CHAPTER 18

INDEX NUMBERS

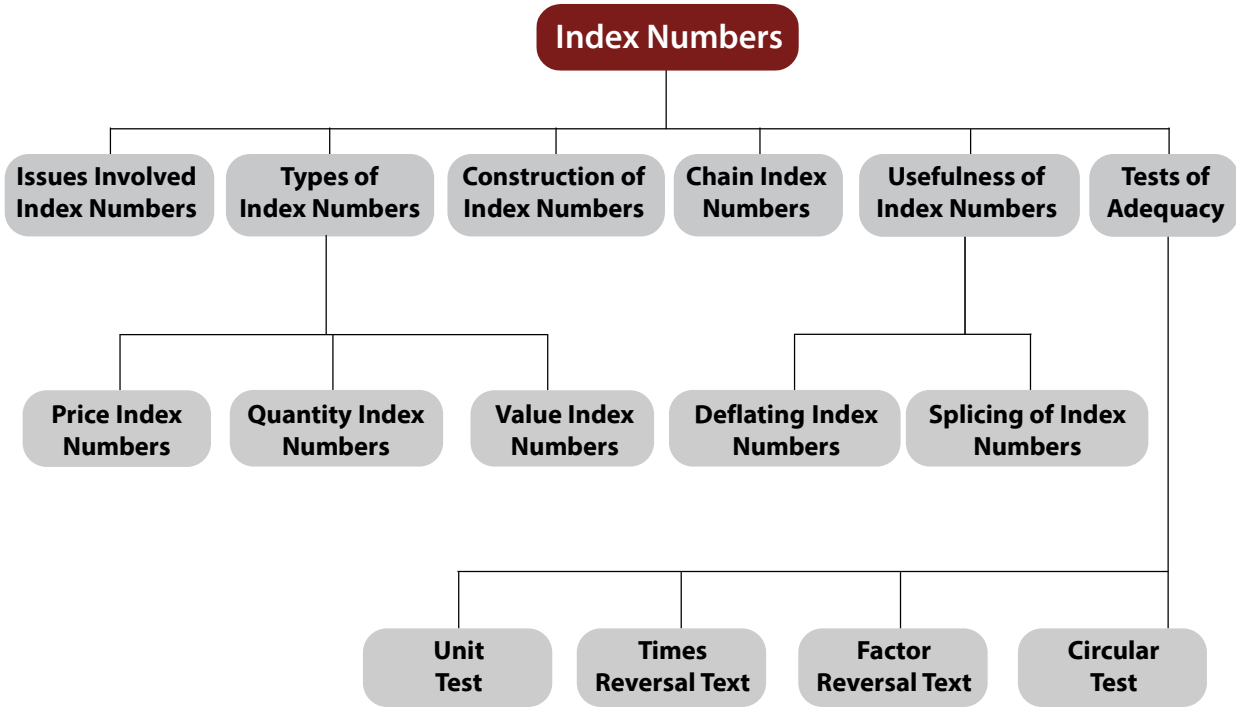
LEARNING OBJECTIVES

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



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.

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:

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

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

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:

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

Similarly, there are value relatives:

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

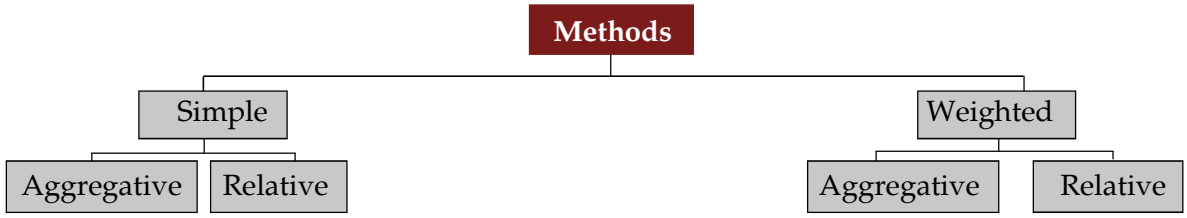
When successive prices or quantities are taken, the relatives are called the link relative,

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

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:



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

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 = $\frac{\sum P_n}{\sum P_o} = \frac{24.60}{20.00} \times 100 = 123$

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

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

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.

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

(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

$$\frac{\sum \frac{P_n}{P_o} \times (P_o Q_o)}{\sum P_o Q_o} \times 100 = \frac{\sum P_n Q_o}{\sum P_o Q_o} \times 100$$

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.

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.

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.,

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

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

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

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

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.

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.

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

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

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

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.**

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: $P_{01} = \sqrt{\frac{\Sigma P_1Q_0}{\Sigma P_0Q_0} \times \frac{\Sigma P_1Q_1}{\Sigma P_0Q_1}} \times 100 = \sqrt{\frac{63}{52} \times \frac{59}{52}} \times 100$

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

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

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.

- 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.

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 = $\frac{\sum P_n}{\sum P_o} \times 100$

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

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

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

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

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

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

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

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

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

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

Quantity Index Numbers

- Simple aggregate of quantities: $\frac{\sum Q_n}{\sum Q_o}$
- The simple average of quantity relatives: $\frac{\frac{\sum Q_n}{\sum Q_o}}{N}$
- Weighted aggregate quantity indices:

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

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

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

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

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

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

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

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

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

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) $\frac{\text{Price in the given year} \times 100}{\text{Price in the base year}}$ b) $\frac{\text{Price in the year base year} \times 100}{\text{Price in the given year}}$
   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 with fixed weights 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

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

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

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 = $\frac{\text{Price Index of the current year}}{\text{previous value}}$

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

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

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

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

(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

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.

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.

(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

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

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

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

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

(c) $\frac{\sum P_0 (q_0 + q_n)}{\sum P_n (P_0 + P_n)}$ (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.

(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

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) There 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) $\frac{\sum P_1Q_1}{\sum P_0Q_0}$ (b) $\frac{\sum P_1Q_1}{\sum P_0Q_0} \times \frac{\sum P_1Q_1}{\sum P_0Q_1}$

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

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.

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

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

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

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

(a) $P_{01} \times Q_{01} = \frac{\sum P_1 Q_1}{\sum P_0 Q_0}$ (b) $I_{01} \times I_{10}$

(c) $\frac{\sum P_0 Q_0}{\sum P_1 Q_1}$ (d) $\sqrt{\frac{\sum P_1 Q_1}{\sum P_0 Q_0} \times \frac{\sum P_0 Q_1}{\sum Q_{10} P_0}}$

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.

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.

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. 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.

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%. 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

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

(b) $I_{01} \times I_{12} \times I_{23} \times \ldots I_{(n-1)n} \times I_{n0} = 1$ (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, 121.13, 130.82

(c) 107, 100.25, 104, 118.72 (d) None of these.

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. If he has rightly compensated. The additional dearness allowance paid to the employee.

(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 he 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 value 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) $\frac{\text{Price Relative for the year}}{\text{Price Relative for the previous year}} \times 100$ (b) $\frac{\sum(\text{Price Relative} \times w)}{\sum w}$

(c) $\frac{\sum(\text{Price Relative} \times w)}{\sum w} \times 100$ (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.**	(d)	**89.**	(c)	**90.**	(d)
91.	(c)	**92.**	(a)	**93.**	(b)	**94.**	(a)	**95.**	(b)
96.	(a)	**97.**	(d)	**98.**	(a)	**99.**	(d)	**100.**	(b)

APPENDICES

TABLE 1(a)

Compound Interest

Annual Compounding

No. of Periods n	$(1 + i)^n$		
	10% per Annum $i = 0.10$	14% per Annum $i = 0.14$	18% per Annum $i = 0.18$
1	1.1	1.14	1.18
2	1.21	1.2996	1.3924
3	1.331	1.48154	1.64303
4	1.4641	1.68896	1.93878
5	1.61051	1.92541	2.28776
6	1.77156	2.19497	2.69955
7	1.94872	2.50227	3.18547
8	2.14359	2.85258	3.75886
9	2.35795	3.25194	4.43546
10	2.59374	3.70722	5.23384
11	2.85312	4.22622	6.17593
12	3.13843	4.8179	7.28759
13	3.45227	5.4924	8.59936
14	3.7975	6.26,133	10.1472
15	4.17725	7.13792	11.9738
16	4.59497	8.13723	14.129
17	5.05447	9.27644	16.6723
18	5.55992	10.5751	19.6733
19	6.11591	12.0557	23.2144
20	6.7275	12.7435	27.393

TABLE 1(b)

Present Value of Re. 1

Annual Compounding

No. of Periods n	$(1 + i)^{-n}$		
	10% per Annum	14% per Annum	18% per Annum
1	.909091	.877193	.847458
2	.826446	.769468	.718184
3	.751315	.674972	.608631
4	.683014	.592081	.515789
5	.620921	.519369	.437109
6	.564474	.455587	.370432
7	.513158	.399638	.313925
8	.466507	.35056	.266038
9	.424098	.307508	.225456
10	.385543	.269744	.191064
11	.350494	.236618	.161919
12	.318631	.20756	.137219
13	.289664	.18207	.116288
14	.263331	.15971	.0985489
15	.239392	.140097	.083516
16	.217629	.122892	.0707763
17	.197845	.1078	.0599799
18	.179859	.0945614	.0508304
19	.163508	.0829486	.0430766
20	.148644	0.72762	.0365056

TABLE 2(a)

