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COMPUTERIZED APPROACH TO INDEX NUMBERS COMPUTATION AND APPLICATION

by

OTOBOR ANGELA OGHOYE
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Of

The Department of Mathematics/Computer Science
School of Science and Science Education
Federal University of Technology, Minna.
Niger State.

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CERTIFICATION/APPROVAL PAGE

This is the project work of Otobor Angela Oghoye in partial fulfilment of the requirements for the award of Post Graduate Diploma in Computer Science.

Prince R. Badmus
Project Supervisor

Date

Dr S.A. Reju
Head of Department

Date

External Examiner

Date

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ABSTRACT

Index numbers are indispensible tools in our daily transactions, hence, the methods for computing them as well as their applications from the focus of this project work. Index numbers are computed in this work through both manual and computer aided computations.

The use of computer application to index numbers is outlined here and the programming language applied is BASIC. Although many methods for computing index numbers are enumerated here, emphasis is on the Laspeyres and the Paasche's method.

Attempt is made to apply a computerized approach.

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LIST OF SPECIAL SYMBOLS AND ABBREVIATIONS

SYMBOL & ABBREVIATION	MEANING
$	And
Σ	Sum of
I	Index
P_O	Price in the base year
P_n	Price in the given [current]year
P_nP_o	Prices per unit of an item in year $_n$ and in base period $_O$, used in constructing index numbers.
TV	Television
CPI	Consumer price Index
GNP	Gross National Product
q_O	Quantity in the base year
q_n	Quantity in the given [current] year
Wt	Weighting
M	Marshall Edgeworth's Index
F	Fisher's Ideal Index
L	Laspeyres Index
P	Paasche Index
DOS	Disk Operating System

CHAPTER ONE

INTRODUCTION

1.1 TIME SERIES ANALYSIS

Time series analysis is a statistical procedure that is relevant for business and economic decision making. As inflation continues, the public will become aware of indexes such as price index.

1.2 AIMS AND OBJECTIVES

- To make index numbers computation and application easier and better utilised.

- To make the computation faster, ie, increased speed of computation.

- To enhance better understanding of the uses of index numbers.

- To expose individuals to a more efficient way of computing index numbers.

- To identify the methods used now in order to computerized them.

- To facilitate greater accuracy and improved records.

- To aid the elimination of wastage [in storage space and use of large quantity of stationery]

- To make the computations more comprehensible and less tedious to compute thereby making way for the eventual elimination of tedious repetitive work.

1.3 SCOPE AND LIMITATIONS OF STUDY

This work is not exhaustive on all the methods of computing index numbers rather it focuses on some methods namely:- Laspeyres, Paasche's, Fisher's, Marshall Edgeworth's with emphasis on Laspeyre's and Paasche's.

1.4 SEASONAL INDEX

Seasonal Index is a set of numbers showing relative values of a time series variable in corresponding months of successive years. It is usually expressed in percentage. Seasonal Index is used by the production manager to know the general trend of sales, the effect of price and the seasons on sales, when to increase or decrease

production, how to adjust the production rate, why production is being affected in what ways, what to do about this trend and the month or season to boost production.

1.5 INDEX NUMBERS

Index numbers can hardly be avoided – scarcely a day goes by without some mention of them on the television news, or in the daily papers. The movements of the stock exchange are reported. Changes in the cost of living are reported.

Indexes depend on choice of population, choice of weighting, and even method of calculation. Indexes depend on many value judgements. But an index is of great use because it allows us to explore the data, get an indication of the general level of prices. The values of index numbers cause substantial changes in the fortunes of a large number of people. Details of several thousand prices are recorded each week. This can only be handled quickly and cheaply by a computer. Once the data are in the computer, further calculations can be carried out at very little cost.

1.6 DEFINITIONS

(i) An index number is a measure which summarises the changes in value of a set of items. It measures the change in level of a whole set of items compared with some base period.

Indexes are usually based on a whole range of items. Indeed, one of the main purposes of index numbers is to simplify a large number of changes into one simple, easy to understand single figure.

(ii) An index number is a device designed to measure average changes in the price, quantity or value of a group of commodities over time.

(iii) Index numbers are statistical measures of how much something has changed from one time period to another. Index numbers associated with business and economics are often described as barometers of business change. Every economic variable that affects the business manager, whether it is sales, prices, costs or the purchasing power of the Naira, changes over time. These changes can be expressed as index numbers.

(iv) An index number is a percentage relative that compares economic measures in a given period with those same measures at a fixed time period in the past.

(v) In its simplest form, an index number is a ratio of two numbers, expressed as a percent. The purpose of the index is to give a quick, overall picture of changes taking place.

CHAPTER TWO [COMPUTING INDEX NUMBERS]

2.1 TYPES AND FORMS OF INDEX NUMBERS

The usefulness of any index number lies in the types of questions it can answer. Each index number is designed for a particular purpose, and it is this specific purpose that determines its method of construction. Three basic types of index numbers are the value index, price index and quantity index. In this work, emphasis is on price index.

Value index compares total value in some period with total value in the base period. Value is the product of price times quantity.

Price index measures changes in prices while holding measures of quantity constant.

Quantity index measures changes in volume of goods produced, bought or consumed.

Simple Index – A simple index follows the changes in a single item. It is given as $\frac{P_n}{P_o}$

Aggregate index is conventionally calculated by taking the means of the various samples. First, calculate the aggregate or average value for the base period and each of the subsequent periods. Second, calculate the index in exactly the same way as for the simple index, but using the aggregate value instead of the single value. [The mean or median can be used.]

Weighted Index – The technique of weighting is used to give a fair representation to the different sectors or subsets of the market.

Composite Index Numbers – These are obtained by combining the information from a set of economic commodities of like kind. Such a composite index number usually cannot be calculated or computed except each component is weighted. A weighting factor is an indicator of the importance of each component commodity. Standard weight for price indices are quantities, and for quantity indices are prices. There are two standard types of composite index number, these are weighted average of price relatives and weighted aggregates.

Weighted Average of Price relatives – This involves calculating price index relatives for each of the given components then using the given weight to obtain a weighted average of the relatives.

Composite Index = $\frac{\Sigma P_n}{\Sigma P_o}$

2.2 USES OF INDEX NUMBERS

Index numbers have a great many uses and new ones are being added constantly as managers and the general public become more familiar with them. Some of the more common uses are given as follows:

Measure changes that have taken place from one time period to another:- Measuring economic changes over time is basic to success in business. Such a barometer tells what has happened in the past, and its careful study may foretell much of the future.

