	q_0	p_1	q_1		
Wheat	6	45	10	40	400	240
Rice	7	50	12	35	420	245
Cotton	8	60	16	30	480	240
					1300	725

Paache's Index No.

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

Paache's Index No. For 1995

$$P_{01} = \frac{\sum P_1 q_1}{\sum P_0 q_1} \times 100 = \frac{1300}{725} \times 100 = 179.31$$

:-4.37:-

Commodity	2004		2005	
	p_0	q_0	P_1	q_1
A	2	50	10	40
B	3	10	8	50
C	4	60	4	80
Total	-----	-----	-----	-----

P_1q_0	P_0q_0	P_1q_1	P_0q_1
500	100	400	80
80	30	400	150
240	240	320	320
820	370	1120	550

Fisher's Ideal Index No.

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

Fisher's Ideal Index No. For 2005

$$\begin{aligned}
 P_{01} &= \sqrt{\frac{\sum P_1 q_0}{\sum P_0 q_0} \times \frac{\sum P_1 q_1}{\sum P_0 q_1}} \times 100 \\
 &= \sqrt{\frac{820}{370} \times \frac{1120}{550}} \times 100 = \sqrt{2.21 \times 2.03} \times 100 = \sqrt{4.48} \times 100 \\
 &= 2.1166 \times 100 = 211.66
 \end{aligned}$$

-:4.38:-

Commodity	1973		1975	
	P_0	q_0	P_1	q_1
Wheat	40	180	42	95
Rice	10	75	11	70
Bajra	12	110	14	125
Total	-----	-----	-----	-----

P_1q_0	P_0q_0	P_1q_1	P_0q_1
7560	7200	3990	3800
825	750	770	700
1540	1320	1750	1500
9925	9270	6510	6000

(i) Laspeyre's Index No.

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

Laspeyre's Index No. for 1973.

$$P_{01} = \frac{\sum P_1 q_0}{\sum P_0 q_0} \times 100 = \frac{9925}{9270} \times 100 = 107.07$$

(ii) Paasche's Index No.

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

Paasche's Index No. for 1973.

$$P_{01} = \frac{\sum P_1 q_1}{\sum P_0 q_1} \times 100 = \frac{6510}{6000} \times 100 = 108.5$$

(iii) **Fisher's Ideal Index No.**

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

Fisher's Ideal Index No. for 1973.

$$P_{0n} = \sqrt{\frac{9925}{9270} \times \frac{6510}{6000}} = 100 = P_{0n} = \sqrt{1.070 \times 1.085 \times 100} = 107.8$$

(iv) **Marshall Edgeworth Index No.**

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

Marshall Edgeworth Index No. for 1973.

$$P_{01} = \frac{\sum P_1 q_0 + \sum P_1 q_1}{\sum P_0 q_0 + \sum P_0 q_1} \times 100 = P_{01} = \frac{9925 + 6410}{9270 + 6000} \times 100$$

$$= \frac{16435}{15270} \times 100 = 107.6$$

-:4.39:-

Commodity	1973		1963	
	P_0	q_0	P_1	q_1
A	2	50	10	40
B	3	10	8	5
C	4	5	4	5
Total	-----	-----	-----	-----

$P_1 q_0$	$P_0 q_1$	$P_1 q_1$	$P_0 q_1$
500	100	400	80
80	30	40	15
20	20	20	20
600	150	460	115

(i) **Laspeyre's Index No. for 1963.**

$$P_{01} = \frac{\sum P_1 q_0}{\sum P_0 q_0} \times 100 = \frac{600}{150} \times 100 = 400$$

(ii) **Paasche's Index No. for 1963.**

$$P_{01} = \frac{\sum P_1 q_1}{\sum P_0 q_1} \times 100 = \frac{460}{115} \times 100 = 400$$

(iii) Fisher's Ideal Index No. for 1963.

$$P_{01} = \sqrt{\frac{\sum P_1 q_0}{\sum P_0 q_0} \times \frac{\sum P_1 q_1}{\sum P_0 q_1}} \times 100 = P_{01} = \sqrt{\frac{600}{150} \times \frac{460}{115}} \times 100$$

$$P_{01} = \sqrt{4 \times 4} \times 100 = 400$$

-:4.40:-

Commodity	1975		1980	
	P_0	q_0	P_1	q_1
Wheat	55	100	63	130
Jawar	25	55	29	45
Gur	27	130	32	85
Total	----	----	----	----