Present Value of an Annuity

Annual Compounding

No. of Periods n	10% per Annum		14% per Annum		18% per Annum	
	$P(n, i)$	$1/P(n, i)$	$P(n, i)$	$1/P(n, i)$	$P(n, i)$	$1/P(n, i)$
1	.909091	1.1	.877192	1.14	.847458	1.18
2	1.73554	.576191	1.64666	.60729	1.56564	.638716
3	2.48685	.402115	2.32163	.430732	2.17427	.459924
4	3.16987	.315471	2.91371	.343205	2.69006	.371739
5	3.79079	.263798	3.43308	.291284	3.12717	.319778
6	4.35526	.229607	3.88867	.257158	3.4976	.28591
7	4.86842	.205406	4.2883	.233193	3.81153	.262362
8	5.33493	.187444	4.63886	.21557	4.07757	.245244
9	5.75902	.173641	4.94637	.202169	4.30302	.232395
10	6.14457	.162745	5.21611	.191714	4.49409	.222515
11	6.49506	.153963	5.45273	.183394	4.65601	.214776
12	6.81369	.146763	5.66029	.176669	4.79323	.208628
13	7.10336	.140779	5.84236	.171164	4.90951	.203686
14	7.36669	.135746	6.00207	.166609	5.00806	.199678
15	7.60608	.131474	6.14217	.162809	5.09158	.196403
16	7.82371	.127817	6.26506	.159615	5.16236	.19371
17	8.02155	.124664	6.37286	.156915	5.22233	.191485
18	8.20141	.12193	6.46742	.154621	5.27316	.189639
19	8.36492	.119547	6.55037	.152663	5.31624	.188103
20	8.51356	.11746	6.62313	.150986	5.35275	.18682

TABLE 2(b)

Amount of an Annuity

Annual Computing

No. of Periods n	10% per Annum		14% per Annum		18% per Annum	
	$A(n, i)$	$1/A(n, i)$	$A(n, i)$	$1/A(n, i)$	$A(n, i)$	$1/A(n, i)$
1	1,000000	.999999994	1.00000001	999999993	1	.999999996
2	2.100000	.476190473	2.14000001	.467289717	2.18000001	.458715595
3	3.310000	.302114802	3.43960003	.290731478	3.57240001	.27992386
4	4,641000	.215470802	4.92114404	.203204782	5.21543202	.19173867
5	6.105100	.16379748	6.61010421	.151283545	7.15420979	.139777841
6	7.71561006	.129607379	8.53551881	.117157495	9.44196755	.105910129
7	9,48717108	.105405499	10.7304915	.0931923765	12.1415217	.082361999
8	11.4358882	.0874440168	13.2327603	0.755700232	15.3269956	.0652443586
9	13.579477	0.736405385	16.0853467	.0621683833	19.0858549	.0523948237
10	15.9374248	.0627453949	19.3372953	0.517135403	23.5213088	.0425146411
11	18.5311672	0.539631415	23.0445166	.043394271	28.7551443	.034776386
12	21.384284	.0467633146	27.270749	.0366693265	34.9310704	.0286278087
13	24.5227124	.0407785234	32.0886539	.0311636631	42.218663	.0236862072
14	27.9749837	.0357462229	37.5810655	.0266091445	50.8180224	0.196780582
15	31.772482	.0314737765	43.8424147	.0228089627	60.9652664	.0164027824
16	35.9497303	.0278166204	50.9803528	.0196153998	72.9390144	.0137100838
17	40.5447033	.0246641341	59.1176022	.0169154357	87.0680371	.011485271
18	45.5991737	.021930222	68.3940666	.0146211514	103.740284	.00963945696
19	51.1590911	.019546868	78.969236	.0126631591	123.413535	.00810283897
20	57.274999	.0174596250	91.0249291	.0109860014	146.627971	.00681998115

TABLE 3
Future Value and Present Value

i = rate of interest per period, n = number of periods

	$i = \frac{1}{4}\%$		$i = \frac{1}{2}\%$		$i = \frac{3}{4}\%$	
n	$(1+i)^n$	$(1+i)^{-n}$	$(1+i)^n$	$(1+i)^{-n}$	$(1+i)^n$	$(1+i)^{-n}$
1	1.0025 0000	0.9975 0623	1.0050 0000	0.9950 2488	1.0075 0000	0.9925 5583
2	1.0050 0625	0.9950 1869	1.0100 2500	0.9900 7450	1.0150 5625	0.9851 6708
3	1.0075 1877	0.9925 3734	1.0150 7513	0.9851 4876	1.0226 6917	0.9778 3333
4	1.0100 3756	0.9900 6219	1.0201 5050	0.9802 4752	1.0303 3919	0.9705 5417
5	1.0125 6266	0.9875 9321	1.0252 5125	0.9753 7067	1.0380 6673	0.9633 2920
6	1.0150 9406	0.9851 3038	1.0303 7751	0.9705 1808	1.0458 5224	0.9561 5802
7	1.0176 3180	0.9826 7370	1.0355 2940	0.9656 8963	1.0536 9613	0.9490 4022
8	1.0201 7588	0.9802 2314	1.0407 0704	0.9608 8520	1.0615 9885	0.9419 7540
9	1.0227 2632	0.9777 7869	1.0459 1058	0.9561 0468	1.0695 6084	0.9349 6318
10	1.0252 8313	0.9753 4034	1.0511 4013	0.9513 4794	1.0775 8255	0.9280 0315
11	1.0278 4634	0.9729 0807	1.0563 9583	0.9466 1487	1.0856 6441	0.9210 9494
12	1.0304 1596	0.9704 8187	1.0616 7781	0.9419 0534	1.0938 0690	0.9142 3815
13	1.0329 9200	0.9680 6171	1.0669 8620	0.9372 1924	1.1020 1045	0.9074 3241
14	1.0355 7448	0.9656 4759	1.0723 2113	0.9325 5646	1.1102 7553	0.9006 7733
15	1.0381 6341	0.9632 3949	1.0776 8274	0.9279 1688	1.1186 0259	0.8939 7254
16	1.0407 5882	0.9608 3740	1.0830 7115	0.9233 0037	1.1269 9211	0.8873 1766
17	1.0433 6072	0.9584 4130	1.0884 8651	0.9187 0684	1.1354 4455	0.8307 1231
18	1.0459 6912	0.9560 5117	1.0939 2894	0.9141 3616	1.1439 6039	0.8741 5614
19	1.0485 8404	0.9536 6700	1.0993 9858	0.9095 8822	1.1525 4009	0.8676 4878
20	1.0512 0550	0.9512 8878	1.1048 9558	0.9050 6290	1.1611 8414	0.8611 8985
21	1.0538 3352	0.9489 1649	1.1104 2006	0.9005 6010	1.1698 9302	0.8547 7901
22	1.0564 6810	0.9465 5011	1.1159 7216	0.8960 7971	1.1786 6722	0.8484 1589
23	1.0591 0927	0.9441 8964	1.1215 5202	0.8916 2160	1.1875 0723	0.8421 0014
24	1.0617 5704	0.9418 3505	1.1271 5978	0.8871 8567	1.1964 1353	0.8358 3140
25	1.0644 1144	0.9394 8634	1.1327 9558	0.8827 7181	1.2053 8663	0.8296 0933
26	1.0670 7247	0.9371 4348	1.1384 5955	0.8783 7991	1.2144 2703	0.8234 3358
27	1.0697 4015	0.9348 0646	1.1441 5185	0.8740 0986	1.2235 3523	0.8173 0380
28	1.0724 1450	0.9324 7527	1.1498 7261	0.8696 6155	1.2327 1175	0.8112 1966
29	1.0750 9553	0.9301 4990	1.1556 2197	0.8653 3488	1.2419 5709	0.8051 8080
30	1.0777 8327	0.9278 3032	1.1614 0008	0.8610 2973	1.2512 7176	0.7991 8690
31	1.0804 7773	0.9255 1653	1.1672 0708	0.8567 4600	1.2606 5630	0.7932 3762
32	1.0831 7892	0.9232 0851	1.1730 4312	0.8524 8358	1.2701 1122	0.7873 3262
33	1.0858 8687	0.9209 0624	1.1789 0833	0.8482 4237	1.2796 3706	0.7814 7158
34	1.0886 0159	0.9186 0972	1.1848 0288	0.8440 2226	1.2892 3434	0.7756 5418
35	1.0913 2309	0.9163 1892	1.1907 2689	0.8398 2314	1.2989 0359	0.7698 8008
36	1.0940 5140	0.9140 3384	1.1966 8052	0.8356 4492	1.3086 4537	0.7641 4896
37	1.0967 8653	0.9117 5445	1.2026 6393	0.8314 8748	1.3184 6021	0.7584 6051
38	1.0995 2850	0.9094 8075	1.2086 7725	0.8273 5073	1.3283 4866	0.7528 1440
39	1.1022 7732	0.9072 1272	1.2147 2063	0.8232 3455	1.3383 1128	0.7472 1032
40	1.1050 3301	0.9049 5034	1.2207 9424	0.8191 3886	1.3483 4861	0.7416 4796
41	1.1077 9559	0.9026 9361	1.2268 9821	0.8150 6354	1.3584 6123	0.7361 2701
42	1.1105 6508	0.9004 4250	1.2330 3270	0.8110 0850	1.3686 4969	0.7306 4716
43	1.1133 4149	0.8981 9701	1.2391 9786	0.8069 7363	1.3789 1456	0.7252 0809
44	1.1161 2485	0.8959 5712	1.2453 9385	0.8029 5884	1.3892 5642	0.7198 0952
45	1.1189 1516	0.8937 2281	1.2516 2082	0.7989 6402	1.3996 7584	0.7144 5114
46	1.1217 1245	0.8914 9407	1.2578 7892	0.7949 8907	1.4101 7341	0.7091 3264
47	1.1245 1673	0.8892 7090	1.2641 6832	0.7910 3390	1.4207 4971	0.7038 5374
48	1.1273 2802	0.8870 5326	1.2704 8916	0.7870 9841	1.4314 0533	0.6986 1414
49	1.1301 4634	0.8848 4116	1.2768 4161	0.7831 8250	1.4421 4087	0.6934 1353
50	1.1329 7171	0.8826 3457	1.2832 2581	0.7792 8607	1.4529 5693	0.6882 5165

