COMPUTER APPROACH TO INVESTMENT METHOD OF VALUATION

BY

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Dr. Y. M. Aiyeshimi

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CERTIFICATION

This is to certify that this work was carried out by Ogunsanya Abraham Kehinde, Registration No. PGD/MCS/97/98/524, of the Department of Mathematics/Computer Science, Federal University of Technology, Minna, Niger State.

.....	.....
Prof. K. R. Adeboye *(Project Supervisor)*	DATE
.....	.....
Dr. S. A. Reju *(Head of Department)*	DATE
.....	.....
External Examiner	DATE

DEDICATION

This project is dedicated to God Almighty and to the memory of my late father Late Pa. David Ogunsanya

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ABSTRACT

There are five methods of valuation. Today, the widest approach to property valuation is the income approach otherwise known as the investment method. This is used for valuing properties which are normally held as income producing investment.

The method determines through the process of capitalisation or discounting the present value of the net future benefits received from property. The appraisal process in this method involves establishing the net benefits (income) from the property and capitalising or discounting this by the use of a multiplier, which reflects the interest rate appropriate to the property regarded as an investment.

The use of investment method requires sound knowledge of mathematics and ability to forecast into the future. With the aid of computer system characterised by high speed, accuracy, high storage facility, and safety such enormous task could easily be overcome. It will not only save time but also slim down the probable errors and overcome rigours of computation.

The study will look at property valuation in perspective; concept of property value and its application; analyse the investment method of valuation; and review the mathematics of valuation. Thereon, a computer program will be design to streamline the chronological order of value computation using the investment method.

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CHAPTER ONE

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information:

Over the years, the development of Computer Science has been a useful advance technology for all facets of life. To the profession of Estate Surveying and Valuation, its significance cannot be over emphasised.

Often time, the Estate Surveyor and Valuer is called upon to render professional services ranging from property management, property development, feasibility and viability studies, to property valuation for varying purposes. In each case, his professional opinion is considered valid at a given point in time. In the valuation of interest on landed properties for instance, adequate knowledge of valuation techniques and sound mathematical background is required so as not to mislead a client who is a layman in this regard.

There are five methods of valuation namely

(1) Investment method
(2) Comparison method
(3) Replacement cost method or the contractors Test method
(4) Profit method
(5) Residual method

The first three methods are basic methods while the last two methods are derived approach. Each method is applicable to a property based on a specified condition, basis and purpose for such valuation.

The Investment method of valuation is used for valuing interest in properties, which are normally held as income producing investment. The method determines through the process of capitalisation or discounting, the present value of the net future benefits receivable from properties. Thus, the method is concerned with the present value of the future benefits of property. The appraisal process in this method involves establishing the net benefit (income) from property and capitalising or discounting this by the use of a multiplier, which reflects the interest rate appropriate to the property regarded as an investment.

The entire approach is basically mathematical in nature. Hence the computerisation of this approach will not only marginalize the level of error in computation and speed up the process but also provide a nearing accurate result. The computerised investment method of valuation can be seen as a system for capturing, storing, checking, integrating, manipulating, analysing and displaying property related data with the aim of computing values.

The study is divided into five chapters. Chapter one is primarily concerned with introduction. Chapter two concentrates on the theoretical and conceptual framework as it relates to the study. Chapter three considers in perspective the mathematics of valuation as a basis for the investment method of valuation. Programs to accept mathematical formulae (the valuation table) and an hypothetic investment approach to property valuation is treated under chapter four. Chapter five restricts itself to the Analysis and interpretation of the study upon which findings, recommendations and conclusion are drawn.

1.2 The Goal of Study:

The ultimate goal of this study is to consider the application of computer system to the investment method of valuation.

1.3 Objective of Study:

(a) To review the concept of valuation.

(b) To critically examine the investment method of valuation.

(c) To develop computer programs which will accept the computation of values using the investment approach.

(d) To identify the significance of computer system to the evaluation of landed properties in particular and to the profession of Estate surveying and valuation in general.