Combine changes in several series:- a builder concerned with changes in several commodities used for construction may wish to summarize changes in cost of lumber, glass, steel and many other materials. Since these materials are measured in many different kinds of units for pricing, such as board feet, pounds and gallons, they cannot be added or compared directly. An index number can be designed, however, that combines relative changes in all the series into a single measure of overall change.

Devalue a time series in terms of constant money [say Naira]:- The purchasing power of the Naira is constantly changing. Over the short run these changes may be small, but over a long period of time they can be substantial. If a series such as wage rates is divided by its equivalent cost of living index for each period, the resulting series is said to be expressed in constant money.

Measure consumer attitudes:- scientifically designed sample interviews are used to measure consumer attitudes and expectations and to predict future consumer behaviour. [As is done in the Survey Research Centre at the University of Michigan, The device is called an Index of Consumer Confidence (which is watched closely by executives in many businesses)].

Index number series are widely used in connection with decision making and analysis in business and government. One of the best known applications of a price index is the use of the CPI as an escalator in collective bargaining contracts.

Much use is made of index numbers by individual companies as well as at the levels of entire industries and the overall economy. In certain Industries, it is standard practice to key changes in selling prices to changes in indices of prices of raw materials and wage earnings.

Assessments of past trends and current status and projection of future economic activity are made on the basis of appropriate indices. Economists follow many of the various indices in order to appraise the performance of the economy and to analyze its structure and behaviour.

The use of index numbers is not confined to business and economics. They are widely used in many other fields, and they are not always related to changes over time in some fields. For example, the National Weather Service has a discomfort index that measures the combined effects of heat or cold, wind and humidity on individuals.

The psychologist's measure of intelligence [IQ] is essentially an index number comparing a person's intelligence with that of an average for others of the same age. State boards of education compute indexes to measure effectiveness of school systems, health officials have measures of the efficiency of hospitals and so on.

Computations of index numbers aids in forecasting. Forecasting is a universal endeavor. The practice of basing a current decision upon a forecast of the future is so common, it is hard to imagine any individual or organisation that does not do so at one time or another. A statistical forecasting technique is one that generates forecasts by extrapolating patterns in historical data.

Many applications arise in fields where forecasts are needed on a regular basis. Some of the areas in which forecasting is an ongoing concern include:- sales forecasting, strategic planning, financial forecasting, technology forecasting, energy forecasting, market forecasting, econometric modeling, inventory control, material requirements planning, service product forecasting, stock market forecasting.

Planning and forecasting are closely related functions in any decision – making process. Planning involves several stages. First, current forecasts are used as inputs in developing an interim plan. Then, as more information and the effects of planning are observed, the forecasts are revised and the plan is updated. This process is repeated until a suitable plan is finalized. The influence which forecasts are allowed to have as the plan develops depends on their reliability and on the costs of over and under forecasting.

Also, price index is used majorly for comparative purposes over time. This could easily be done through weighting the price index. The weighting of the price index is very important for this very purpose. It helps to forecast future planning for development, is used to measure the change that has occurred in prices, products, cost of living etc. Price materials may be studied in order to discount their causes or effects on the economic community. This aids the government in the formation of price, deciding what measures to take in order to decrease price or increase it.

2.3 PRICE INDEX

A numerical value that summarizes price level is called a price index. For such an index, the seasonal rise in the price of a commodity should not have any significant influence. But increase in the price of that commodity from one may to the next should. Likewise, only goods that are important to a great many people ought to be considered.

A Price index expresses the relationship between prices at time t and time o, or the base period. Index numbers are always interpreted relative to the base.

Price indexes have other uses besides being barometers of inflation. Economic models deal with real wages and real income so that wages and income are adjusted to account for changing price levels by means of index numbers. Actual economic growth is ordinarily expressed in terms of change in real national product, which is found by using a price index to adjust annual GNP values comparable to those of a prior period.

Price relatives for a single item are limited in usefulness. Price changes in a single commodity do not indicate the general movement in prices. Of greater importance in economic planning and in comparing conditions from year to year would be a composite price index that covers many different items. Thus, an index that considers several food items for example, can help us measure the change in the standard of living of a large number of people.

A major use of a price index such as the CPI is to measure the "real" values in economic time series data expressed in monetary amounts. GNP is the basic measure of economic growth, so that to determine how much the physical goods and services have grown over time, increases in value due to price should not be included. It is possible for the quantity of goods and services to actually fall during a recession, while inflation causes the GNP to rise due solely to price increases. Real economic growth may be determined by using a price index to deflate GNP values.

Economic models are often expressed in terms of real or price – adjusted values. Thus, we may use price indexes to find real wages, real income, or real production. To determine whether a typical worker's salary has risen enough to provide an increased standard of living, a price index can be used to compare take – home wages to prices.

2.4 WEIGHTING

Index numbers computed do not give the true situation of the cost of living if no consideration is given to the quantities consumed of the commodities, because they take all items as being equally important. Items with high prices therefore tend to dominate the index and this gives false impressions of the cost of living. The problem can however be overcome by weighting.

Weighting means importance attached to each item i.e. importance of each item. And this can be linked with the quantities consumed of the items as people tend to take more of items of greater importance and less of items of little importance. Since quantities can be either for base year or current year, we have base year weighting and current year weighting.

When base year quantities are used as weights, the resulting index is called Laspeyre's index which is given by:-

$$\frac{\Sigma P_n Wt}{\Sigma P_o Wt}\ (100) = \frac{\Sigma P_n q_o}{\Sigma P_o q_o} \times 100$$

When current year quantities are used as weights, the index is called Paasche's index which is given by:-

$$\frac{\Sigma P_n q_n}{\Sigma P_o q_n} \times 100$$

To overcome the bias involved in the base and current year weighting, other weighting systems had been devised. These are:-
Marshall Edgeworth index,
Fisher's Ideal index
And Fixed Weighted index.

Marshall Edgeworth utilises both the current and the base year quantities as weights.

$$M = \frac{\Sigma P_o (q_o + q_n)}{\Sigma P_o (q_o + q_n)} \times 100$$

Fisher's Ideal index is simply the geometric means of Laspeyres index and Paasche's index i.e.

$$F = \sqrt{L \times P} \times 100$$

$$= \sqrt{\frac{\Sigma P_n q_o}{\Sigma P_o q_o} \times \frac{\Sigma P_n q_n}{\Sigma P_o q_n}} \times 100$$

It is called ideal index because it satisfies some test of mathematical consistency which are not satisfied by either Paasche's or Laspeyre's index.

Fixed Weighting is more generally used than other methods. These weights could be values for a particular period in the past or may be average computed over years.

2.5 METHODS OF COMPUTATION

From any given data, the following methods can be used to compute index numbers:-

(i) Simple Index

$\frac{P_n}{P_o}$ Where P_n is current year price and P_o is base year price.