	$i = 1\%$		$i = 1\frac{1}{4}\%$		$i = 1\frac{1}{2}\%$	
n	$(1+i)^n$	$(1+i)^{-n}$	$(1+i)^n$	$(1+i)^{-n}$	$(1+i)^n$	$(1+i)^{-n}$
1	1.0100 0000	0.9900 9901	1.0125 0000	0.9876 5432	1.0150 0000	0.9852 2167
2	1.0201 0000	0.9802 9605	1.0251 5625	0.9754 6106	1.0302 2500	0.9706 6175
3	1.0303 0100	0.9705 9015	1.0379 7070	0.9634 1833	1.0456 7838	0.9563 1699
4	1.0406 0401	0.9609 8034	1.0509 4534	0.9515 2428	1.0613 6355	0.9421 8423
5	1.0510 1005	0.9514 6569	1.0640 8215	0.9397 7706	1.0772 8400	0.9282 6033
6	1.0615 2015	0.9420 4524	1.0773 8318	0.9281 7488	1.0934 4326	0.9145 4219
7	1.0721 3535	0.9327 1805	1.0908 5047	0.9167 1593	1.1098 4491	0.9010 2679
8	1.0828 5671	0.9234 8322	1.1044 8610	0.9053 9845	1.1264 9259	0.8877 1112
9	1.0936 8527	0.9143 3982	1.1182 9218	0.8942 2069	1.1433 8998	0.8745 9224
10	1.1046 2213	0.9052 8695	1.1322 7083	0.8831 8093	1.1605 4083	0.8616 6723
11	1,1156 6835	0.8963 2372	1,1464 2422	0.8722 7746	1.1779 4894	0.8489 3323
12	1.1268 2503	0.8874 4923	1.1607 5452	0.8615 0860	1.1956 1817	0.8363 8742
13	1.1380 9328	0.8786 6260	1.1752 6395	0.8508 7269	1.2135 5244	0.8240 2702
14	1.1494 7421	0.8699 6297	1.1899 5475	0.8403 6809	1.2317 5573	0.8118 4928
15	1.1609 6896	0.8613 4947	1.2048 2918	0.8299 9318	1.2502 3207	0.7998 5150
16	1.1725 7864	0.8528 2126	1.2198 8955	0.8197 4635	1.2689 8555	0.7880 3104
17	1.1843 0443	0.8443 7749	1.2351 3817	0.8096 2602	1.2880 2033	0.7763 8526
18	1.1961 4748	0.8360 1731	1.2505 7739	0.7996 3064	1.3073 4064	0.7649 1159
19	1.2081 0895	0.8277 3992	1.2662 0961	0.7897 5866	1.3269 5075	0.7536 0747
20	1.2201 9004	0.8195 4447	1.2820 3723	0.7800 0855	1.3468 5501	0.7424 7042
21	1.2323 9194	0.8114 3017	1.2980 6270	0.7703 7881	1.3670 5783	0.7314 9795
22	1.2447 1586	0.8033 9621	1.3142 8848	0.7608 6796	1.3875 6370	0.7206 8763
23	1.2571 6302	0.7954 4179	1.3307 1709	0.7514 7453	1.4083 7715	0.7100 3708
24	1.2697 3465	0.7875 6613	1.3473 5105	0.7421 9707	1.4295 0281	0.6995 4392
25	1.2824 3200	0.7797 6844	1.3641 9294	0.7330 3414	1.4509 4535	0.6892 0583
26	1.2952 5631	0.7720 4796	1.3812 4535	0.7239 8434	1.4727 0953	0.6790 2052
27	1.3082 0888	0.7644 0392	1.3985 1092	0.7150 4626	1.4948 0018	0.6689 8574
28	1.3212 9097	0.7568 3557	1.4159 9230	0.7062 1853	1.5172 2218	0.6590 9925
29	1.3345 0388	0.7493 4215	1.4336 9221	0.6974 9978	1.5399 8051	0.6493 5887
30	1.3478 4892	0.7419 2292	1.4516 1336	0.6888 8867	1.5630 8022	0.6397 6243
31	1.3613 2740	0.7345 7715	1.4697 5853	0.6803 8387	1.5865 2642	0.6303 0781
32	1.3749 4068	0.7273 0411	1.4881 3051	0.6719 8407	1.6103 2432	0.6209 9292
33	1.3886 9009	0.7201 0307	1.5067 3214	0.6636 8797	1.6344 7918	0.6118 1568
34	1.4025 7699	0.7129 7334	1.5255 6629	0.6554 9429	1.6589 9637	0.6027 7407
35	1.4166 0276	0.7059 1420	1.5446 3587	0.6474 0177	1.6838 8132	0.5938 6608
36	1.4307 6878	0.6989 2495	1.5639 4382	0.6394 0916	1.7091 3954	0.5850 8974
37	1.4450 7647	0.6920 0490	1.5834 9312	0.6315 1522	1.7347 7663	0.5764 4309
38	1.4595 2724	0.6851 5337	1.6032 8678	0.6237 1873	1.7607 9828	0.5679 2423
39	1.4741 2251	0.6783 6967	16233 2787	06160 1850	1.7872 1025	0.5595 3126
40	1.4888 6373	0.6716 5314	1.6436 1946	0.6084 1334	1.8140 1841	0.5512 6232
41	1.5037 5237	0.6650 0311	1.6641 6471	0.6009 0206	1.8412 2868	0.5431 1559
42	1.5187 8989	0.6584 1892	1.6849 6677	0.5934 8352	1.8688 4712	0.5350 8925
43	1.5339 7779	0.6518 9992	1.7060 2885	0.5861 5656	1.8968 7982	0.5271 8153
44	1.5493 1757	0.6454 4546	1.7273 5421	0.5789 2006	1.9253 3302	0.5193 9067
45	1.5648 1075	0.6390 5492	1.7489 4614	0.5717 7290	1.9542 1301	0.5117 1494
46	1.5804 5885	0.6327 2764	1.7708 0797	0.5647 1397	1.9835 2621	0.5041 5265
47	1.5962 6344	0.6264 6301	1.7929 4306	0.5577 4219	2.0132 7910	0.4967 0212
48	1.6122 2608	0.6202 6041	1.8153 5485	0.5508 5649	2.0434 7829	0.4893 6170
49	1.6283 4834	0.6141 1921	1.8380 4679	0.5440 5579	2.0741 3046	0.4821 2975
50	1.6446 3182	0.6080 3882	1.8610 2237	0.5373 3905	2.1052 4242	0.4750 0468

	$i = 1\frac{3}{4}\%$		$i = 2\%$		$i = 2\frac{1}{4}\%$	
n	$(1 + i)^n$	$(1 + i)^{-n}$	$(1 + i)^n$	$(1 + i)^{-n}$	$(1 + i)^n$	$(1 + i)^{-n}$
1	1.0175 0000	0.9828 0098	1.0200 0000	0.9803 9216	1.0225 0000	0.9779 9511
2	1.0353 0625	0.9658 9777	1.0404 0000	0.9611 6878	1.0455 0625	0.9564 7444
3	1.0534 2411	0.9492 8528	1.0612 0800	0.9423 2233	1.0690 3014	0.9354 2732
4	1.0718 5903	0.9329 5851	1.0824 3216	0.9238 4543	1.0930 8332	0.9148 4335
5	1.0906 1656	0.9169 1254	1.1040 8080	0.9057 3081	1.1176 7769	0.8947 1232
6	1.1097 0235	0.9011 4254	1.1261 6242	0.8879 7138	1.1428 2544	0.8750 2427
7	1.1291 2215	0.8856 4378	1.1486 8567	0.8705 6018	1.1685 3901	0.8557 6946
8	1.1488 8178	0.8704 1157	1.1716 5938	0.8534 9037	1.1948 3114	0.8369 3835
9	1.1689 8721	0.8554 4135	1.1950 9257	0.8367 5527	1.2217 1484	0.8185 2161
10	1.1894 4449	0.8407 2860	1.2189 9442	0.8203 4830	1.2492 0343	0.8005 1013
11	1.2102 5977	0.8262 6889	1.2433 7431	0.8042 6304	1.2773 1050	0.7828 9499
12	1.2314 3931	0.8120 5788	1.2682 4179	0.7884 9318	1.3060 4999	0.7656 6748
13	1.2529 8950	0.7980 9128	1.2936 0663	0.7730 3253	1.3354 3611	0.7488 1905
14	1.2749 1682	0.7843 6490	1.3194 7876	0.7578 7502	1.3654 8343	0.7323 4137
15	1.2972 2786	0.7708 7459	1.3458 6834	0.7430 1473	1.3962 0680	0.7162 2628
16	1.3199 2935	0.7576 1631	1.3727 8571	0.7284 4581	1.4276 2146	0.7004 6580
17	1.3430 2811	0.7445 8605	1.4002 4142	0.7141 6256	1.4597 4294	0.6850 5212
18	1.3665 3111	0.7317 7990	1.4282 4625	0.7001 5937	1.4925 8716	0.6699 7763
19	1.3904 4540	0.7191 9401	1.4568 1117	0.6864 3076	1.5261 7037	0.6552 3484
20	1.4147 7820	0.7068 2458	1.4859 4740	0.6729 7133	1.5605 0920	0.6408 1647
21	1.4395 3681	0.6946 6789	1.5156 6634	0.6597 7582	1.5956 2066	0.6267 1538
22	1.4647 2871	0.6827 2028	1.5459 7967	0.6468 3904	1.6315 2212	0.6129 2457
23	1.4903 6146	0.6709 7817	1.5768 9926	0.6341 5592	1.6682 3137	0.5994 3724
24	1.5164 4279	0.6594 3800	1.6084 3725	0.6217 2149	1.7057 6658	0.5862 4668
25	1.5429 8054	0.6480 9632	1.6406 0599	0.6095 3087	1.7441 4632	0.5733 4639
26	1.5699 8269	0.6369 4970	1.6734 1811	0.5975 7928	1.7833 8962	0.5607 2997
27	1.5974 5739	0.6259 9479	1.7068 8648	0.5858 6204	1.8235 1588	0.5483 9117
28	1.6254 1290	0.6152 2829	1.7410 2421	0.5743 7455	1.8645 4499	0.5363 2388
29	1.6538 5762	0.6046 4697	1.7758 4469	0.5631 1231	1.9064 9725	0.5245 2213
30	1.6828 0013	0.5942 4764	1.8113 6158	0.5520 7089	1.9493 9344	0.5129 8008
31	1.7122 4913	0.5840 2716	1.8475 8882	0.5412 4597	1.9932 5479	0.5016 9201
32	1.7422 1349	0.5739 8247	1.8845 4059	0.5306 3330	2.0381 0303	0.4906 5233
33	1.7727 0223	0.5641 1053	1.9222 3140	0.5205 2873	2.0839 6034	0.4798 5558
34	1,8037 2452	0.5544 0839	1.9606 7603	0.5100 2817	2.1308 4945	0.4692 9641
35	1.8352 8970	0.5448 7311	1.9998 8955	0.5000 2761	2.1787 9356	0.4589 6960
36	1.8674 0727	0.5355 0183	2.0398 8734	0.4902 2315	2.2278 1642	0.4488 7002
37	1.9000 8689	0.5262 9172	2.0806 8509	0.4806 1093	2.2779 4229	0.4389 9268
38	1.9333 3841	0.5172 4002	2.1222 9879	0.4711 8719	2.3291 9599	0.4293 3270
39	1.9671 7184	0.5083 4400	2.1647 4477	0.4619 4822	2.3816 0290	0.4198 8528
40	2.0015 9734	0.4996 0098	2.2080 3966	0.4528 9042	2.4351 8897	0.4106 4575
41	2.0366 2530	0.4910 0834	2.2522 0046	0.4440 1021	2.4899 8072	0.4016 0954
42	2.0722 6624	0.4825 6348	2.2972 4447	0.4353 0413	2.5460 0528	0.3927 7216
43	2.1085 3090	0.4742 6386	2.3431 8936	0.4267 6875	2.6032 9040	0.3841 2925
44	2.1454 3019	0.4661 0699	2.3900 5314	0.4184 0074	2.6618 6444	0.3756 7653
45	2.1829 7522	0.4580 9040	2.4378 5421	0.4101 9680	2.7217 5639	0.3674 0981
46	2.2211 7728	0.4502 1170	2.4866 1129	0.4021 5373	2.7829 9590	0.3593 2500
47	2.2600 4789	0.4424 6850	2.5363 4352	0.3942 6836	2.8456 1331	0.3514 1809
48	2.2995 9872	0.4348 5848	2.5870 7039	0.3865 3761	2.9096 3961	0.3436 8518
49	2.3398 4170	0.4273 7934	2.6388 1179	0.3789 5844	2.9751 0650	0.3361 2242
50	2.3807 8893	0.4200 2883	2.6915 8803	0.3715 2788	3.0420 4640	0.3287 2608