$P_1 q_0$	$P_0 q_0$	$P_1 q_1$	$P_0 q_1$
6300	5500	8190	7150
1595	1375	1305	1125
4160	3510	2720	2295
12055	10385	12215	10570

(i) Laspeyre's Index No. for 1980.

$$P_{01} = \frac{\sum P_1 q_0}{\sum P_0 q_0} \times 100 = \frac{12055}{10385} \times 100 = 116.08$$

(ii) Paaschr's Index No. for 1980.

$$P_{01} = \frac{\sum P_1 q_1}{\sum P_0 q_1} \times 100 = \frac{12215}{10570} \times 100 = 115.56$$

(iii) Fisher's Ideal Index No. for 1980

$$P_{01} = \sqrt{\frac{\sum P_1 q_0}{\sum P_0 q_0} \times \frac{\sum P_1 q_1}{\sum P_0 q_1}} \times 100 = P_{01} = \sqrt{\frac{12055}{10385} \times \frac{12215}{10570}} \times 100$$

$$P_{01} = \sqrt{1.161 \times 1.1556} \times 100 = 115.82$$

-:4.41:-

Commodity	1980		1981	
	P_0	q_0	P_1	q_1
A	10	25	13	21
B	9	27	12	22
C	4	10	3	14

P_1q_0	P_0q_0	P_1q_1	P_0q_1
225	250	243	270
252	273	264	286
30	40	42	56
507	563	549	612

- (i)
- Laspeyre's Index No. for 1981**

$$P_{01} = \frac{\sum P_1q_0}{\sum P_0q_0} \times 100 = \frac{507}{563} \times 100 = 90.05$$

- (ii)
- Paasche's Index No. for 1981**

$$P_{01} = \frac{\sum P_1q_1}{\sum P_0q_1} \times 100 = \frac{549}{612} \times 100 = 89.71$$

- (iii)
- Fisher's Ideal Index No for 1981**

$$P_{01} = \sqrt{\frac{\sum P_1q_0}{\sum P_0q_0} \times \frac{\sum P_1q_1}{\sum P_0q_1}} \times 100 = P_{01} = \sqrt{\frac{507}{563} \times \frac{549}{612}} \times 100$$

$$P_{01} = \sqrt{0.898794} \times 100 = 89.88$$

-:4.42:-

Commodity	1960		1964	
	p_0	q_0	p_1	q_1
Milk	3.95	9675	4.25	10436
Cheese	34.80	78	38.90	83
Butter	61.56	118	59.70	116

P_1q_0	P_0q_0	P_1q_1	P_0q_1
41118.75	38216.25	44353.0	41222.2
3034.20	2714.40	3228.7	2888.4
7044.60	7264.08	6925.2	7140.96
51197.55	48194.73	54506.9	51251.56

- (i)
- Laspeyre's Index No. for 1964**

$$P_{01} = \frac{\sum P_1q_0}{\sum P_0q_0} \times 100 = \frac{51197.55}{48194.73} \times 100 = 106.23$$

- (ii)
- Paasche's Index No. for 1964**

$$P_{01} = \frac{\sum P_1q_1}{\sum P_0q_1} \times 100 = \frac{54506.9}{51251.56} \times 100 = 106.35$$

-:4.43:-

Commodity	1970		1971		1972	
	P_0	Q_0	P_1	Q_1	Q_2	Q_3
Wheat	4	50	4	50	5	40
Gram	3	100	8	50	5	80
Tobacco	2	500	10	400	8	200

P_1Q_0	P_0Q_0	P_1Q_1	P_0Q_1
200	250	200	200
800	500	300	400
5000	4000	1000	4000
6000	4750	1500	4600

P_2Q_2	P_0Q_1	P_2Q_1
200	200	160
400	150	240
1600	800	400
2200	1150	800

(i) Laspeyre's Index No. for 1971

$$P_{01} = \frac{\sum P_1Q_0}{\sum P_0Q_0} \times 100 = \frac{6000}{1500} \times 100 = 400$$

Laspeyre's Index No. for 1972

$$P_{02} = \frac{\sum P_2Q_0}{\sum P_0Q_0} \times 100 = \frac{4750}{1500} \times 100 = 316.67$$

(ii) Paasche's Index No. for 1971

$$P_{01} = \frac{\sum P_1Q_1}{\sum P_0Q_1} \times 100 = \frac{4600}{1500} \times 100 = 400$$