1.4 Limitation/Scope of Study:

Limitations of this study include some difficulties posed by inadequate time, finance and the distance to the school. In terms of scope, the study is limited to the computer approach to investment method of valuation.

1.5 Definition of Terminologies:

(a) Property:

Property in this regard refers to land and buildings other than chattels or perishable goods.

(b) Valuation:

Valuation is the estimation of the capital or rental value of land and/or buildings at a certain time.

(c) Value:

The value of an interest in property may be defined as the amount of money which can be obtained for that interest at a particular time from those who are able and willing to purchase it.

(d) Computer:

This is an electronic device which accept, store, process and retrieve data based on users specification.

(e) Program:

A program is a set of instructions written in the language of the computer in order to make the computer perform a specific task.

1.6 Methodology of Study:

For the purpose of this study, data from both primary and secondary sources are utilised.

(a) Primary Sources:

These were obtained from personal experience in computer science and Estate management coupled with interactions with colleagues both in school and office.

(b) Secondary Sources:

Other relevant information were obtained from textbooks, journals, lecture notes and other relevant publications on the subject matter.

CHAPTER TWO

CHAPTER TWO

2.0 THEORITICAL AND CONCEPTUAL FRAMEWORK OF VALUATION

2.1 Concept of Property Values:

Value is normally expressed in monetary terms, which indicate the power of a commodity to command other commodities in exchange. Subject to certain conditions, it approximates to market price.

Property values are affected by

(a) Location – the general situation and accessibility of the property in relation to the demand for its use.

(b) Position – the actual situs of the property in the context of its immediate environment.

(c) Physical Characteristics – the form and quality of the property in respect of its layout, structure and design.

Other factors include:

- Economic
- Legal
- Government policy

A purchaser of an interest in property may buy for occupation, investment or speculation. A purchaser for personal occupation will have regard to location and social and commercial facilities. A purchaser for investment purposes will consider the return he can obtain from the property in the form of rent, security and

capital growth. While a speculator may purchase with the hope of selling at higher price in the future, thus making a capital gain.

2.2 Purpose of Valuation:

Property valuation is required for varying purposes, which include:

(a) Sales/purchases
(b) Mortgage
(c) Probate
(d) Going concern
(e) Rating
(f) Taxation
(g) Insurance
(h) Lease
(i) Developmental
(j) Special

2.3 Basis of Valuation:

Basis of valuation are usually in two folds, namely,

(i) Open Market value; and
(ii) Depreciated replacement cost (statutory basis).

And these could be either

(a) Capital values or (b) Rental values

2.4 Methods of Valuation:

2.4.1 Comparison method:

This method entails analysing recent transaction involving properties similar to the ones under valuation to determine the

values achieved. This value is then applied to the subject property to determine its value. The ideal situations for using this method are:

(a) When the properties are similar and in the same location

(b) When there are records of many recent past transaction of similar properties.

(c) When the market within the intervening period (i.e. the period between the date of record and the date of valuation of subject property) has been relatively stable.

Market data required include:

(a) Sales prices

(b) Date of sale

(c) Terms of sale

(d) Period of exposure

(e) Buyers/sellers motive

(f) Availability of finance

2.4.2 ***Investment method:***

This method is used for valuing properties, which are normally held as income producing investment. The method determines, through the process of capitalisation or discounting, the present value of the net future benefits from property. Investment or income approach to valuation is concerned with the present value of the future benefits of property.

The appraisal process in this method involves establishing the net benefits (income) from the property and capitalising or discounting

this by the use of a multiplier, which reflects the interest rate appropriate to the property regarded as an investment.

The valuation process takes cognisance of

(a) The determination of income

(b) The determination of outgoing expenses and other deductions from the gross income to obtain the net income flow.

(c) The determination on the basis of cognate market comparables of the yield or capitalisation rate appropriate to the nature of the income flow.

(d) The determination of the duration of the income to be capitalised, i.e. (i) Perpetual; or (ii) Terminal.