	$i = 2\frac{1}{2}\%$		$i = 3\%$		$i = 3\frac{1}{2}\%$	
n	$(1 + i)^n$	$(1 + i)^{-n}$	$(1 + i)^n$	$(1 + i)^{-n}$	$(1 + i)^n$	$(1 + i)^{-n}$
1	1.0250 0000	0.9756 0976	1.0300 0000	0.9708 7379	1.0350 0000	0.9661 8357
2	1.0506 2500	0.9518 1440	1.0609 0000	0.9425 9591	1.0712 2500	0.9335 1070
3	1.0768 9063	0.9285 9941	1.0927 2700	0.9151 4166	1.1087 1788	0.9019 4271
4	1.1038 1289	0.9059 5064	1.1255 0881	0.8884 8705	1.1475 2300	0.8714 4223
5	1.1314 0821	0.8838 5429	1.1592 7407	0.8626 0878	1.1876 8631	0.8419 7317
6	1.1596 9342	0.8622 9687	1.1940 5230	0.8374 8426	1.2292 5533	0.8135 0064
7	1.1886 8575	0.8412 6524	1.2298 7387	0.8130 9151	1.2722 7926	0.7859 9096
8	1.2184 0290	0.8207 4657	1.2667 7008	0.7894 0923	1.3168 0904	0.7594 1156
9	1.2488 6297	0.8007 2836	1.3047 7318	0.7664 1673	1.3628 9735	0.7337 3097
10	1.2800 8454	0.7811 9840	1.3439 1638	0.7440 9391	1.4105 9876	0.7089 1881
11	1.3120 8666	0.7621 4478	1.3842 3387	0.7224 2128	1.4599 6972	0.6849 4571
12	1.3448 8882	0.7435 5589	1.4257 6089	0.7013 7988	1.5110 6866	0.6617 8330
13	1.3785 1104	0.7254 2038	1.4685 3371	0.6809 5134	1.5639 5606	0.6394 0415
14	1.4129 7382	0.7077 2720	1.5125 8972	0.6611 1781	1.6186 9452	0.6177 8179
15	1.4482 9817	0.6904 6556	1.5579 6742	0.6418 6195	1.6753 4883	0.5968 9062
16	1.4845 0562	0.6736 2493	1.6047 0644	0.6231 6694	1.7339 8604	0.5767 0591
17	1.5216 1826	0.6571 9506	1.6528 4763	0.6050 1645	1.7946 7555	0.5572 0378
18	1.5596 5872	0.6411 6591	1.7024 3306	0.5873 9461	1.8574 8920	0.5383 6114
19	1.5986 5019	0.6255 2772	1.7535 0605	0.5702 8603	1.9225 0132	0.5201 5569
20	1.6386 1644	0.6102 7094	1.8061 1123	0.5536 7575	1.9897 8886	0.5025 6588
21	1.6795 8185	0.5953 8629	1.8602 9457	0.5375 4928	2.0594 3147	0.4855 7090
22	1,7215 7140	0.5808 6467	1,9161 0341	0.5218 9250	2,1315 1158	0.4691 5063
23	1.7646 1068	0.5666 9724	1.9735 8651	0.5066 9175	2.2061 1448	0.4532 8563
24	1.8087 2595	0.5528 7535	2.0327 9411	0.4919 3374	2.2833 2849	0.4379 5713
25	1.8539 4410	0.5393 9059	2.0937 7793	0.4776 0557	2.3632 4498	0.4231 4699
26	1.9002 9270	0.5262 3472	2.1565 9127	0.4636 9473	2.4459 5856	0.4088 3767
27	1.9478 0002	0.5133 9973	2.2212 8901	0.4501 8906	2.5315 6711	0.3950 1224
28	1.9964 9502	0.5008 7778	2.2879 2768	0.4370 7675	2.6201 7196	0.3816 5434
29	2.0464 0739	0.4886 6125	2.3565 6551	0.4243 4636	2.7118 7798	0.3687 4815
30	2.0975 6758	0.4767 4269	2.4272 6247	0.4119 8676	2.8067 9370	0.3562 7841
31	2.1500 0677	0.4651 1481	2.5000 8035	0.3999 8715	2.9050 3148	0.3442 3035
32	2.2037 5694	0.4537 7055	2.5750 8276	0.3883 3703	3.0067 0759	0.3325 8971
33	2.2588 5086	0.4427 0298	2.6523 3524	0.3770 2625	3.1119 4235	0.3213 4271
34	2.3153 2213	0.4319 0534	2.7319 0530	0.3660 4490	3.2208 6033	0.3104 7605
35	2.3732 0519	0.4213 7107	2.8138 6245	0.3553 8340	3.3335 9045	0.2999 7686
36	2.4325 3532	0.4110 9372	2.8982 7833	0.3450 3243	3.4502 6611	0.2898 3272
37	2.4933 4870	0.4010 6705	2.9852 2668	0.3349 8294	3.5710 2543	0.2800 3161
38	2.5556 8242	0.3912 8492	3.0747 8348	0.3252 2615	3.6960 1132	0.2705 6194
39	2.6195 7448	0.3817 4139	3.1670 2698	0.3157 5355	3.8253 7171	0.2614 1250
40	2.6850 6384	0.3724 3062	3.2620 3779	0.3065 5684	3.9592 5972	0.2525 7247
41	2.7521 9043	0.3633 4695	3.3598 9893	0.2976 2800	4.0978 3381	0.2440 3137
42	2.8209 9520	0.3544 8483	3.4606 9589	0.2889 5922	4.2412 5799	0.2357 7910
43	2.8915 2008	0.3458 3886	3.5645 1677	0.2805 4294	4.3897 0202	0.2278 0590
44	2.9638 0808	03374 0376	3.6714 5227	0.2723 7178	4.5433 4160	0.2201 0231
45	3.0379 0328	0.3291 7440	3.7815 9584	0.2644 3862	4.7023 5855	0.2126 5924
46	3.1138 5086	0.3211 4576	3.8950 4372	0.2567 3653	4.8669 4110	0.2054 6787
47	3.1916 9713	0.3133 1294	4.0118 9503	0.2492 5876	5.0372 8404	0.1985 1968
48	3.2714 8956	0.3056 7116	4.1322 5188	0.2419 9880	5.2135 8898	0.1918 0645
49	3.3532 7680	0.2982 1576	4.2562 1944	0.2349 5029	5.3960 6459	0.1853 2024
50	3.4371 0872	0.2909 4221	4.3839 0602	0.2281 0708	5.5849 2686	0.1790 5337