Paasche's Index No for 1972

$$P_{02} = \frac{\sum P_2Q_2}{\sum P_0Q_2} \times 100 = \frac{2200}{800} \times 100 = 275$$

(iii) Fisher's Ideal Index No. for 1971

$$P_{01} = \sqrt{\frac{\sum P_1Q_0}{\sum P_0Q_0} \times \frac{\sum P_1Q_1}{\sum P_0Q_1}} \times 100 = P_{01} = \sqrt{\frac{6000}{1500} \times \frac{4600}{1150}} \times 100$$

$$P_{01} = \sqrt{4 \times 4} \times 100 = 400$$

Fisher's Ideal Index No. for 1972.

$$P_{02} = \sqrt{\frac{\sum P_2Q_0}{\sum P_0Q_0} \times \frac{\sum P_2Q_2}{\sum P_0Q_2}} \times 100 = P_{02} = \sqrt{\frac{4750}{1500} \times \frac{2200}{800}} \times 100$$

$$= 295.00$$

-:4.44:-

	1986		1987		1988	
	p_0	q_0	p_1	q_1	p_2	q_2
A	5	100	6	120	10	56
B	7	120	10	80	21	20
C	10	80	12	80	6	60
D	4	50	5	60	12	24
E	8	70	8	80	12	36

p_0q_1	p_1q_0	p_1q_1	p_0q_2	p_0q_1	p_2q_2	p_2q_0
500	600	720	600	560	280	1000
840	1200	800	500	240	840	240
800	960	960	800	360	600	480
200	250	300	240	288	96	600
560	560	640	640	432	288	840
2900	3570	3420	2840	1880	2104	3160

1. Laspeyre's Index or Base Year Weighted Index

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

$$P_{01} = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100 = \frac{3570}{2900} \times 100 = 123.10$$

$$P_{02} = \frac{\sum p_2 q_0}{\sum p_0 q_0} \times 100 = \frac{3160}{2900} \times 100 = 108.96$$

2. Paasche's Index or Current Year Weighted Index

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

$$P_{01} = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100 = \frac{3420}{2840} \times 100 = 120.42$$

$$P_{02} = \frac{\sum p_2 q_2}{\sum p_0 q_2} \times 100 = \frac{1680}{1404} \times 100 = 119.66$$

3. Fisher's Ideal Index

$$P_{01} = \sqrt{\frac{\sum p_n q_0}{\sum p_0 q_0} \times \frac{\sum p_n q_n}{\sum p_0 q_n}} \times 100$$

$$P_{01} = \sqrt{\frac{\sum p_1 q_0}{\sum p_0 q_0} \times \frac{\sum p_1 q_1}{\sum p_0 q_1}} \times 100 = \sqrt{\frac{3580}{2800} \times \frac{3420}{2840}} \times 100 = 121.93$$

$$P_{02} = \sqrt{\frac{\sum p_2 q_0}{\sum p_0 q_0} \times \frac{\sum p_2 q_2}{\sum p_0 q_2}} \times 100 = \sqrt{\frac{3160}{2900} \times \frac{1680}{1404}} \times 100 = 114.18$$

4. Marshall Edgeworth Index

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

$$P_{01} = \frac{\sum p_1 q_0 + \sum p_1 q_1}{\sum p_0 q_0 + \sum p_0 q_1} \times 100 = \frac{3580 + 3420}{2900 + 2840} \times 100 = \frac{7000}{5740} \times 100 = 121.95$$

$$P_{02} = \frac{\sum p_2 q_0 + \sum p_2 q_2}{\sum p_0 q_0 + \sum p_0 q_2} \times 100 = \frac{3160 + 1680}{2900 + 1404} \times 100 = \frac{4840}{5304} \times 100 = 112.45$$

-:4.45:-

Commodity	146		1950		1951	
	p_0	q_0	p_1	q_1	p_2	q_2
A	64	270	75	276	80	290
B	40	124	45	118	41	144
C	18	130	21	121	20	137
D	58	185	68	167	56	355

$p_1 q_0$	$p_2 q_0$	$p_0 q_0$	$p_1 q_1$
20250	21600	17280	20700
5580	5084	4960	5310
2780	2600	2340	2541
12580	10360	10730	11356
41140	39644	35310	39907

$p_2 q_2$	$p_0 q_1$	$p_0 q_2$
23200	17664	18560
5904	4720	5760
2740	2178	2466
19880	9686	20590
51724	34248	47376