The formula in use include:

(i) $\frac{\text{Net Income}}{\text{Rate of interest}} = \text{Value}$

(ii) Net income x capitalisation factor [cf(yp)] = value

(iii) CF(yp) is derived by $\frac{100}{\text{Rate\%}}$ or $\frac{1}{i}$ or $\frac{1}{i+ASF}$

2.4.3 ***Replacement cost or Reinstatement method:***

This method is used to value properties that seldom change hands and for which there is therefore few comparables. The theory is that cost is related to value such that the cost of the site plus the

cost of buildings would give the values of the land and building as one unit.

The price for the site would be based on the value of comparable site. It must be valued by reference to the concept of opportunity cost. While on the other hand, the cost of erecting the building is derived from prevailing building cost.

However, in employing the contractor's Test Approach, it is needful to take cognisance of the underlisted parameters:

(a) Cost of land acquisition and preparation.

(b) Unit cost rate of construction.

(c) Professional fees payable to members of the construction team.

(d) An allowance for developer's profit as remuneration for risk-taking and entrepreneurship.

(e) An allowance for contingencies emanating from oscillating prices of building components.

(f) An allowance for obsolescence and depreciation arising from intrinsic defects in space affordability, arrangement and design as well as visible disrepairs afflicting the subject properties.

*2.2.4 **Profit or Account method:***

The method is normally used to estimate the rental values in the case of a certain properties where some element of monopolies exists and for properties, which are rarely sold. Example of these

properties are Racecourses, Hotels, Petrol Filling Stations, Theatres, Cinemas, Football stadia, etc. all of which are capable of making profits and so have values to a potential user. The theory is that the hypothetical tenant would relate his rental bid to the profits he would be likely to make from the business he would conduct on the premises.

The process of valuation takes the following forms:

(a) Determine the gross earnings of the year.

(b) Deduct purchases adjusted for stock position to arrive at profit.

(c) Deduct from the gross profit, all working expenses (except rent which is what you are looking for and mortgage interest payment) to arrive at the net profit or divisible balance.

(d) Deduct from the divisible balance the tenant share:

- tenant's remuneration.
- an allowance for the interest on capital invested, in furniture, equipment, stock, cash and working capital
- an allowance to cover the tenant's risk and capital.

(e) The final figure represents a sum available to pay for the use of the premises, that is, rent or rental value.

The use of the method requires the following

(a) Proper knowledge of the business.

(b) Ability to interpret accounts.

(c) Ability to analyse the profit.

2.4.5 ***Residual method:***

The residual method is used in valuing sites and property that have development and redevelopment values respectively. The theory is

that the gross value of a land/building erected on it after redevelopment of the property less total cost of development or redevelopment equals the value of the land before the development or of the property before redevelopment. Hence, its use entails estimating the value of the land/building after development or of the property after redevelopment and deducting therefore the total cost of development or redevelopment. The cost in this case include:

- cost of construction/site works.
- professional fees – Quantity Surveyor, Lawyer, Architect, Estate Surveyor.
- interest on capital borrowed.
- contingencies.
- developer's profit.

The residue is the value of the site or of the property in its present position.

The use of the method entails the following

(a) Determine the best uses to which the land or property can be put to in the future if planning permission is granted.

(b) Estimate the market value of the property when put to its most profitable use. This gives the proceeds of sale or Gross Development Value (GDV)

(c) Estimate the cost of carrying out all the necessary works require to put the land in its proposed use plus all other cost before realisation of GDV. These are normally in two folds:

(1) Cost of Sale – This includes agents fees advertising cost and legal fees.

(2) Cost of Development – This include

(i) Cost of building – These are the prevailing costs of the gross floor area. In addition to the actual cost of building, the professional services of the design team are payable.

(ii) Miscellaneous items: This includes

- cost of demolition
- cost of obtaining possession
- cost of providing boundary works
- cost of site clearance, etc.

(iii) Cost of finance – This include interest on borrowed loan.