	$i = 4\%$		$i = 4\frac{1}{2}\%$		$i = 5\%$	
n	$(1 + i)^n$	$(1 + i)^{-n}$	$(1 + i)^n$	$(1 + i)^{-n}$	$(1 + i)^n$	$(1 + i)^{-n}$
1	1.0400 0000	0.9615 3846	1.0450 0000	0.9569 3780	1.0500 0000	0.9523 8095
2	1.0816 0000	0.9245 5621	1.0920 2500	0.9157 2995	1.1025 0000	0.9070 2948
3	1.1248 6400	0.8889 9636	1.1411 6613	0.8762 9660	1.1576 2500	0.8638 3760
4	1.1698 5856	0.8548 0419	1.1925 1860	0.8382 6134	1.2155 0625	0.8227 0247
5	1.2166 5290	0.8219 2711	1.2461 8194	0.8024 5105	1.2762 8156	0.7835 2617
6	1.2653 1902	0.7903 1453	1.3022 6012	0.7678 9574	1.3400 9564	0.7462 1540
7	1.3159 3178	0.7599 1781	1.3608 6183	0.7348 2846	1.4071 0042	0.7106 8133
8	1.3685 6905	0.7306 9021	1.4221 0061	0.7031 8513	1.4774 5544	0.6768 3936
9	1.4233 1181	0.7025 8674	1.4860 9514	0.6729 0443	1.5513 2822	0.6446 0892
10	1.4802 4428	0.6755 6417	1.5529 6942	0.6439 2768	1.6288 9463	0.6139 1325
11	1.5394 5406	0.6495 8093	1.6228 5305	0.6161 9874	1.7103 3936	0.5846 7929
12	1.6010 3222	0.6245 9705	1.6958 8143	0.5896 6386	1.7958 5633	0.5568 3742
13	1.6650 7351	0.6005 7409	1.7721 9610	0.5642 7164	1.8856 4914	0.5303 2135
14	1.7316 7645	0.5774 7508	1.8519 4492	0.5399 7286	1.9799 3160	0.5050 6795
15	1.8009 4351	0.5552 6450	1.9352 8244	0.5167 2044	2.0789 2818	0.4810 1710
16	1.8729 8125	0.5339 0818	2.0223 7015	0.4944 6932	2.1828 7459	0.4581 1152
17	1.9479 0050	0.5133 7325	2.1133 7681	0.4731 7639	2.2920 1832	0.4362 9669
18	2.0258 1652	0.4936 2812	2.2084 7877	0.4528 0037	2.4066 1923	0.4155 2065
19	2.1068 4918	0.4746 4242	2.3078 6031	0.4333 0179	2.5269 5020	0.3957 3396
20	2.1911 2314	0.4563 8695	2.4117 1402	0.4146 4286	2.6532 9771	0.3768 8948
21	2.2787 6807	0.4388 3360	2.5202 4116	0.3967 8743	2.7859 6259	0.3589 4236
22	2.3699 1879	0.4219 5539	2.6336 5201	0.3797 0089	2.9252 6072	0.3418 4987
23	2.4647 1554	0.4057 2633	2.7521 6635	0.3633 5013	3.0715 2376	0.3255 7131
24	2.5633 0416	0.3901 2147	2.8760 1383	0.3477 0347	3.2250 9994	0.3100 6791
25	2.6658 3633	0.3751 1680	3.0054 3446	0.3327 3060	3.3863 5494	0.2953 0277
26	2.7724 6978	0.3606 8923	3.1406 7901	0.3184 0248	3.5556 7269	0.2812 4073
27	2.8833 6858	0.3468 1657	3.2820 0956	0.3046 9137	3.7334 5632	0.2678 4832
28	2.9987 0332	0.3334 7747	3.4296 9999	0.2915 7069	3.9201 2914	0.2550 9364
29	3.1186 5145	0.3206 5141	3.5840 3649	0.2790 1502	4.1161 3560	0.2429 4632
30	3.2433 9751	0.3083 1867	3.7453 1813	0.2670 0002	4.3219 4238	0.2313 7745
31	3.3731 3341	0.2964 6026	3.9138 5745	0.2555 0241	4.5380 3949	0.2203 5947
32	3.5080 5875	0.2850 5794	4.0899 8104	0.2444 9991	4.7649 4147	0.2098 6617
33	3.6483 8110	0.2740 9417	4.2740 3018	0.2339 7121	5.0031 8854	0.1998 7254
34	3.7943 1634	0.2635 5209	4.4663 6154	0.2238 9589	5.2533 4797	0.1903 5480
35	3.9460 8899	0.2534 1547	4.6673 4781	0.2142 5444	5.5160 1537	0.1812 9029
36	4.1039 3255	0.2436 6872	4.8773 7846	0.2050 2817	5.7918 1614	0.1726 5741
37	4.2680 8986	0.2342 9685	5.0968 6049	0.1961 9921	6.0814 0694	0.1644 3563
38	4.4388 1345	0.2252 8543	5.3262 1921	0.1877 5044	6.3854 7729	0.1566 0536
39	4.6163 6599	0.2166 2061	5.5658 9908	0.1796 6549	6.7047 5115	0.1491 4797
40	4.8010 2063	0.2082 8904	5.8163 6454	0.1719 2870	7.0399 8871	0.1420 4568
41	4.9930 6145	0.2002 7793	6.0781 0094	0.1645 2507	7.3919 8815	0.1352 8160
42	5.1927 8391	0.1925 7493	6.3516 1548	0.1574 4026	7.7615 8756	0.1288 3962
43	5.4004 9527	0.1851 6820	6.6374 3818	0.1506 6054	8.1496 6693	0.1227 0440
44	5.6165 1508	0.1780 4635	6.9361 2290	0.1441 7276	8.5571 5028	0.1168 6133
45	5.8411 7568	0.1711 9841	7.2482 4843	0.1379 6437	8.9850 0779	0.1112 9651
46	6.0748 2271	0.1646 1386	7.5744 1961	0.1320 2332	9.4342 5818	0.1059 9668
47	6.3178 1562	0.1582 8256	7.9152 6849	0.1263 3810	9.9059 7109	0.1009 4921
48	6.5705 2824	0.1521 9476	8.2714 5557	0.1208 9771	10.4012 6965	0.0961 4211
49	6.8333 4937	0.1463 4112	8.6436 7107	0.1156 9158	10.9213 3313	0.0915 6391
50	7.1066 8335	0.1407 1262	9.0326 3627	0.1107 0965	11.4673 9979	0.0872 0373

	i = 6%		i = 7%		i = 8%	
n	$(1 + i)^n$	$(1 + i)^{-n}$	$(1 + i)^n$	$(1 + i)^{-n}$	$(1 + i)^n$	$(1 + i)^{-n}$
1	1.0600 0000	0.9433 9623	1.0700 0000	0.9345 7944	1.0800 0000	0.9259 2593
2	1.1236 0000	0.8899 9644	1.1449 0000	0.8734 3873	1.1664 0000	0.8573 3882
3	1.1910 1600	0.8396 1928	1.2250 4300	0.8162 9788	1.2597 1200	0.7938 3224
4	1.2624 7696	0.7920 9366	1.3107 9601	0.7628 9521	1.3604 8896	0.7350 2985
5	1.3382 2558	0.7472 5817	1.4025 5173	0.7129 8618	1.4693 2808	0.6805 8320
6	1.4185 1911	0.7049 6054	1.5007 3035	0.6663 4222	1.5868 7432	0.6301 6963
7	1.5036 3026	0.6650 5711	1.6057 8148	0.6227 4974	1.7138 2427	0.5834 9040
8	1.5938 4807	0.6274 1237	1.7181 8618	0.5820 0910	1.8509 3021	0.5402 6888
9	1.6894 7896	0.5918 9846	1.8384 5921	0.5439 3374	1.9990 0463	0.5002 4897
10	1.7908 4770	0.5583 9478	1.9671 5136	0.5083 4929	2.1589 2500	0.4631 9349
11	1.8982 9856	0.5267 8753	2.1048 5195	0.4750 9280	2.3316 3900	0.4288 8286
12	2.0121 9647	0.4969 6936	2.2521 9159	0.4440 1196	2.5181 7012	0.3971 1376
13	2.1329 2826	0.4688 3902	2.4098 4500	0.4149 6445	2.7196 2373	0.3676 9792
14	2.2609 0396	04423 0096	2.5785 3415	0.3878 1724	2.9371 9362	0.3404 6104
15	2.3965 5819	0.4172 6506	2.7590 3154	0.3624 4602	3.1721 6911	0.3152 4170
16	2.5403 5168	0.3936 4628	2.9521 6375	0.3387 3460	3.4259 4264	0.2918 9047
17	2.6927 7279	0.3713 6442	3.1588 1521	0.3165 7439	3.7000 1805	0.2702 6895
18	2.8543 3915	0.3503 4379	3.3799 3228	0.2958 6392	3.9960 1950	0.2502 4903
19	3.0255 9950	0.3305 1301	3.6165 2754	0.2765 0833	4.3157 0106	0.2317 1206
20	3.2071 3547	0.3118 0473	3.8696 8446	0.2584 1900	4.6609 5714	0.2145 4821
21	3.3995 6360	0.2941 5540	4.1405 6237	0.2415 1309	5.0338 3372	0.1986 5575
22	3.6035 3742	0.2775 0510	4.4304 0174	0.2257 1317	5.4365 4041	0.1839 4051
23	3.8197 4966	0.2617 9726	4.7405 2986	0.2109 4688	5.8714 6365	0.1703 1528
24	4.0489 3464	0.2469 7855	5.0723 6695	0.1971 4662	6.3411 8074	0.1576 9934
25	4.2918 7072	0.2329 9863	5.4274 3264	0.1842 4918	6.8484 7520	0.1460 1790
26	4.5493 8296	0.2198 1003	5.8073 5292	0.1721 9549	7.3963 5321	0.1352 0176
27	4.8223 4594	0.2073 6795	6.2138 6763	0.1609 3037	7.9880 6147	0.1251 8682
28	5.1116 8670	0.1956 3014	6.6488 3836	0.1504 0221	8.6271 0639	0.1159 1372
29	5.4183 8790	0.1845 5674	7.1142 5705	0.1405 6282	9.3172 7490	0.1073 2752
30	5.7434 9117	0.1741 1013	7.6122 5504	0.1313 6712	10.0626 5689	0.0993 7733
31	6.0881 0064	0.1642 5484	8.1451 1290	0.1227 7301	10.8676 6944	0.0920 1605
32	6.4533 8668	0.1549 5740	8.7152 7080	0.1147 4113	11.7370 8300	0.0852 0005
33	6.8405 8988	0.1461 8622	9.3253 3975	0.1072 3470	12.6760 4964	0.0788 8893
34	7.2510 2528	0.1379 1153	9.9781 1354	0.1002 1934	13.6901 3361	0.0730 4531
35	7.6860 8679	0.1301 0522	10.6765 8148	0.0936 6294	14.7853 4429	0.0676 3454
36	8.1472 5200	0.1227 4077	11.4239 4219	0.0875 3546	15.9681 7184	0.0626 2458
37	8.6360 8712	0.1157 9318	12.2236 1814	0.0818 0884	17.2456 2558	0.0579 8572
38	9.1542 5235	0.1092 3885	13.0792 7141	0.0764 5686	18.6252 7563	0.0536 9048
39	9.7035 0749	0.1030 5552	13.9948 2041	0.0714 5501	20.1152 9768	0.0497 1341
40	10.2857 1794	0.0972 2219	14.9744 5784	0.0667 8038	21.7245 2150	0.0460 3093
41	10.9028 6101	0.0917 1905	16.0226 6989	0.0624 1157	23.4624 8322	0.0426 2123
42	11.5570 3267	0.0865 2740	17.1442 5678	0.0583 2857	25.3394 8187	0.0394 6411
43	12.2504 5463	0.0816 2962	18.3443 5475	0.0545 1268	27.3666 4042	0.0365 4084
44	12.9854 8191	0.0770 0908	19.6284 5959	0.0509 4643	29.5559 7166	0.0338 3411
45	13.7646 1083	0.0726 5007	21.0024 5176	0.0476 1349	31.9204 4939	0.0313 2788
46	14.5904 8748	0.0685 3781	22.4726 2338	0.0444 9859	34.4740 8534	0.0290 0730
47	15.4659 1673	0.0646 5831	24.0457 0702	0.0415 8747	37.2320 1217	0.0268 5861
48	16.3938 7173	0.0609 9840	25.7289 0651	0.0388 6679	40.2105 7314	0.0248 6908
49	17.3775 0403	0.0575 4566	27.5299 2997	0.0363 2410	43.4274 1899	0.0230 2693
50	18.4201 5427	0.0542 8836	29.4570 2506	0.0339 4776	46.9016 1251	0.0213 2123