(ii) Composite Index

$$\frac{\Sigma P_n}{\Sigma P_o}$$

(iii) Laspeyres Index

$$\frac{\Sigma P_n Wt}{\Sigma P_o Wt} (100) = \frac{\Sigma P_n q_o}{\Sigma P_o q_o} \times 100$$

Where:

Σ = Sum of

P_n = Current year price

P_o = Base year price

Wt = Weight

q_o = Base year quantity

(iv) Paasche Index

$$\frac{\Sigma P_n q_n}{\Sigma P_o q_n} \times 100$$

Where:

q_n = Current year quantity

(v) Marshall Edgeworth's Index

$$\frac{\Sigma P_n (q_o + q_n)}{\Sigma P_o (q_o + q_n)} \times 100$$

(vi) Fisher's Ideal Index

$$\sqrt{\frac{\Sigma P_n q_o}{\Sigma P_o q_o} \times \frac{\Sigma P_n q_n}{\Sigma P_o q_n}} \times 100$$

2.6 ADVANTAGES AND DISADVANTAGES OF THE METHODS

(i) Simple Index

This index has the advantage of emphasizing only one commodity, and it is easy to compute. The disadvantages are:- The selection of units is arbitrary and the prices are not weighted.

(ii) Laspeyres Index

Laspeyres has the following advantages:- It "weights" the price of the ith commodity by the quantity that is consumed. Because the quantities [q] refer to the base period, the Laspeyres index shows how the cost of all quantities in the base – period market basket changes.

The Laspeyres index is appropriate when the base period quantities are reasonable weights to apply to all time periods. They are also appropriate when the base period quantities remain reasonable approximations of purchase quantities in subsequent periods. Laspeyres is used in the United States to compute the all – items consumer price Index [CPI].

It involves less data manipulations as it requires only the current year prices to compute the index for different years using the same base year. However, the following disadvantages exist:- With time, the weights may be out-of-date because the consumption pattern of the commodity is not likely to remain the same over a long period of time.

A further disadvantage is that of over-estimating the cost of living. At higher prices [P_n] the same quantity [q_o] is assumed to be consumed which might not be true as it contradicts or violates the fundamental law in economics which states that at higher prices, less quantities is demanded. The index therefore assumes quantities that are higher than the reality and this automatically over-estimates the true cost of living because of the multiplicative interaction it has got with P_n.

When the price of a commodity increases, we would expect a family to reduce it's consumption of that item. Because the Laspeyres index assumes that the quantities in the market basket will not change as prices rise at different rates, the index exaggerates the general price increase. The index can be misleading when the relative purchase quantities change significantly from those in the base period.

(iii) Paasche Index

The Paasche Index uses quantity weights from the current period. The Paasche Index is most appropriate when you want to compare current prices to base period prices at current purchase levels. Also, it is suitable for many purposes.

However, there are several major problems associated with the Paasche index. First, it requires that purchase quantities be known for every time period. This rules out a Paasche index for applications such as the [CPI] because the time and monetary resource expenditures required to collect quantity information are considerable. A second problem is that, although each period is compared to the base period, it is difficult to compare the index at two other periods because the questions used are different for each period.

It also has the disadvantage of under-estimating the cost of living because the index assumes that at lower prices [P_o] the same quantity [q_n] is consumed but this is not true because greater quantities ought to be consumed at lower prices [P_n]. P_oq_n therefore assumes value that are lower than normal.

The denominator ΣP_oq_n therefore tends to be smaller than what it should be, since the index is inversely proportional to ΣP_oq_n the index tends to be lower than reality. Paasche Index in other words under-estimates the true cost of living. The Paasche index is not that popular because the weights have to be revised every year.

Despite the above disadvantages, and although there are other types of indexes that use different weighting factors, the Laspeyre and Paasche indexes are the most used composite indexes. Depending on the primary objective in constructing an index, one of them will probably be suitable for most purposes. Hence, the emphasis of this project work is on Laspeyres and Paasche Indexes.

(iv) Marshall Edgeworth index

This index has the advantage of being able to utilise both the current and the base year quantities as weights. Hence it is a compromise formula, without bias. But it has a draw back of being tedious to compute.

(v) Fisher's Ideal Index

Fisher's Ideal Index is the ideal index which corrects the shortcomings of Laspeyres and Paasche indexes since it combines both i.e. it is the geometric mean of Laspeyres index and Paasche's. It satisfies some test of mathematical consistency which neither Paasche nor Laspeyres index can satisfy. But it involves complex calculations.

CHAPTER THREE

INDEX NUMBERS AND THEIR APPLICATIONS

3.1 INPUT OUTLINE [DATA]

The following table gives sales values of some commodities within nine years.

Table 1

Information on department store sales [in ₦]

Commodity:

	Rice		Beans		Corn		Cassava	
Year	Price ₦	Qty [Mudu]	Price ₦	Qty [Mudu]	Price ₦	Qty [Mudu]	Price ₦	Qty [Mudu]
1990	300	10	200	10	90	9	80	10
1991	320	10	250	10	90	7	90	10
1992	450	9	270	9	84	7	90	8
1993	480	8	320	8	90	6	100	7
1994	490	7	315	7	100	5	100	6
1995	523	7	375	9	120	4	110	6
1996	540	6	400	8	125	4	160	8
1997	562	6	450	8	240	6	200	8
1998	630	7	640	8	360	8	240	8

Source: Marketing Department, Luck Farms and Ventures, Usebi.

3.2 COMPUTATIONS AND APPLICATIONS

In the first set of computations, values for 1990 shall be used as base year to evaluate values for 1992, 1993 and 1994 which shall be used as current year respectively. While 1995, shall be base year and 1998 shall be current year for the next computations.

The first set of computation comprises Laspeyres, Paasche and Fishers index, whereas the next comprises Marshall Edgeworth index. After each computation, its application which is the interpretation of the index is given.

Table 2

Year:-	1990	1991	1992	1993	1994	1990	1991	1992	1993	1994
Commodity	**[Price in ₦]**					**[Quantity in Mudu]**				
Rice	300	320	450	480	490	10	10	9	8	7
Beans	200	250	270	320	315	10	10	9	8	7
Corn	90	90	84	90	100	9	7	7	6	5
Cassava	80	90	90	100	100	10	10	8	7	6

Using 1990 price values as P_o, quantity values as q_o and 1992 price values as P_n, we have the following table to compute for Laspeyres index:-

Table 3

P_o	P_n	q_o	P_nq_o	P_oq_o
300	450	10	4,500	3,000
200	270	10	2,700	2,000
90	84	9	756	810
80	90	10	900	800
Total			**8,856**	**6,610**

$$I_L = \frac{\Sigma P_n q_o}{\Sigma P_o q_o} \times 100$$

$$= \frac{8,856}{6,610} \times 100$$

$$= 133.979$$

This means there is 33.9% increase in the price index, therefore cost of living increased by 33.9% as regards food items.

$$I_F = \sqrt{\frac{\Sigma P_n q_o}{\Sigma P_o q_o} \times \frac{\Sigma P_n q_n}{\Sigma P_o q_n}} \times 100$$

$$= \sqrt{\frac{9,950}{6,610} \times \frac{6,735}{4,430}} \times 100$$

$$= 151.279$$

Application: There is 51.3% increase in the index.