(iv) Developer's profit – This is the gross profit to the developer before reaching his general overheads and tax.

(d) Determine the sum available to be spent on land cost or the value of the property undeveloped.

CHAPTER THREE

CHAPTER THREE

3.0 MATHEMATICS OF VALUATION

3.1 Arithmetical Progressions:

An arithmetical progression is a series of numbers, in which each term is formed from the preceding one, by adding the same number to it. The amount to be added each time is termed the common difference and it may have a positive or a negative values.

Assume that an arithmetical progression has 'n' terms, and that the first term is 'a' and the common difference is 'd'. The sequence of numbers emerges by adding 'd' to the preceding number, and the series develops thus a, a + d, a + 2d, a + 3d .... up to and including a + (n-1) d this being the last term. (The characteristic of 'd' is one less than its place in the series, so that for the nth term, 'd' has a characteristic of n-1).

It can be seen that the average of the first and last terms is the same as the average of the second and the next-to-last terms so that the average for the whole series is the average of the first and last terms, namely

$$\frac{a + (a + (n-1)d)}{2}$$

The sum of the arithmetical progression

Sn is thus $Sn = \frac{n}{2}(a + a + (n-1)d)$

$$= \frac{n}{2}(2a + (n-1)d)$$

3.2 Geometrical Progression

A geometrical progression is a series of numbers in which each term is formed from the preceding one by multiplying it by a constant factor, this factor being termed the common ratio.

Assume that a geometrical progression has 'n' terms, the first term is 'a' and the common ratio is 'r'. The standard form of a geometrical progression is

a, ar, ar^2, ar^3 ... up to and including ar^{n-1}

Let Sn = the sum of 'n'terms

Sn = a + ar + ar^2 + ar^3 ... up to and including ar^{n-2} + ar^{n-1} .... (i)

rsn = ar + ar^2 ar^3 + ar^4 ..... up to and including ar^{n-1} + ar^n .... (ii)

Subtracting equation (i) from equation (ii) gives

rsn – sn = ar^n - a

sn (r-1) = a (r^{n-1})

$$sn = \frac{a(r^{n-1})}{r-1}$$

If 'r' has a negative value or is a fraction less than unity, the formula is reversed thus

$$sn = \frac{a(1-r^n)}{1-r}$$

3.3 Simple interest

If money is loaned or invested the owner of that money will expect a return for having forgone an alternative use of these funds. This return is generally in the form of interest, which will accumulate at regular intervals, usually on an annual basis. The interest may be paid to the owner at regular intervals, and does not then itself accumulate interest. This is simple interest.

Thus in general terms, if

p = the principal amount

i = rate of interest per annum expressed as a decimal

n = term of years

and I = total simple interest

Then $I = p \times i \times n$

This formula may further be transposed as given below

$$p = \frac{I}{i \times n}$$

$$i = \frac{I}{p \times n}$$

$$n = \frac{I}{p \times i}$$

3.4 Compound Interest:

As previously stated, where money is invested, the investor will expect an annual return, instead of receiving a monetary return at regular intervals, he may chose to have the interest added to the principal amount. This interest, which will also accumulate further interest, is termed compound interest.

Assume ₦1 is invested at 'i' compound interest. At the end of the first year, ₦1 will accumulate to (1+i). At the end of the second year, it will accumulate to $(1+i) + (1 + i) = 1 + 2i + 1^2 = (1 + i)^2$. At the end of the third year the sum will further accumulate to $(1+2i+1^2)i + (1+2i+i^2) = 1 + 3i + 3i^2 + i^3 = (1 + i)^3$. So that at the end of 'n' years, ₦1 will have accumulated to $₦(1+i)^n$. thus

Total amount accumulated = $₦(1+i)^n$

and Total interest = $₦(1+i)^n - 1$

For the investment of a principal amount 'P' and the total amount 'A'

$$A = p(1+i)^n$$

The formula may further be transposed as given below

$$P = \frac{A}{(1+i)^n}$$

$$i = \sqrt[n]{\frac{A}{p}} - 1$$

$$n = \frac{\log A - \log p}{\log (1+i)}$$

3.5 Mortgage Repayments:

If a capital sum of money is borrowed over a period of time, the lender may stipulate that repayment should be made at regular intervals during the period of borrowing, each repayment being of an equal amount. The agreement to lend and borrow capital for the purchase of land and/or property may be termed a mortgage.