TABLE 4
Log-Tables
LOGARITHAMS

	0	1	2	3	4	5	6	7	8	9	Mean Difference								
											1	2	3	4	5	6	7	8	9
10	0000	0043	0086	0128	0170	0212	0253	0294	0334	0374	4	8	12	17	21	25	29	33	37
11	0414	0453	0492	0531	0569	0607	0645	0682	0719	0755	4	8	11	15	19	23	26	30	34
12	0792	0828	0864	0899	0934	0969	1004	1038	1072	1106	3	7	10	14	17	21	24	28	31
13	1139	1173	1206	1239	1271	1303	1335	1367	1399	1430	3	6	10	13	16	19	23	26	29
14	1461	1492	1523	1553	1584	1614	1644	1673	1703	1732	3	6	9	12	15	18	21	24	27
15	1761	1790	1818	1847	1875	1903	1931	1959	1987	2014	3	6	8	11	14	17	20	22	25
16	2041	2068	2095	2122	2148	2175	2201	2227	2253	2279	3	5	8	11	13	16	18	21	24
17	2304	2330	2355	2380	2405	2430	2455	2480	2504	2529	2	5	7	10	12	15	17	20	22
18	2553	2577	2601	2625	2648	2672	2695	2718	2742	2765	2	5	7	9	12	14	16	19	21
19	2788	2810	2833	2856	2878	2900	2923	2945	2967	2989	2	4	7	9	11	13	16	18	20
20	3010	3032	3054	3075	3096	3118	3139	3160	3181	3201	2	4	6	8	11	13	15	17	19
21	3222	3243	3263	3284	3304	3324	3345	3365	3385	3404	2	4	6	8	10	12	14	16	18
22	3424	3444	3464	3483	3502	3522	3541	3560	3579	3598	2	4	6	8	10	12	14	15	17
23	3617	3636	3655	3674	3692	3711	3729	3747	3766	3784	2	4	6	7	9	11	13	15	17
24	3802	3820	3838	3856	3874	3892	3909	3927	3945	3962	2	4	5	7	9	11	12	14	16
25	3979	3997	4014	4031	4048	4065	4082	4099	4116	4133	2	3	5	7	9	10	12	14	15
26	4150	4166	4183	4200	4216	4232	4249	4265	4281	4298	2	3	5	7	8	10	11	13	15
27	4314	4330	4346	4362	4378	4393	4409	4425	4440	4456	2	3	5	6	8	9	11	13	14
28	4472	4487	4502	4518	4533	4548	4564	4579	4594	4609	2	3	5	6	8	9	11	12	14
29	4624	4639	4654	4669	4683	4698	4713	4728	4742	4757	1	3	4	6	7	9	10	12	13
30	4771	4786	4800	4814	4829	4843	4857	4871	4886	4900	1	3	4	6	7	9	10	11	13
31	4914	4928	4942	4955	4969	4983	4997	5011	5024	5038	1	3	4	6	7	8	10	11	12
32	5051	5065	5079	5092	5105	5119	5132	5145	5159	5172	1	3	4	5	7	8	9	11	12
33	5185	5198	5211	5224	5237	5250	5263	5276	5289	5302	1	3	4	5	6	8	9	10	12
34	5315	5328	5340	5353	5366	5378	5391	5403	5416	5428	1	3	4	5	6	8	9	10	11
35	5441	5453	5465	5478	5490	5502	5514	5527	5539	5551	1	2	4	5	6	7	9	10	11
36	5563	5575	5587	5566	5611	5623	5635	5647	5658	5670	1	2	4	5	6	7	8	10	11
37	5682	5694	5705	5717	5729	5740	5752	5763	5775	5786	1	2	3	5	6	7	8	9	10
38	5798	5809	5821	5832	5843	5855	5866	5877	5888	5899	1	2	3	5	6	7	8	9	10
39	5911	5922	5933	5944	5955	5966	5977	5988	5999	6010	1	2	3	4	5	7	8	9	10
40	6021	6031	6042	6053	6064	6075	6085	6096	6107	6117	1	2	3	4	5	6	8	9	10
41	6128	6138	6149	6160	6170	6180	6191	6201	6212	6222	1	2	3	4	5	6	7	8	9
42	6232	6243	6253	6263	6274	6284	6294	6304	6314	6325	1	2	3	4	5	6	7	8	9
43	6335	6345	6355	6365	6375	6385	6395	6405	6415	6425	1	2	3	4	5	6	7	8	9
44	6435	6345	6454	6464	6474	6484	6493	6503	6513	6522	1	2	3	4	5	6	7	8	9
45	6532	6542	6551	6561	6571	6580	6590	6599	6609	6618	1	2	3	4	5	6	7	8	9
46	6628	6637	6646	6656	6665	6675	6684	6693	6702	6712	1	2	3	4	5	6	7	7	8
47	6721	6730	6739	6749	6758	6767	6776	6785	6794	6803	1	2	3	4	5	5	6	7	8
48	6812	6821	6830	6839	6848	6857	6866	6875	6884	6893	1	2	3	4	4	5	6	7	8
49	6902	6911	6920	6928	6937	6946	6955	6964	6972	6981	1	2	3	4	4	5	6	7	8
50	6990	6998	7007	7016	7024	7033	7042	7050	7059	7067	1	2	3	3	4	5	6	7	8
51	7076	7084	7093	7101	7110	7118	7126	7135	7143	7152	1	2	3	3	4	5	6	7	8
52	7160	7168	7177	7185	7193	7202	7210	7218	7226	7235	1	2	2	3	4	5	6	7	7
53	7243	7251	7259	7267	7275	7284	7292	7300	7308	7316	1	2	2	3	4	5	6	6	7
54	7324	7332	7340	7348	7356	7364	7372	7380	7388	7396	1	2	2	3	4	5	6	6	7
	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9