Sometimes, the base year can be shifted so to evaluate Marshall Edgeworth Index, the base year is shifted from 1990 to 1995 while the current year is 1998. This gives:

Table 6

P_o	P_n	q_o	q_n	q_o+q_n	$P_n(q_o+q_n)$	$P_o(q_o+q_n)$
523	630	7	7	14	8,820	7,322
375	640	9	8	17	10,880	6,375
120	360	4	8	12	4,320	1,440
110	240	6	8	14	3,360	1,540
Total					**27,380**	**16,677**

$$I_M = \frac{\Sigma P_n(q_o+q_n)}{\Sigma P_o(q_o+q_n)} \times 100$$

$$= \frac{27,380}{16,677} \times 100$$

$$= 164.178$$

Interpretation: Cost of living via food items increased by 64.2%

3.3 CHANGING OF BASE PERIOD

The selection of a base period for an index involves one over-riding consideration – it should be a period in the past that is considered to be relatively "normal".

Occasions often arise when the base year is taken as two years instead of one. This is done to achieve a more realistic result. One would resort to this if none of the two years is a period of economic stability. The procedure is to use the average value for the two years.

Many a time, it becomes necessary to shift or change the base of a series for any of the following reasons:

1. Because the old base is too distant in the past.

2. Recent comparison is desired.

3. Because one wants to compare two or more series, a procedure that is valid if the series have similar base period.

See table 6, A base period must therefore be a period of economic stability and also it must not be too distant in the past.

3.4 DEFLATING OF SERIES

Deflation of time series plays a vital role in the measurement of change in the real values of some commodities. Deflation of time series is therefore defined as a technique used to obtain a set of index relatives that measures the changes in the real value of some commodities with respect to some given indicators. This is done by using price indexes.

In other words, deflation means making adjustment for the changing cost of living. In any economy, nominal or money wages may be increasing but the real wages might not be increasing at the same rate which is typically the case. This is to say increase in money wages does not necessarily compensate for the inflation rate.

Money or nominal wages has to do with the amount earned but real wages has to do with what the amount earned can afford. A worker may therefore earn more but may afford less commodities and services. To deflate wages the cost of living index is usually employed. When an index is used in this way, it is called a "deflation"

Deflated or real income

$$= \frac{\text{Money Income}}{\text{Index for the period}} \times 100$$

Under consideration.

If a worker therefore earns ₦3,000 and the cost of living index is 111.28, the real income is $\frac{3,000}{111.28} \times 100$

$$= \text{₦}2,695.90$$

with respect to the period to which reference is made in the index. The value of the money or what it can buy is the real income. Therefore, it does not necessarily mean that the higher the income earned, the lower the cost of living.

3.5 LIMITATIONS OF INDEX NUMBERS

Despite the numerous uses and benefits of price index numbers, there are shortcomings. The following are some limitations of price index:

1. Price index gives only general indications of changes.

2. Weighting factors can become out of date.

3. Samples if used never give the exact size value.

4. The index can be misinterpreted by the uninformed layman.

CHAPTER FOUR

PROGRAM DEVELOPMENT AND IMPLEMENTATION

4.1 PROGRAMMING LANGUAGE CHOSEN

The programming language chosen is **BASIC,** the name BASIC is an acronym for Beginners All-purpose Symbolic Instruction Code. It was developed in 1963 by professors John Kememy and Thomas Kurtz at Dartmouth college, USA, as a sample instructional tool to teach fundamental programming concepts and to facilitate the educational use of computers.

It is widely used for a variety of more advanced applications in programming scientific, mathematical, engineering and many business problems.

BASIC is the principal high-level language that is used with microcomputers. Hence it can be used for many novel applications, for example, computer games requiring the use of graphics and sound generation as well as more traditional applications such as personnel, finance and database management.

Another good thing about BASIC is that it encourages running the computer in an interactive mode. As soon as the user submits a program and some data to the computer, the computer executes the program, produces the result back to the user immediately. In this way, it is easy for the user to find out whether the program is working properly or there is a bug [error].

Version available are:-
1. GWBASIC available on DOS 3.3
2. BASIC and BASICA available on DOS 4.01
3. QBASIC available on DOS 5 and above.

Some advantages of Basic are:-
1. BASIC is "friendly" ie it is people oriented, easy to learn and fun to use.

2. BASIC is flexible, allowing the programmer to develop new programs and to alter existing programs with relatively little effort.

3. BASIC is well suited for use in an interactive environment. This includes microcomputers applications as well as large computer time-sharing applications.

4. BASIC is universally available on both large and small computers. It has become the standard programming language for most microcomputer applications.

5. Many BASIC programs can be run [executed] on a variety of different computers with little or no modification.

In addition to the above advantages, QBASIC version supports blocked operations particularly structured programming than those before it. For instance, the block IF....THEN....ELSE.... ENDIF, and many others are supported by QBASIC. Also, QBASIC supports instant syntax checking as instructions are entered and gives instant help on errors.

4.2 FEATURES OF PROGRAMMING LANGUAGES

Some features of BASIC programming language include the followings:

Easy to learn
Readily available compiler/interpreter
Written to teach
Scientific operations
Graphics facility
Also, it is a programming language that can handle creation, maintenance, extraction and summarizing of data record and files. It is also able to cater for data integrity, accuracy, reliability and security.

BASIC programming language though a conventional programming language is a human-like language. It thus allows for the easy specification of the task to be performed and even predict other behaviour of easy expression before it is actually executed. It has a fast input and output facility and it also possesses modularity characteristics ie. Allows the use of sub-programs such as subroutines.

Finally, the fast compilation and execution of programs in Qbasic version due to Qbasic's higher efficiency and good points led to its evaluation and choice as an ideal programming language for this project work.