(i) Laspeyre's Index No. for 1950

$$P_{01} = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100 = \frac{41140}{35310} \times 100 = 116.5$$

Laspeyre's Index No. for 1951

$$P_{02} = \frac{\sum p_2 q_0}{\sum p_0 q_0} \times 100 = \frac{39644}{35310} \times 100 = 112.3$$

(ii) Paasche's Index No. for 1950

$$P_{01} = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100 = \frac{39907}{34248} \times 100 = 116.5$$

Paasche's Index No. for 1951

$$P_{02} = \frac{\sum P_2 q_2}{\sum P_0 q_2} \times 100 = \frac{51724}{47376} \times 100 = 109.2$$

(iii) **Fisher's Ideal Index No. for 1950**

$$P_{0n} = \sqrt{\frac{\sum P_1 q_0}{\sum P_0 q_0} \times \frac{\sum P_1 q_1}{\sum P_0 q_1}} \times 100 = P_{01} = \sqrt{\frac{41140}{35310} \times \frac{39907}{34248}} \times 100 = 116.5$$

Fisher's Ideal Index No. for 1951

$$P_{02} = \sqrt{\frac{\sum P_2 q_0}{\sum P_0 q_0} \times \frac{\sum P_2 q_2}{\sum P_0 q_2}} \times 100 = P_{01} = \sqrt{\frac{39644}{35310} \times \frac{51724}{47376}} \times 100 = 110.7$$

-:4.46:-

Commodity	Quantity Consumed in 1939	Unit of Price
	q_0	
Rice	6 mds	pr md
Wheat	6 mds	"
Gram	1 md	"
Sugar	1 md	"
Arhar	6 mds	"
Ghee	4 seers	per seer

Price in 1939	Price in 1940
P_0	P_1
5.75	6.00
5.00	8.00
6.00	9.00
20.00	15.00
8.00	10.00
2.00	1.50

Aggregate Expenditure in base year	Aggregate Expenditure in Current year
$P_0 q_0 = w$	$P_1 q_0$
34.50	36.00
30.00	48.00
6.00	9.00
20.00	15.00
48.00	60.00
8.00	6.00
146.50	174.00

Price Relative $\frac{p_1}{p_0} \times 100 = 1$	W x 1
104.3	3598.36
160.0	4800.00
150.0	900.00
75.0	500.00
125.0	6000.00
75.0	600.00
	17398.35

(i) **Aggregate Expenditure Method**

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

$$P_{01} = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100 = \frac{174}{146.50} \times 100 = 118.8$$

(ii) **Family Budget Method**

$$= \frac{\sum W \times 1}{\sum W} = \frac{17398.36}{146.50} = 118.8$$

-:4.47:-

Commodity	Quantity Consumed in 1939	Unit of Price
	q_0	
Wheat	0.50 md	per md
Rice	0.20 "	"
Sugar	0.05 "	"
Ghee	0.025 "	"
Milk	25 seer	Per seer
Vegetables	16 seer	"
Mutton	5 seer	"
Fuel	4 md	per md

Price in 1956	Price in 1962
p_0	p_1
12	15
40	45
40	50
110	120
0.50	0.75
0.25	0.50
3.00	4.00
2.50	3.00

Aggregate Expenditure in base year	Aggregate Expenditure in Current year
$p_0q_0 = W$	p_1q_0
6.00	7.50
8.00	9.00
2.00	2.50
2.75	3.00
12.50	18.75
4.00	8.00
15.00	20.00
10.00	12.00
59	80.75

Price Relative $\frac{p_1}{p_0} \times 100 = I$	$W \times I$
1250.00	750.00
1125.00	900.00
125.00	250.00
109.09	230.00
150.00	1875.00
200.00	800.00
133.33	1999.95
120.00	800.495

(i) **Aggregate Expenditure Method**

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

$$P_{01} = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100 = \frac{80.75}{59} \times 100 = 136$$