	0	1	2	3	4	5	6	7	8	9	Mean Difference								
											1	2	3	4	5	6	7	8	9
55	7404	7412	7419	7427	7435	7443	7451	7459	7466	7474	1	2	2	3	4	5	5	6	7
56	7482	7490	7497	7505	7513	7520	7528	7536	7543	7551	1	2	2	3	4	5	5	6	7
57	7559	7566	7574	7582	7589	7597	7604	7612	7619	7627	1	2	2	3	4	5	5	6	7
58	7634	7642	7649	7657	7664	7672	7679	7686	7694	7701	1	1	2	3	4	4	5	6	7
59	7709	7716	7723	7731	7738	7745	7752	7760	7767	7774	1	1	2	3	4	4	5	6	7
60	7782	7789	7769	7803	7810	7818	7825	7832	7839	7846	1	1	2	3	4	4	5	6	6
61	7853	7860	7868	7875	7882	7889	7896	7903	7910	7917	1	1	2	3	4	4	5	6	6
62	7924	7931	7938	7945	7952	7959	7966	7973	7980	7987	1	1	2	3	3	4	5	6	6
63	7993	8000	8007	8014	8021	8028	8035	8041	8048	8055	1	1	2	3	3	4	5	5	6
64	8062	8069	8075	8082	8089	8096	8102	8109	8116	8122	1	1	2	3	3	4	5	5	6
65	8129	8136	8142	8149	8156	8162	8169	8176	8182	8189	1	1	2	3	3	4	5	5	6
66	8195	8202	8209	8215	8222	8228	8235	8241	8248	8254	1	1	2	3	3	4	5	5	6
67	8261	8267	8274	8280	8287	8293	8299	8306	8312	8319	1	1	2	3	3	4	5	5	6
68	8325	8331	8338	8344	8351	8357	8363	8370	8376	8382	1	1	2	3	3	4	4	5	6
69	8388	8395	8401	8407	8414	8420	8426	8432	8439	8445	1	1	2	2	3	4	4	5	6
70	8451	8457	8463	8470	8476	8482	8488	8494	8500	8506	1	1	2	2	3	4	4	5	6
71	8513	8519	8525	8531	8537	8543	8549	8555	8561	8567	1	1	2	2	3	4	4	5	5
72	8573	8579	8585	8591	8597	8603	8609	8615	8621	8627	1	1	2	2	3	4	4	5	5
73	8633	8639	8645	8651	8657	8663	8669	8675	8681	8686	1	1	2	2	3	4	4	5	5
74	8692	8698	8704	8710	8716	8722	8727	8733	8739	8745	1	1	2	2	3	4	4	5	5
75	8751	8756	8762	8768	8774	8779	8785	8791	8797	8802	1	1	2	2	3	3	4	5	5
76	8808	8814	8820	8825	8831	8837	8842	8848	8854	8859	1	1	2	2	3	3	4	5	5
77	8865	8871	8876	8882	8887	8893	8899	8904	8910	8915	1	1	2	2	3	3	4	4	5
78	8921	8927	8932	8938	8943	8949	8954	8960	8965	8971	1	1	2	2	3	3	4	4	5
79	8976	8982	8987	8993	8998	9004	9009	9015	9020	9025	1	1	2	2	3	3	4	4	5
80	9031	9036	9042	9047	9053	9058	9063	9069	9074	9079	1	1	2	2	3	3	4	4	5
81	9085	9090	9096	9101	9106	9112	9117	9122	9128	9133	1	1	2	2	3	3	4	4	5
82	9138	9143	9149	9154	9159	9165	9170	9175	9180	9186	1	1	2	2	3	3	4	4	5
83	9191	9196	9201	9206	9212	9217	9222	9227	9232	9238	1	1	2	2	3	3	4	4	5
84	9243	9248	9253	9258	9263	9269	9274	9279	9284	9289	1	1	2	2	3	3	4	4	5
85	9294	9299	9304	9309	9315	9320	9325	9330	9335	9340	1	1	2	2	3	3	4	4	5
86	9345	9350	9355	9360	9365	9370	9375	9380	9385	9390	1	1	2	2	3	3	4	4	5
87	9395	9400	9405	9410	9415	9420	9425	9430	9435	9440	0	1	1	2	2	3	3	4	4
88	9445	9450	9455	9460	9465	9469	9474	9479	9484	9489	0	1	1	2	2	3	3	4	4
89	9494	9499	9504	9509	9513	9518	9523	9528	9533	9538	0	1	1	2	2	3	3	4	4
90	9542	9547	9552	9557	9562	9566	9571	9576	9581	9586	0	1	1	2	2	3	3	4	4
91	9590	9595	9600	9605	9609	9614	9619	9624	9628	9633	0	1	1	2	2	3	3	4	4
92	9638	9643	9647	9652	9657	9661	9666	9671	9675	9680	0	1	1	2	2	3	3	4	4
93	9685	9689	9694	9699	9703	9708	9713	9717	9722	9727	0	1	1	2	2	3	3	4	4
94	9731	9736	9741	9745	9750	9754	9759	9763	9768	9773	0	1	1	2	2	3	3	4	4
95	9777	9782	9786	9791	9795	9800	9805	9809	9814	9818	0	1	1	2	2	3	3	4	4
96	9823	9827	9832	9836	9841	9845	9850	9854	9859	9863	0	1	1	2	2	3	3	4	4
97	9868	9872	9877	9881	9886	9890	9894	9899	9903	9908	0	1	1	2	2	3	3	4	4
98	9912	9917	9921	9926	9930	9934	9939	9843	9948	9952	0	1	1	2	2	3	3	4	4
99	9956	9961	9965	9969	9974	9978	9983	9987	9991	9996	0	1	1	2	2	3	3	3	4
	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9

TABLE 5
ANTILOGARITHAMS

LOG-TABLES

	0	1	2	3	4	5	6	7	8	9	Mean Difference								
											1	2	3	4	5	6	7	8	9
.00	1000	1002	1005	1007	1009	1012	1014	1016	1019	1021	0	0	1	1	1	1	2	2	2
.01	1023	1026	1028	1030	1033	1035	1038	1040	1042	1045	0	0	1	1	1	1	2	2	2
.02	1047	1050	1052	1054	1057	1059	1062	1064	1067	1069	0	0	1	1	1	1	2	2	2
.03	1072	1074	1076	1079	1081	1084	1086	1089	1091	1094	0	0	1	1	1	1	2	2	2
.04	1096	1099	1102	1104	1107	1109	1112	1114	1117	1119	0	1	1	1	1	2	2	2	2
.05	1122	1125	1127	1130	1132	1135	1138	1140	1143	1146	0	1	1	1	1	2	2	2	2
.06	1148	1151	1153	1156	1159	1161	1164	1167	1169	1172	0	1	1	1	1	2	2	2	2
.07	1175	1178	1180	1183	1186	1189	1191	1194	1197	1199	0	1	1	1	1	2	2	2	2
.08	1202	1205	1208	1211	1213	1216	1219	1222	1225	1227	0	1	1	1	1	2	2	2	3
.09	1230	1233	1236	1239	1242	1245	1247	1250	1253	1256	0	1	1	1	1	2	2	2	3
.10	1259	1262	1265	1268	1271	1274	1276	1279	1282	1285	0	1	1	1	1	2	2	2	3
.11	1288	1291	1294	1297	1300	1303	1306	1309	1312	1315	0	1	1	1	2	2	2	2	3
.12	1318	1321	1324	1327	1330	1334	1337	1340	1343	1346	0	1	1	1	2	2	2	2	3
.13	1349	1352	1355	1358	1361	1365	1368	1371	1374	1377	0	1	1	1	2	2	2	3	3
.14	1380	1384	1387	1390	1393	1396	1400	1403	1406	1409	0	1	1	1	2	2	2	3	3
.15	1413	1416	1419	1422	1426	1429	1432	1435	1439	1442	0	1	1	1	2	2	2	3	3
.16	1445	1449	1452	1455	1459	1462	1466	1469	1472	1476	0	1	1	1	2	2	2	3	3
.17	1479	1483	1486	1489	1493	1496	1500	1503	1507	1510	0	1	1	1	2	2	2	3	3
.18	1514	1517	1521	1524	1528	1531	1535	1538	1542	1545	0	1	1	1	2	2	2	3	3
.19	1549	1552	1556	1560	1563	1567	1570	1574	1578	1581	0	1	1	1	2	2	3	3	3
.20	1585	1289	1592	1596	1600	1603	1607	1611	1614	1618	0	1	1	1	2	2	3	3	3
.21	1622	1626	1629	1633	1637	1641	1644	1648	1652	1656	0	1	1	2	2	2	3	3	3
.22	1660	1663	1667	1671	1675	1679	1683	1687	1690	1694	0	1	1	2	2	2	3	3	3
.23	1698	1702	1706	1710	1714	1718	1722	1726	1730	1734	0	1	1	2	2	2	3	3	4
.24	1738	1742	1746	1750	1754	1758	1762	1766	1770	1774	0	1	1	2	2	2	3	3	4
.25	1778	1782	1786	1791	1795	1799	1803	1807	1811	1816	0	1	1	2	2	2	3	3	4
.26	1820	1824	1828	1832	1837	1841	1845	1849	1854	1858	0	1	1	2	2	3	3	3	4
.27	1862	1866	1871	1875	1879	1884	1888	1892	1897	1901	0	1	1	2	2	3	3	3	4
.28	1905	1910	1914	1919	1923	1928	1932	1936	1941	1945	0	1	1	2	2	3	3	4	4
.29	1950	1954	1959	1963	1968	1972	1977	1982	1986	1991	0	1	1	2	2	3	3	4	4
.30	1995	2000	2004	2009	2014	2018	2023	2028	2032	2037	0	1	1	2	2	3	3	4	4
.31	2042	2046	2051	2056	2061	2065	2070	2075	2080	2084	0	1	1	2	2	3	3	4	4
.32	2089	2094	2099	2104	2109	2113	2118	2123	2128	2133	0	1	1	2	2	3	3	4	4
.33	2138	2143	2148	2153	2158	2163	2168	2173	2178	2183	0	1	1	2	2	3	3	4	4
.34	2188	2193	2198	2203	2208	2213	2218	2223	2228	2234	1	1	2	2	3	3	4	4	5
.35	2239	2244	2249	2254	2259	2265	2270	2275	2280	2286	1	1	2	2	3	3	4	4	5
.36	2291	2296	2301	2307	2312	2317	2323	2328	2333	2339	1	1	2	2	3	3	4	4	5
.37	2344	2350	2355	2360	2366	2371	2377	2382	2388	2393	1	1	2	2	3	3	4	4	5
.38	2399	2404	2410	2415	2421	2427	2432	2438	2443	2449	1	1	2	2	3	3	4	4	5
.39	2455	2460	2466	2472	2477	2483	2489	2495	2500	2506	1	1	2	2	3	3	4	5	5
.40	2512	2518	2523	2529	2535	2541	2547	2553	2559	2564	1	1	2	2	3	4	4	5	5
.41	2570	2576	2582	2588	2594	2600	2606	2612	2618	2624	1	1	2	2	3	4	4	5	5
.42	2630	2636	2642	2649	2655	2661	2667	2673	2679	2685	1	1	2	2	3	4	4	5	6
.43	2692	2698	2704	2710	2716	2723	2729	2735	2742	2748	1	1	2	3	3	4	4	5	6
.44	2754	2761	2767	2773	2780	2786	2793	2799	2805	2812	1	1	2	3	3	4	4	5	6
.45	2818	2825	2831	2838	2844	2851	2858	2864	2871	2877	1	1	2	3	3	4	5	5	6
.46	2884	2891	2897	2904	2911	2917	2924	2931	2938	2944	1	1	2	3	3	4	5	5	6
.47	2951	2958	2965	2972	2979	2985	2992	2999	3006	3013	1	1	2	3	3	4	5	5	6
.48	3020	3027	3034	3041	3048	3055	3062	3069	3076	3083	1	1	2	3	4	4	5	6	6
.49	3090	3097	3105	3112	3119	3126	3133	3141	3148	3155	1	1	2	3	4	4	5	6	6
	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9