4.3 HARDWARE/SOFTWARE REQUIRED

HARDWARE SPECIFIED

This refers to the configuration of the computer system used in implementing the system. To ensure a highly efficient, effective and reliable system, the following minimum requirement will suffice:

- 386 processor or higher
- At least 640KB RAM
- 80 MB Hard-disk
- 3.5 Floppy disk drive
- VGA or SVGA monitor
- Standard keyboard
- Mouse
- Printer [Laserjet 5L, Epson LQ-2170]
- Stabilizer [1000 volts]
- UPS [1500 volts]

SOFTWARE REQUIREMENTS

In order to effectively implement this new system, the required software that will enhance an efficient operation is:

- MS-DOS version 5.0 [which definitely includes Qbasic package].
  or
- WINDOWS '95

4.4 STARTING THE SYSTEM

GETTING STARTED WITH QBASIC

After the booting process, the C:\> prompt will appear.
Type CD DOS to go to the DOS directory since QBASIC comes with MS-DOS, then type QBASIC or QB. Ie.

```
C:\>
C:\>CD DOS     press enter
C:\DOS>
C:\DOS>QBASIC    press enter
```

This will bring you to the QBASIC environment where you can now type, edit and execute your programs.

4.5 MENU STRUCTURE [See Appendix A for details]

The menu structure of the program is given below:

After the introduction, "A project on computation of index numbers", the main menu is displayed thus:

MAIN MENU

1.	Laspeyres Index
2.	Paasche Index
3.	Fishers Ideal Index
4.	Marshall Edgeworth Index
5.	Quit

Enter choice [1 – 5] :-

4.6 SUB – MENU [See Appendix A]

There is no sub-menu since the indexes have nothing to select under them.

4.7 THE QUIT OPTION [See Appendix A]

The Quit option ie. Choice 5 leaves the program [named OTOBOR.BAS] to Qbasic environment. To quit Qbasic, press exit from the file sub-memu.

4.8 FILE MAINTENANCE

To maintain the file, there should be:

(i) Back-up copies

(ii) Modification or updating it from time to time when necessary or if need be.

(iii) A password to protect it from unauthorized users.

(iv) Thorough documentation.

4.9 COMPUTER APPLICATION

The Application of computer techniques has several benefits. For instance, in developed countries, details of several thousand prices are recorded each week. This can only be handled quickly and cheaply by a computer. Once the data are in the computer, further calculations can be carried out at very little cost. Other advantages include the followings:

(i) Accuracy of Calculations: Once the input data supplied to the system is correct and error free, calculation of index number and its processing are expected to be highly accurate.

(ii) Expansion and modification of the designed system is possible and easy when the need arises without much expenses.

(iii) High degree of Security: The system is protected against unauthorized person to gain access to the information by use of password and the reliability is highly ensured.

(iv) The system also has the advantage of storing large volume of information for a longer period through the storage media which cannot easily be destroyed.

(v) The information can easily be replaced when there is an accident through the back-up files.

(vi) Printing of document [report] is very easy and when there is any mistake(s) it can be corrected or modified without total destruction of the document.

Therefore, in a nutshell, the manual way of computing is slow, retrival is difficult and hence access is delayed. There are bound to be mistakes through manual computations of index numbers. Hence a computerized system is designed to handle this.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 SUMMARY AND CONCLUSION

In this project work, there is an outline of both the manual computation and computerized computation of index numbers. The computerized program given here [see Appendix A] can be used to obtain different indexes of various items in order to determine the price index and invariably the cost of living index or the consumer index on data supplied.

This knowledge is very important to individuals, organisations and the government as it aids in planning, budget and decision making. As mentioned earlier, index numbers have a great many uses and new ones are being added constantly as managers and the general public becomes more familiar with them.

Now, the fear of having to do a tedious, repetitive manual computation is removed by reason of this computerized program. Therefore, this all-important index number can be evaluated in an easier and faster way, so as to utilise its many benefits.

5.2 RECOMMENDATION

Computer is now used in all spheres of life due to its sterling characteristics. As such, large amount of data can be stored for a long time. Easy and direct access to information is provided when needed. Also, it processes data at a very fast rate.

As a result of this, it is advantageous to make use of computer application in the computation of index numbers. This will yield increased speed, improved record, greater accuracy, elimination of tedious repetitive manual work [calculations] and elimination of wastage [in storage space and use of large quantity of stationery].

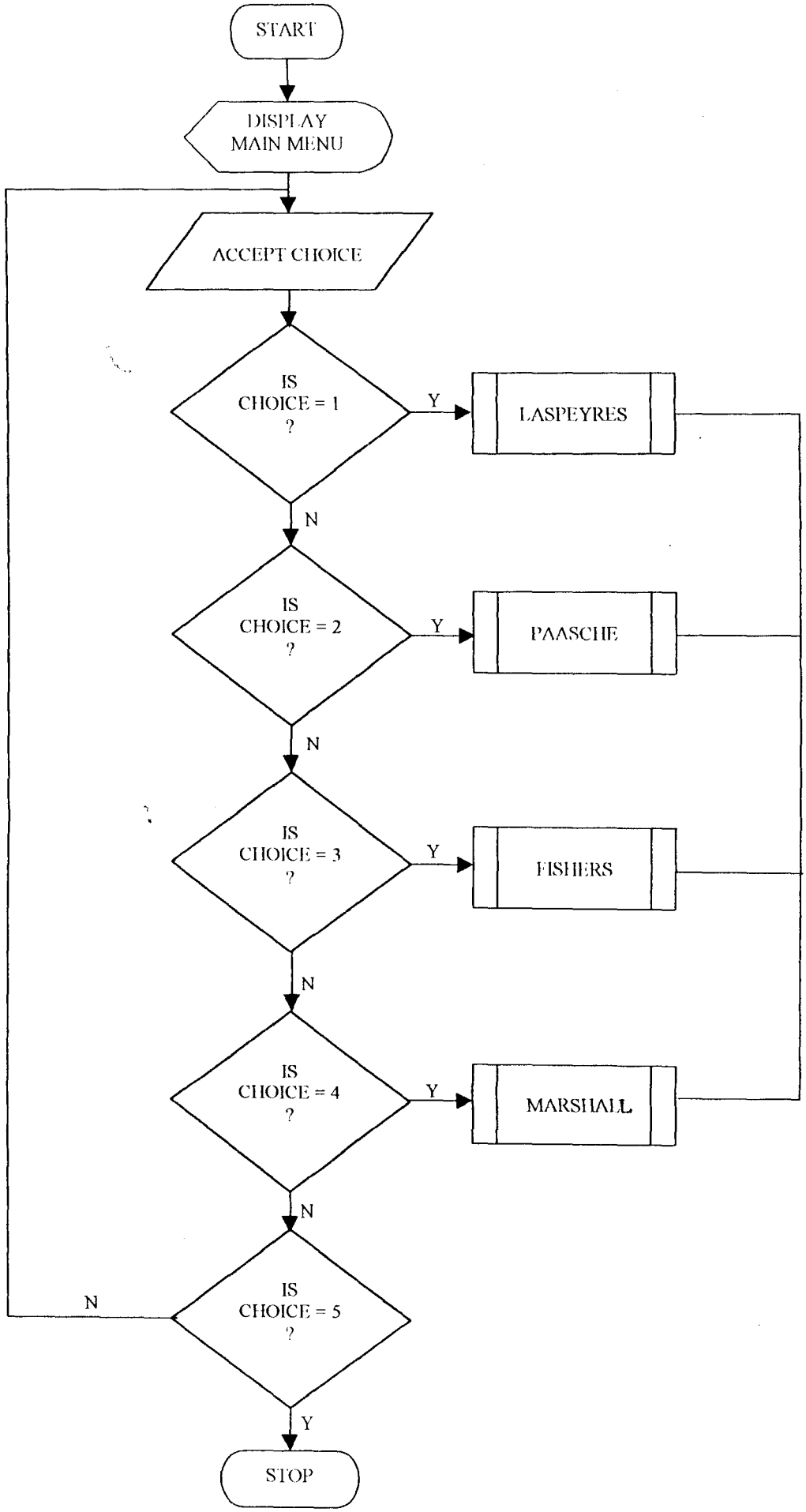
It is therefore highly recommended that, computerization of index number should be encouraged.