Let the amount of the mortgage be '₦m', and the annual repayments be 'p'. If the mortgagee lends 'm' for a period of 'n' years, he releases not only 'm', but also the compound interest, at an annual rate of 'i', which would otherwise have accumulated each years, the total thus being $₦m(1+i)^n$. The annual repayment 'p' will also be able to accumulate compound interest at an annual rate of 'i'.

The first payment of 'p' will accumulate to $p(1+i)^{n-1}$, the second payment of p to $p(1+i)^{n-2}$ and so on. The sum of the repayments and interest will be $p(1+i)^{n-1} + p(1+i)^{n-2}$ and .... up to and including

$p(1+i)^2 + p(1+i) + p$. If this is reversed, the sum of repayments and interest $= p+p(1+i) + p(1+i)^2$ .... up to and including $p(1+i)^{n-2} + p(1+i)^{n-1}$.

From the geometrical progression

$$Sn = \frac{a(r^n - 1)}{r - 1}$$

Where Sn=the sum of repayments and interest

$a = p$
$r = (1+i)$

Therefore, the sum of repayments and interest is

$$P\left[\frac{(1+i)^n - 1}{(1+i) - 1}\right]$$

$$P\left[\frac{(1+i)^n - 1}{i}\right]$$

The total of repayments and interest must equal the value of the mortgage with its interest. Thus

$$P\left[\frac{(1+i)^n - 1}{i}\right] = \text{₦}m(1+i)^n$$

So $$P = \frac{\text{₦}\, m(1+i)^n i}{(1+i)^n - 1}$$

3.6 **Depreciation:**

When new plant or machinery is purchased, its value as at purchase will depreciate year by year. This annual depreciation may be expressed as a fixed percentage, 'i', per annum, when the value at any particular time can be determined by means of a compound interest calculation with a negative value. Thus, if the original

value = p, the depreciating rate of interest per annum = i, term of years = n and the value after 'n' years = D then,

$$D = p(1+i)^n$$

3.7 Analysis of Valuation Tables:

The mathematics of valuation requires knowledge of finance and the theory of compounding and discounting. The tables would be considered under three broad headings.

i) Single Rate tables

ii) Dual Rate tables

iii) Mortgage Instalment table

The following abbreviations will be used

i = rate of interest per annum expressed as a decimal

n = term of years (or number of periods of interest accumulation)

s = annual sinking fund to be invested to accumulate to ₦1 after a given number of years at a certain rate of compound interest.

3.7.1 Single Rate Tables:

(a) Amount of ₦1(A)

This is the amount to which ₦1 invested now will accumulate at 'i' compound interest in 'n' years. It is assumed that interest is added annually at the end of each year.

$$A = (1+i)^n$$

(b) Present Value of ₦1 (PV):

This is the amount that must be invested now to accumulate to ₦1 at 'i' compound interest in 'n' years. The formula for this table may be constructed as follows:

(i) Assume ₦1 is invested at 'i' for 1 year; then at the end of the year the accumulation will be ₦(1+i)

(ii) Assume x (an unknown) is invested at 'i' for 1 year, and at the end of the year the accumulation will be ₦1

In (i) ₦1 is the present value (PV). In (ii) x is the present value (PV).

$$x:1=1:1+i$$

So that $x = \frac{1}{(1+I)^n}$

Thus $PV = \frac{1}{(1+I)^n}$

This is the reciprocal of the amount of ₦1 table

(c) The amount of ₦1 per annum:

This is the amount to which ₦1 invested at the end, of each year will accumulate at 'i' compound interest in 'n' years.