(ii) **Family Budget Method**

$$P_{01} = \frac{\sum W \times I}{\sum W} = \frac{8004.95}{59} = 136$$

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INDEX NUMBERS

QUESTION NO. 1

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

S#	Questions	Answers			
1)	In chain base method the base year is	✓ Variable	Fixed	Both variable & fixed	None of these
(Faisalabad Board, 2008)					
2)	If $\sum P_1 q_0 = 403$, $\sum P_0 q_0 = 283$, then IN is	152.40	130.40	122.4	✓ 142.4
(Faisalabad Board, 2008)					
3)	Index number are called the barometers of	Statistics	✓ Economics	Mathematics	None of these
(Lahore Board, 2008; Faisalabad Board, 2009)					
4)	Index number for base period is	100	✓ Always 100	Never 100	None of these
(Lahore Board, 2008; Gujranwala Board, 2009)					
5)	Price relative is percentage ratio of current year price and	✓ Base year price	Base year quantity	Preceding year price	None of these
(Lahore Base 2008)					
6)	For averaging the relatives, we never use	A.M.	G.M.	Median	✓ Mode
(Lahore Board, 2008)					
7)	Link relative are used in	Fixed base method	✓ Chain base method	Both fixed and chain	None of these
(Gujranwala Board, 2009)					

S#	Questions	Answers			
8)	Index number for base period is	✓			
		100	One	Fix	None of these
(Faisalabad & Lahore Boards, 2009)					
9)	In chain base method, the base period is			✓	
		Fixed	Constant	Not fixed	Zero
(Lahore Board, 2009)					
10)	The most suitable average, in connection with index number				✓
		A.M.	Median	Mode	G.M.
(Lahore Board, 2009)					
11)	Laspeyre's index number is also called	✓			
		Base year weight	Current year weight	Ideal index number	None of these
(Lahore Board, 2009; Faisalabad Board, 2010)					
12)	Index number for base period is	✓			
		100	200	150	50
(Faisalabad Board, 2010)					
13)	Current year weighted index number is also called	✓			
		Paache's	Marshall's	Fisher's	Laspyre's
(Lahore Board, 2010)					
14)	In chain base method the base year is			✓	
		Fixed year	Next year	Previous year	Same year
(Lahore Board, 2010)					
15)	In chain base method the base period is		✓		
		Fixed	Changed	Constant	None of these
(Lahore Board, 2010)					

S#	Questions	Answers			
16)	$\frac{P_n}{P_{10}} \times 100$ is equal to	Link relative	Chain indices	✓ Price relative	None of these
(Lahore Board, 2010)					
17)	Which is considered to be the most suitable average for computing index number?	Median	Mean	Mode	✓ None
(Gujranwala Board, 2010)					
18)	Fisher's index number is	$\sqrt{\frac{P}{L}}$	$\sqrt{\frac{L}{P}}$	✓ $\sqrt{L \times P}$	None of these
(Gujranwala Board, 2010)					
19)	Index numbers are called	Statistical barometer	✓ Economic barometer	Mathematical barometer	Physical barometer
(Rawalpindi Board, 2010)					
20)	In fixed base method the base period should be	For away	Abnormal	✓ Normal	Unreliable
(Rawalpindi Board, 2010)					
21)	Price index number calculate changes is	Price	Quantity	✓ Price and quantity	None of these
(Sargodha Board, 2010)					

QUESTION NO. 2

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

S#	Questions	Answers			
1)	Index number are divided into two types:	Price and quantity	✓ Simple and composite	Weighted and un-weighted	None of these

S#	Questions	Answers			
		index numbers	index numbers	index number	
2)	An index number is called a simple index number when it deal with:	✓ Single variable	Two variables	More than two variables	None of these
3)	If all the values of equal importance, the index numbers are called:	✓ Un-weighted	Weighted	Composite	None of these
4)	An index number, which indicates a relative change in a single variable with respect to a base, is called:	Weighted index number	Composite index number	✓ Simple index number	None of these
5)	The most suitable average in connection with index numbers is:	Arithmetic mean	Median	✓ Geometric mean	H.M.
6)	Price relative is the percentage ratio of current year price and:	✓ Base year price	Preceding year price	Both base & current	None of these
7)	Link relative is the percentage ratio of current year price and:	Base year price	✓ Preceding year price	Both base & preceding year price	None of these
8)	An index number constructed to measure the relative changes in price of a commodity or a group of commodities are:	✓ Price index numbers	Quantity index numbers	Consumer's index numbers	All of these
9)	Index number constructed to measure the relative change in quantity or volume are:	Price index numbers	✓ Quantity index numbers	Consumer's index numbers	Laspeyre Index number