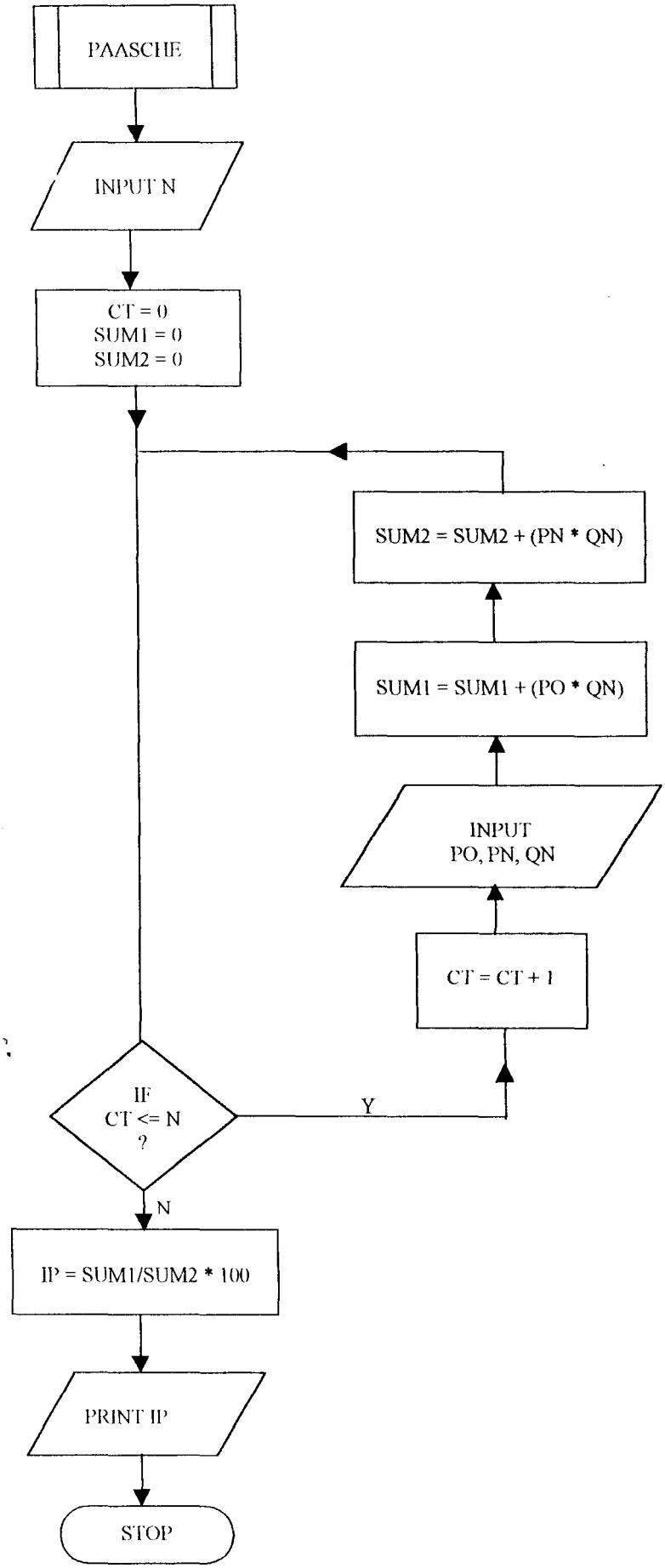
A

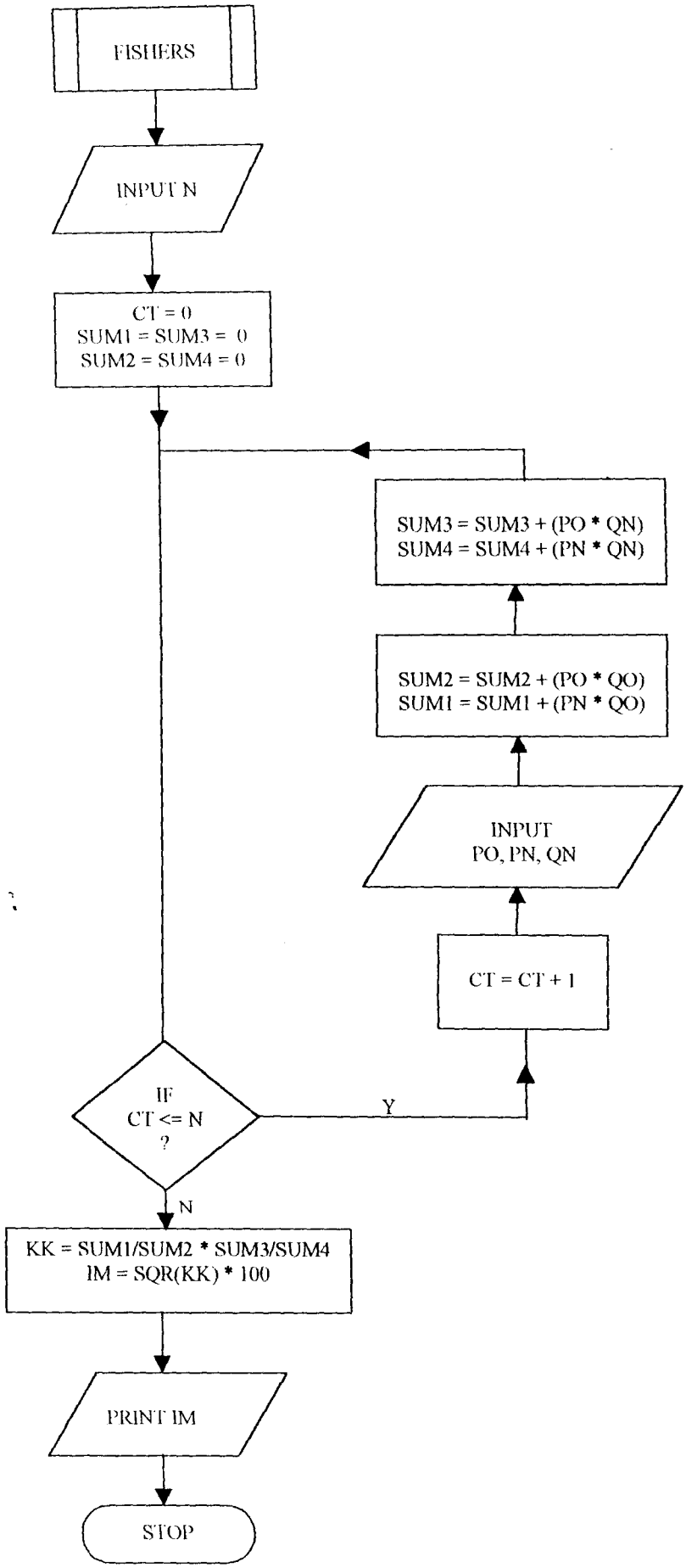
```
'*********************************************
'*** NAME:    OTOBOR A. O.                   ***
'*** NUMBER: PGD/MCS/554/97/98              ***
'*** TOPIC:  COMPUTATION OF INDEX NUMBERS   ***
'*********************************************
DIM PN(50), PO(50), QO(50), QN(50)
'--------------Introduction Screen Design
SCREEN 9
FOR I = 0 TO 30 STEP 5
LINE (0 + I, 0 + I)-(639 - I, 329 - I), (I / 5) + 1, BF
NEXT I
STATE1$ = "A   P R O J E C T    W O R K"
STATE2$ = "O N"
STATE3$ = "C O M P U T A T I O N   O F   I N D E X   N U M B E R S"

LOCATE 8, 25: COLOR 4, 7          '------- To print first line
FOR I = 1 TO LEN(STATE1$)
PRINT MID$(STATE1$, I, 1);
SOUND 1200, 1
FOR j = 1 TO 1000: NEXT j
NEXT I

LOCATE 11, 38: COLOR 4, 7         '------- To print second line
FOR I = 1 TO LEN(STATE2$)
PRINT MID$(STATE2$, I, 1);