This is represented as

$$Sn = \frac{a(r^n - 1)}{r - 1}$$

In this series sn (sum of such terms) may be substituted by the amount of ₦1 per annum, 'a' by 1; 'r' by (1+i) so that

Amount of ₦1 per annum $= \frac{1(1+i)^n - 1}{(1+i) - 1}$

$$= \frac{(1+i)^n - 1}{i} \text{ or } \frac{A - 1}{i}$$

(where A=amount of ₦1)

(d) Annual Sinking Fund (s):

This is the annual sum, 's' required to be invested at the end of each year to accumulate to ₦1 in 'n' years at 'i' compound interest.

Since the present value of ₦1 is the reciprocal of the amount of ₦1, so the annual sinking fund is the reciprocal of the amount of ₦1 per annum. The formula is

$$S = \frac{i}{(1+i)^n - 1} \quad \text{or} \quad \frac{i}{A-1}$$

The annual sinking fund may be used to calculate the annual amount to be set aside to meet a known future liability or expense.

(e) Year's purchase (YP) or present value of ₦1 per annum.

This is the present value of the right to receive ₦1 at the end of each year for 'n' years at 'i' compound interest. The formula is derived from the addition of the Present values of ₦1 for each ₦1 received. Thus

PV of ₦1 due in 1 year = $\frac{1}{1+i}$

PV of ₦1 due in 2 years = $\frac{1}{(1+i)^2}$

YP for 2 years = $\frac{1}{(1+i)} + \frac{1}{(1+i)^2}$

Thus

YP for 'n' years = $\frac{1}{(1+i)} + \frac{1}{(1+i)^2} + \frac{1}{(1+i)^3}$ .... up to and including $\frac{1}{(1+i)^{n-1}} + \frac{1}{(1+i)^n}$ .....(i)

Multiply both sides by (1+i) and call the resultant equation (ii)

YP for 'n' years x (1+i) = $\frac{1+i}{1+i} + \frac{1+i}{(1+i)^2} + \frac{1+i}{(1+i)^3}$ ... up to and including $\frac{1+i}{(1+i)^{n-1}} + \frac{1+i}{(1+i)^n}$ .....(ii)

This can be expressed as

YP for 'n' years x (1+i) =1+ $\frac{1}{1+i} + \frac{1}{(1+i)^2}$ .... up to and

including $\frac{1}{(1+i)^{n-2}} + \frac{1}{(1+i)^{n-1}}$

Subtracting equation (i) from equation (ii) giving the YP for 'n' years x (1+i) – the YP for 'n' years as

$$1 - \frac{1}{(1+i)^n}$$

This is YP for 'n' years + i (YP for 'n' years) – YP for 'n' years which equals

$$1 - \frac{1}{(1+i)^n}$$

$$i \text{ (YP for 'n' years)} = 1 - \frac{1}{(1+i)^n}$$

$$\text{YP for 'n' years} = \frac{1 - \frac{1}{(1+i)^n}}{i} \text{ or } \frac{1-PV}{i}$$

(where PV = Present value of ₦1)

This table gives the multiplier which can be applied to an income receivable at the end of each year for 'n' years at 'i' compound interest in order to find its present capital value.

(f) Year's purchase in perpetuity (YP):

This is the present value of the right to receive ₦1 at the end of each year in perpetuity at 'i' compound interest. This differs from the previous table in that the income is received not for a limited period of time but for perpetuity, that is, an endless period of time. This is represented as

$$\text{YP in perpetuity} = \frac{1}{i}$$

This YP can be multiplied to any perpetual income receivable at the end of each year at 'i' compound interest.

(g) Year's purchase of a Reversion to perpetuity:

This is the present value of the right to receive ₦1 at the end of each year in perpetuity at 'i' compound interest, but receivable after the expiration of 'n' years. The YP of a reversion to perpetuity is given by:

$$\text{PV of } ₦1 \times \frac{1}{i}$$

$$= \frac{1}{(1+i)^n} \times \frac{1}{i}$$

$$= \frac{1}{i(1+i)^n} \quad \text{or} \quad \frac{1}{iA}$$

3.7.2 ***Dual Rates Tables***

(a) Years' purchase or present value of ₦1 per annum (YP):

This is the capital value of the right to receive ₦1 at the end of each year for 'n' years at 'i' compound interest, but allowing for a sinking fund 's' to recoup the original capital after 'n' years.