S#	Questions	Answers			
10)	In aggregative index numbers we use:	Only price	Only quantity	✓ Both price and quantity	None of these
11)	When all the values are not of equal importance, we assign certain values and index numbers are called:	✓ Weighted index numbers	Un-weighted index numbers	Simple index number	Composite index number
12)	Index number for base period is always taken:	✓ 100	200	300	400
13)	The prices of wheat are to be compared by:	Quantity index numbers	Aggregative index numbers	✓ Price index numbers	None of these
14)	Import and export of Pakistan is an example of:	✓ Composite index number	Whole sale price index number	Simple index number	None of these
15)	In chain base method, the base period is:	Fixed	✓ Not fixed	Constant	Zero
16)	Other name of consumer's price index number is:	✓ Cost of living index number	Whole-sale price index number	Composite index number	Simple index number
17)	Index numbers are called:	Statistical barometer	Mathematical barometer	✓ Economic barometer	✓ All of these
18)	A normal year should be free from:	War	Floods	Strikes	All of the above
19)	The formula used in fixed base method is:	✓ $\frac{P_n}{P_0} \times 100$	$\frac{P_{n-1}}{P_n} \times 100$	$\frac{P_n}{P_{n-1}} \times 100$	$\frac{P_n - 1}{P_0}$

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

S#	Questions	Answers			
			numbers		
29)	Current year quantities are used as weighted in:	Laspeyre's index number	✓ Paache's index number	Composite index number	None of these
30)	Which one is the ideal index number	Laspeyre's index number	Paache's index number	Marshall Edgeworth index number	✓ Fisher's index number
31)	Fisher's ideal index number is also obtained by:	Calculating A.M. of Laspeyre's and Paache's index number	✓ Calculating G.M. of Laspeyre's and Paache's index number	Median of Laspeyre's and Paache's index number	None of these

QUESTION NO. 3

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

Q. 1: Define an index numbers. (Lahore Board, 2008 & 2010)

(Rawalpindi Board, 2010;

Sargodha Board, 2010)

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

Q. 2: Define price index number.

(Lahore Board, 2008 & 2010)

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

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

(Gujranwala Board, 2010)

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

Q. 4: Define simple index number.

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

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

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

Q. 6: Define composite price index number.

(Lahore Board, 2008)

(Faisalabad Board, 2010)

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

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

Ans: These are two types of index number.

(i) Fixed base index

(ii) Chain base index

Q. 8: Define fixed base method.

(Lahore Board, 2009)

(Gujranwala & Sargodha Boards, 2010)

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

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

Where P_n = Current year price &

P_0 = Base year price

Q. 9: Define chain base method.

(Lahore Board, 2008)

(Rawalpindi Board, 2010)

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

The formula for chain base method is as;

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

Where P_n = Current year price &

P_{n-1} = Preceding year price to current year price

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

(Lahore Board, 2010)

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

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

Q. 11: Define link relative.

(Faisalabad & Lahore Boards, 2008 & 2010)

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

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

Ans: Following methods are used:

(i) Arithmetic mean

(ii) Median

(iii) Geometric mean

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

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

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

(Faisalabad Board, 2009)

(Lahore Board, 2008 & 2010)

(Rawalpindi Board, 2010)

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

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

(Faisalabad Board, 2008)

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

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

(Faisalabad Board, 2010)

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

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

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

(Sargodha Board, 2010)

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

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

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

(Lahore Board, 2008 & 2010)

Ans: Following are the three types of index number.

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

Q. 19: What is quantity index number?

(Lahore Board, 2008)

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

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

(Lahore Board, 2009)

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

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

Q. 21: Give Marshall index number formula

(Lahore Board, 2010)

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

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

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

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

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

(Faisalabad Board, 2009)

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

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

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

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

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

(Lahore Board, 2009)

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

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

Ans: The basket of goods and services contains:

(i) Food

(ii) Clothing

(iii) Education

(iv) House rent

(v) Misc. etc.

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

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

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

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

(a) Aggregate expenditure method

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

(b) Family budget method

$$P_{\text{fin}} = \frac{\sum (W \times I)}{\sum W}$$

Q. 29: Give three uses of index number.

(Faisalabad Board, 2008)

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

Q. 30: Write two limitations of index number.

(Faisalabad Board, 2009)

(Lahore Board, 2010)

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

Q. 31: What is the base period?

(Lahore & Rawalpindi Boards, 2010)

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

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

(Gujranwala Board, 2010)

Ans:

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

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

Taking square of both sides

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

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

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

(Faisalabad Board, 2010)

Ans: Laspeyre Index Number = 119.89

Paache's Index Number = 119.65

We know that

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

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