SOUND 1200, 1
FOR j = 1 TO 1000: NEXT j
NEXT I

LOCATE 14, 15: COLOR 5, 7         '------- To print third line
FOR I = 1 TO LEN(STATE3$)
PRINT MID$(STATE3$, I, 1);
SOUND 1111, 1
FOR j = 1 TO 1000: NEXT j
NEXT I

ANS$ = INPUT$(1)          '------- To wait

SCREEN 2
SCREEN 0                  '------- To return screen to text mode
COLOR 14, 1
ANS = 0
DO WHILE ANS <> 5
CLS
LOCATE 4, 30: PRINT "**********************"
LOCATE 5, 30: PRINT "* M A I N   M E N U *"
LOCATE 6, 30: PRINT "**********************"
LOCATE 8, 30: PRINT "1. LASPEYRES INDEX"
LOCATE 10, 30: PRINT "2. PAASCHE INDEX  "
LOCATE 12, 30: PRINT "3. FISHER'S IDEAL INDEX"
LOCATE 14, 30: PRINT "4. MARSHALL EDGEWORTH INDEX"
LOCATE 16, 30: PRINT "5. QUIT"
LOCATE 19, 30: PRINT "ENTER CHOICE (1-5):"
   ANS = VAL(INPUT$(1))
   DO WHILE ANS < 1 OR ANS > 5
      ANS = VAL(INPUT$(1))
   LOOP
   GOSUB MAINPRG
LOOP
END
```