Assume the net interest on ₦1 to be 'i' and the annual sinking fund to recoup ₦1 at the end of the limited term to be 's'. Then the total income from property worth a capital value of ₦1 = i+s. Assume the capital value of a stream of income to be 'p'. Then the annual income required is p(i+s) but

Capital value = Net income per annum x YP

So that

$$YP = \frac{p}{P(i+s)}$$

$$YP = \frac{i}{(i+s)}$$

In this formula, there are two different rates of interest.

(i) 'i' is the rate of interest expected by the investor (known as a remunerative rate of interest)

(ii) the rate of interest for 's' is a low, risk-free rate (an accumulative rate of interest)

(b) The Annuity ₦1 will purchase:

This is the annual income receivable at the end of each year for 'n' years if ₦1 is invested at 'i' compound interest and a sinking fund is provided at 2½ percent to recoup the ₦1 at the end of the term. It is the reciprocal of the YP Dual Rate Table. Hence

Annuity ₦1 will purchase = i + s

*3.7.3 **Mortgage instalment Table***

This indicates the equal amounts to be paid monthly to redeem each ₦100 capital borrowed over 'n' years at 'i' compound interest. It is calculated on a fixed annual basis with no allowance for interest to compound on each monthly instalment.

The mortgage instalment table is computed from

$$\frac{(i + s)\ 100}{12}$$

CHAPTER FOUR

CHAPTER IV

COMPUTER APPROACH TO INVESTMENT METHOD OF VALUATION

4.1 CHOICE OF COMPUTER LANGUAGE

In making a choice of computer language used for this project work, the following factors have been considered.

(a) Exposure of the user to the language selected.

(b) Simplicity in learning and using the language.

(c) The purpose for which the language is required.

(d) The features of the language in use.

(e) The availability of a compiler or interpreter.

(f) The availability of error checking and diagrammatic facilities.

(g) The availability of resource material e.g. books, personal computer (PC) etc.

Having carefully considered the above factors, BASIC programming language has been selected and particularly the QBASIC

BASIC is an acronym, which denotes "Beginners All-purpose symbolic instruction code". It is a human-like language, which allows the user to perform and predict other behaviour of each expression before it is actually executed. In other words, it is an interactive procedure-oriented language that permits user and computer to communicate with each other directly.

BASIC programming language has a fast input and output flexibility and also possess modularity characteristics i.e. it allow the use of subprogram such as sub-routines.

Finally, the high speed in the compilation and execution of the QBASIC (a version of BASIC programming language) pave way for its choice as ideal programming language of this project work.

4.2. SYSTEM ANALYSIS AND DESIGN:

A system is a set of programs and procedures, inputs and files to produce desire output. Hence this system has been analysed, programmed, tested, installed, maintained and intended to be periodically evaluated. The primary aim of this activity is to produce the best answer to valuation computation using the investment method by applying the most economic solution and operating objectives, equipment capabilities and personal resources.

To achieve this, the underlisted steps were taken in developing the application:

a. The existing system was studied, where the procedures and problems was discovered. The existing system has been the normal arithmetic computation, thus

Annual Net income	₦x
YP for n years @ i% interest rate	y
	₦xy

The problems associated with this system is that it is tedious, time consuming and with low efficiency since it requires several adjustment especially when it involves large

properties e.g. an Estate, petrol filling station, asset of a company (NITEL, NEPA, NNPC, etc.) or ministries etc. The system is equally prone to error of omission (of figures), computation and compilation.