LOG-TABLES

	0	1	2	3	4	5	6	7	8	9	Mean Difference								
											1	2	3	4	5	6	7	8	9
.50	3162	3170	3177	3184	3192	3199	3206	3214	3221	3228	1	1	2	3	4	4	5	6	7
.51	3236	3243	3251	3258	3266	3273	3281	3289	3296	3304	1	2	2	3	4	5	5	6	7
.52	3311	3319	3327	3334	3342	3350	3357	3365	3373	3381	1	2	2	3	4	5	5	6	7
.53	3388	3396	3404	3412	3420	3428	3436	3443	3451	3459	1	2	2	3	4	5	6	6	7
.54	3467	3475	3483	3491	3499	3508	3516	3524	3532	3540	1	2	2	3	4	5	6	6	7
.55	3548	3556	3565	3573	3581	3589	3597	3606	3614	3622	1	2	2	3	4	5	6	7	7
.56	3631	3639	3648	3656	3664	3673	3681	3690	3698	3707	1	2	3	3	4	5	6	7	8
.57	3715	3724	3733	3741	3750	3758	3767	3776	3784	3793	1	2	3	3	4	5	6	7	8
.58	3802	3811	3819	3828	3837	3846	3855	3864	3873	3882	1	2	3	4	4	5	6	7	8
.59	3890	3899	3908	3917	3926	3936	3945	3954	3963	3972	1	2	3	4	5	5	6	7	8
.60	3981	3990	3999	4009	4018	4027	4036	4046	4055	4064	1	2	3	4	5	6	6	7	8
.61	4074	4083	4093	4102	4111	4121	4130	4140	4150	4159	1	2	3	4	5	6	7	8	9
.62	4169	4178	4188	4198	4207	4217	4227	4236	4246	4256	1	2	3	4	5	6	7	8	9
.63	4266	4276	4285	4295	4305	4315	4325	4335	4345	4355	1	2	3	4	5	6	7	8	9
.64	4365	4375	4385	4395	4406	4416	4426	4436	4446	4457	1	2	3	4	5	6	7	8	9
.65	4467	4477	4487	4498	4508	4519	4529	4539	4550	4560	1	2	3	4	5	6	7	8	9
.66	4571	4581	4592	4603	4613	4624	4634	4645	4656	4667	1	2	3	4	5	6	7	9	10
.67	4677	4688	4699	4710	4721	4732	4742	4753	4764	4775	1	2	3	4	5	7	8	9	10
.68	4786	4797	4808	4819	4831	4842	4853	4864	4875	4887	1	2	3	4	6	7	8	9	10
.69	4898	4909	4920	4932	4943	4955	4966	4977	4989	5000	1	2	3	5	6	7	8	9	10
.70	5012	5023	5035	5047	5058	5070	5082	5093	5105	5117	1	2	4	5	6	7	8	9	11
.71	5129	5140	5152	5164	5176	5188	5200	5212	5224	5236	1	2	4	5	6	7	8	10	11
.72	5248	5260	5272	5284	5297	5309	5321	5333	5346	5358	1	2	4	5	6	7	9	10	11
.73	5370	5383	5395	5408	5420	5433	5445	5458	5470	5483	1	3	4	5	6	8	9	10	11
.74	5495	5508	5521	5534	5546	5559	5572	5585	5598	5610	1	3	4	5	6	8	9	10	12
.75	5623	5636	5649	5662	5675	5689	5702	5715	5728	5741	1	3	4	5	7	8	9	10	12
.76	5754	5768	5781	5794	5808	5821	5834	5848	5861	5875	1	3	4	5	7	8	9	11	12
.77	5888	5902	5916	5929	5943	5957	5970	5984	5998	6012	1	3	4	5	7	8	10	11	12
.78	6026	6039	6053	6067	6081	6095	6109	6124	6138	6152	1	3	4	6	7	8	10	11	13
.79	6166	6180	6194	6209	6223	6237	6252	6266	6281	6295	1	3	4	6	7	9	10	11	13
.80	6310	6324	6339	6353	6368	6383	6397	6412	6427	6442	1	3	4	6	7	9	10	12	13
.81	6457	6471	6486	6501	6516	6531	6546	6561	6577	6592	2	3	5	6	8	9	11	12	14
.82	6607	6622	6637	6653	6668	6683	6699	6715	6730	6745	2	3	5	6	8	9	11	12	14
.83	6761	6776	6792	6808	6823	6839	6855	6871	6887	6902	2	3	5	6	8	9	11	13	14
.84	6918	6934	6950	6966	6982	6998	7015	7031	7047	7063	2	3	5	6	8	10	11	13	15
.85	7079	7096	7112	7129	7145	7161	7178	7194	7211	7228	2	3	5	7	8	10	12	13	15
.86	7244	7261	7278	7295	7311	7328	7345	7362	7379	7396	2	3	5	7	8	10	12	13	15
.87	7413	7430	7447	7464	7482	7499	7516	7534	7551	7568	2	3	5	7	9	10	12	14	16
.88	7586	7603	7621	7638	7656	7674	7691	7709	7727	7745	2	4	5	7	9	11	12	14	16
.89	7762	7780	7798	7816	7834	7852	7870	7889	7907	7925	2	4	5	7	9	11	12	14	16
.90	7943	7962	7980	7998	8017	8035	8054	8072	8091	8110	2	4	6	7	9	11	13	15	17
.91	8128	8147	8166	8185	8204	8222	8241	8260	8279	8299	2	4	6	8	9	11	13	15	17
.92	8318	8337	8356	8375	8395	8414	8433	8453	8472	8492	2	4	6	8	10	12	14	15	17
.93	8511	8531	8551	8570	8590	8610	8630	8650	8670	8690	2	4	6	8	10	12	14	16	18
.94	8710	8730	8750	8770	8790	8810	8831	8851	8872	8892	2	4	6	8	10	12	14	16	18
.95	8913	8933	8954	8974	8995	9016	9036	9057	9078	9099	2	4	6	8	10	12	15	17	19
.96	9120	9141	9162	9183	9204	9226	9247	9268	9290	9311	2	4	6	8	11	13	15	17	19
.97	9333	9354	9376	9397	9419	9441	9462	9484	9506	9528	2	4	7	9	11	13	15	17	20
.98	9550	9572	9594	9616	9638	9661	9683	9705	9727	9750	2	4	7	9	11	13	16	18	20
.99	9772	9795	9817	9840	9863	9886	9908	9931	9954	9977	2	5	7	9	11	14	16	18	20
	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9

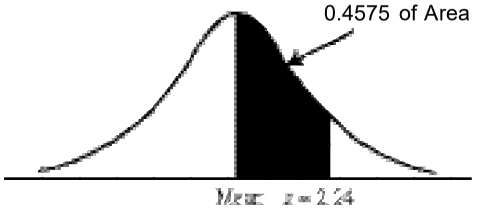


TABLE 6

Areas under the Standard Normal Probability Distribution between the Mean and Positive Values of z

Example:

To find the area under the curve between the mean and a point 2.24 standard deviations to the right of the mean, look up the value opposite 2.2 and under 0.04 in the table; 0.4875 of the area under the curve lies between the mean and a z Value of 2.24

x	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	04956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990

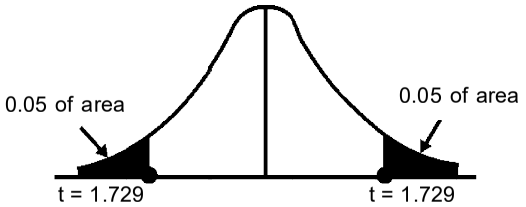


TABLE 7

Areas in Both Tails Combined for Student's t Distribution

Example:

To find the value of t that corresponds to an area of 0.10 in both tails of the distribution combined, when there are 19 degress of freedom, look under the 0.10 column, and proceed down to the 19 degrees of freedom row; the appropriate t value there is 1.729

Degree of Freedom	Area in Both Tails Combined			
	0.10	0.05	0.02	0.01
1	6.314	12.706	31.821	63.657
2	2.920	4.303	6.965	9.925
3	2.353	3.182	4.541	5.841
4	2.132	2.776	3.747	4.604
5	2.015	2.571	3.365	4.032
6	1.943	2.447	3.143	3.707
7	1.895	2.365	2.998	3.499
8	1.860	2.306	2.896	3.355
9	1.833	2.262	2.821	3.250
10	1.812	2.228	2.764	3.169
11	1.796	2.201	2.718	3.106
12	1.782	2.179	2.681	3.055
13	1.771	2.160	2.650	3.012
14	1.761	2.145	2.624	2.977
15	1.753	2.131	2.602	2.947
16	1.746	2.120	2.583	2.921
17	1.740	2.110	2.567	2.898
18	1.734	2.101	2.552	2.878
19	1.729	2.093	2.539	2.861
20	1.725	2.086	2.528	2.845
21	1.721	2.080	2.518	2.831
22	1.717	2.074	2.508	2.819
23	1.714	2.069	2.500	2.807
24	1.711	2.064	2.492	2.797
25	1.708	2.060	2.485	2.787
26	1.706	2.056	2.479	2.779
27	1.703	2.052	2.473	2.771
28	1.701	2.048	2.467	2.763
29	1.699	2.045	2.462	2.756
30	1.697	2.042	2.457	2.750
40	1.684	2.021	2.423	2.704
60	1.671	2.000	2.390	2.660
120	1.658	1.980	2.358	2.617
Normal Distribution	1.645	1.960	2.326	2.576