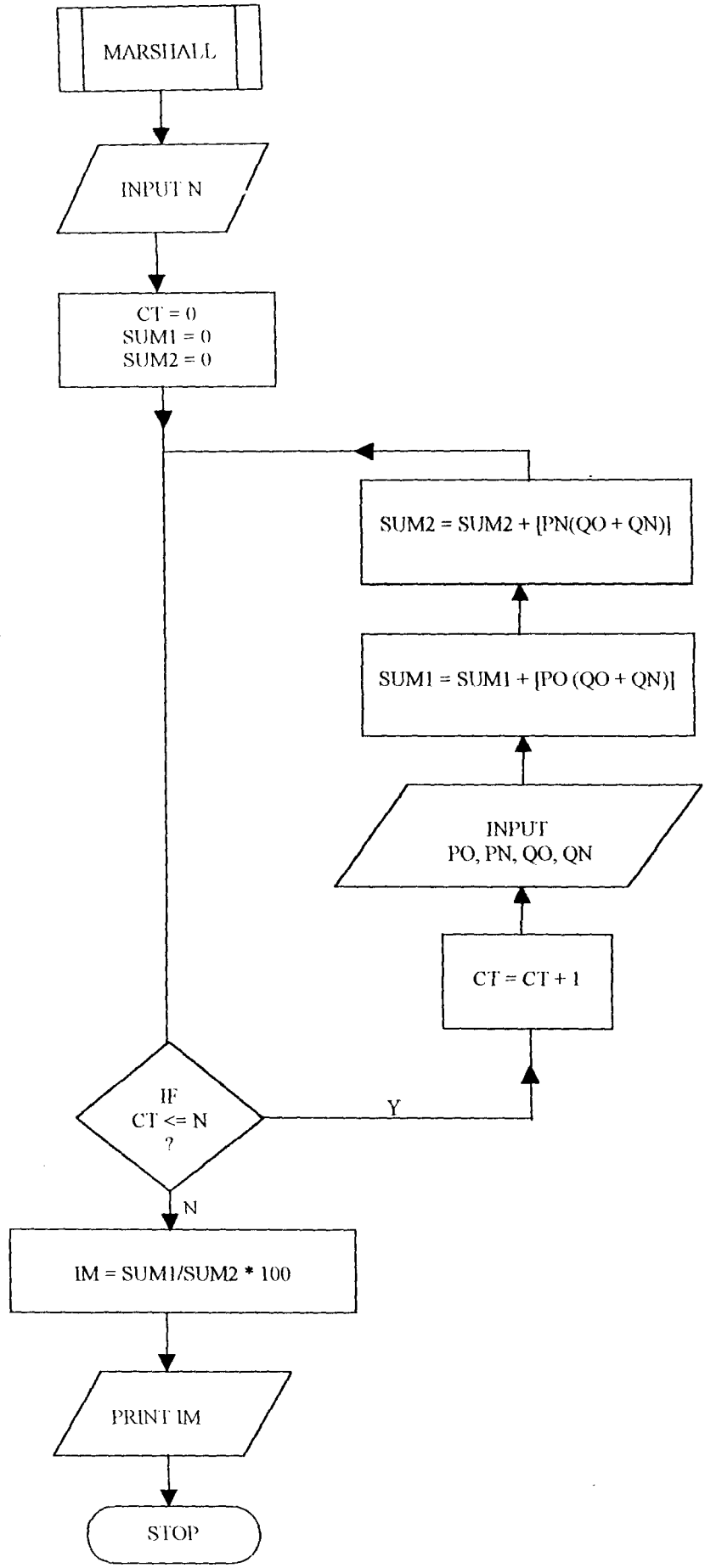
```
G:                                        '-----Main Program
   SELECT CASE ANS
       CASE 1
          GOSUB LASPEYRES
       CASE 2
          GOSUB PAASCHE
       CASE 3
          GOSUB FISHERS
       CASE 4
          GOSUB MARSHALL
   END SELECT
   RETURN


YRES:                                     '-----Laspeyres module
    CLS
    SUM1 = 0: SUM2 = 0
    INPUT "ENTER NUMBER OF DATA VALUES: "; N
    FOR I = 1 TO N
      INPUT "ENTER PRICE IN THE BASE YEAR: "; PO(I)
      INPUT "ENTER PRICE IN THE CURRENT YEAR: "; PN(I)
      INPUT "ENTER QUANTITY IN THE BASE YEAR: "; QO(I)
      SUM1 = SUM1 + (PN(I) * QO(I))
      SUM2 = SUM2 + (PO(I) * QO(I))
    NEXT I
    IL = SUM1 / SUM2 * 100
    CLS
    LOCATE 4, 34: PRINT "OUTPUT TABLE"
    LOCATE 5, 34: PRINT "************"
    LOCATE 8, 10
    PRINT "*************************************************************"
    LOCATE 9, 10
    PRINT "|  PO   |  PN   |   QO   |     PN * QO     |     PO * QO     |"
    LOCATE 10, 10
    PRINT "*************************************************************"
    FOR I = 1 TO N
      PRINT TAB(10); "|";
      PRINT USING "####"; PO(I); : PRINT TAB(18); "|";
      PRINT USING "####"; PN(I); : PRINT TAB(26); "|";
      PRINT USING "####"; QO(I); : PRINT TAB(35); "|";
      PRINT USING "####.##"; PN(I) * QO(I); : PRINT TAB(51); "|";
      PRINT USING "####.##"; PO(I) * QO(I); : PRINT TAB(67); "|";
    NEXT I
    PRINT TAB(10); "*************************************************************
    PRINT TAB(35); "|";
    PRINT USING "####.##"; SUM1; : PRINT TAB(51); "|";
    PRINT USING "####.##"; SUM2; : PRINT TAB(67); "|"
    PRINT
    PRINT TAB(10); "LASPEYRES INDEX = "; IL
    ANS$ = INPUT$(1)
    RETURN


CHE:                                      '------Paasche Module
    CLS
    SUM1 = 0: SUM2 = 0
    INPUT "ENTER NUMBER OF DATA VALUES: "; N
    FOR I = 1 TO N
      INPUT "ENTER PRICE IN THE BASE YEAR: "; PO(I)
```

FLOWCHART OF MAIN PROGRAM




PAASCHE
INPUT N
CT = 0
SUM1 = 0
SUM2 = 0
SUM2 = SUM2 + (PN * QN)
SUM1 = SUM1 + (PO * QN)
INPUT
PO, PN, QN
CT = CT + 1
IF
CT <= N
?
Y
N
IP = SUM1/SUM2 * 100
PRINT IP
STOP


FISHERS
INPUT N
CT = 0
SUM1 = SUM3 = 0
SUM2 = SUM4 = 0
SUM3 = SUM3 + (PO * QN)
SUM4 = SUM4 + (PN * QN)
SUM2 = SUM2 + (PO * QO)
SUM1 = SUM1 + (PN * QO)
INPUT
PO, PN, QN
CT = CT + 1
IF
CT <= N
?
Y
N
KK = SUM1/SUM2 * SUM3/SUM4
IM = SQR(KK) * 100
PRINT IM
STOP


MARSHALL
INPUT N
CT = 0
SUM1 = 0
SUM2 = 0
SUM2 = SUM2 + [PN(QO + QN)]
SUM1 = SUM1 + [PO (QO + QN)]
INPUT
PO, PN, QO, QN
CT = CT + 1
IF
CT <= N
?
Y
N
IM = SUM1/SUM2 * 100
PRINT IM
STOP

B

OUTPUT TABLE

PO	PN	QO	PN * QO	PO * QO
300	450	10	4500.00	3000.00
200	270	10	2700.00	2000.00
90	84	9	756.00	810.00
80	90	10	900.00	800.00
			8856.00	6610.00

LASPEYRES INDEX = 133.9788

OUTPUT TABLE
****

PO	PN	QN	PO * QN	PN * QN
300	480	8	2400.00	3840.00
200	320	8	1600.00	2560.00
90	90	6	540.00	540.00
80	100	7	560.00	700.00
			5100.00	7640.00

PAASCHE INDEX = 149.8039

OUTPUT TABLE
****

PO	PN	QO	QN	PN * QO	PO * QO	PO * QN	PN * QN
300	490	10	7	4900.00	3000.00	2100.00	3430.00
200	315	10	7	3150.00	2000.00	1400.00	2205.00
90	100	9	5	900.00	810.00	450.00	500.00
80	100	10	6	1000.00	800.00	480.00	600.00
				9950.00	6610.00	4430.00	6735.00

FISHERS INDEX = 151.2787

OUTPUT TABLE

PO	PN	QO	QN	QO + QN	PN * (QO+QN)	PO * (QO+QN)
523	630	7	7	14.00	8820.00	7322.00
375	640	9	8	17.00	10880.00	6375.00
120	360	4	8	12.00	4320.00	1440.00
110	240	6	8	14.00	3360.00	1540.00
					27380.00	16677.00

MARSHALL EDGEWORTH INDEX = 164.1782