b. Gathering data and facts including users specifications and requirements for the proposed system. This requires an expert opinion and experience couple with knowledge of a given locality, because values varies according to location and other determinant factors such as:

i. design and level of finishing of a given property (building)
ii. types of property in question e.g. duplex, bungalow, flat, etc.
iii. the use of the property e.g. residential, commercial, industrial, etc.,
iv. neighbourhood e.g. low, medium or high density
v. town planning regulations;
vi. interest rate i.e. borrowing rates which varies from one bank to the other,
vii. and purpose for which the valuation is required – sales, compulsory purchase, going concern, probate etc.

c. Analysis and Evaluation of the information gathered :

Expert opinion as to the choice of interest rate are selected after consulting with various banks and reaching a mean (average) rate. The information regarding Net Income (NI) are always given after deducting for outgoings from a given

gross rent (usually on annual basis) passing on a given property. Thus,

Gross rental value	₦x
Less: Outgoings	₦y
Net Income (NI)	(₦x-y)

Outgoings are expenses required for the upkeep of the property. Such expenses include:

- sinking fund
- Repairs and maintenance
- Management
- Landlord's services e.g. property rate, ground rents, etc.
- Bad debts and voids
- General and water and sewage rates

On the other hand, the years' purchase at various years and interest rate are pre-determined in the valuation table or could be computed using the Arithmetic of valuation's formulae.

d. Benefits to be derived from the proposed system are enormous and they include:
   - Speed in terms of time
   - efficiency and accuracy in compilation and computation of figures.
   - Security of data either raw or processed data through the computer memory.

e. The proposed system is required to perform an arithmetic computation of property value using the investment method of valuation. This may be required urgently and at a spot

and with high degree of accuracy since the valuer's opinion are regarded as a professional opinion. For instance, a client who is with his Bank manager to negotiate for a loan or overdraft is required to pledge his landed property (e.g. building) as collateral. He picked up his telephone and call his Estate surveyor and Valuer to advise him as to the worth of his property. He went ahead to give detail particulars of the property including the Rent passing and location. In this case, all valuer need to do is as follows:

Gross Rent (per annum)	₦500,000.00
Less: Outgoings @ say 10%	₦ 50,000.00
Net Income	₦450,000.00
YP in perp @ say 10%	
(YP = 1/i)	10
Capital Value	₦ 4,500,000.00

The above analysis and computation could easily be done in a minute by punching through the keyboard of a system. However, this is about the simplest example. Others may require much adjustments and computations, which could be time consuming and require longer procedures and high-level technical know-how.

f. The cost of the application is required to be considered along side the expected benefit to determine its viability or otherwise. In determining the viability however, the feasibility of same is likewise needful having recourse to the user and purpose.

4.3 Program Development

4.3.1 *Program to accept Arithmetic formulae*

```
REM THIS PROGRAM IS MENNT FOR PPROJECT WORK
CLS
COLOR 2, 5
LOCATE 10, 20: PRINT "WELCOME TO THIS PROJECT WORK"
LOCATE 12, 15: PRINT TOPIC: "COMPUTER APPROACH TO INVESTMENT
                            METHOD OF VALUATION"
LOCATE 18, 35: PRINT "BY:": SLEEP 5: CLS
LOCATE 10, 28: PRINT "OGUNSANYA K.A"
LOCATE 12, 28: PRINT REG.NO:"FUT/MCS/97/98/PGD/524"
LOCATE 14, 25: PRINT "DEPT: MATHS/COMPUTER SCIENCE":
SLEEP 5: CLS
10 REM THIS PROGRAM CALL ALL SUB PROGRAM
REM **********************************
PRINT TAB(10); "**********************"
PRINT TAB(10); "[1] AMOUNT"
PRINT TAB(10); "[2] PRESENT VALUE(PV)"
PRINT TAB(10); "[3] AMOUNT(PER ANNUM)"
PRINT TAB(10); "[4] ANNUAL SINKING FUND (ASF)"
PRINT TAB(10); "[5] YEARS PURCHASE(SINGLE RATE)"
PRINT TAB(10); "[6] YEARS PURCHASE(DUAL RATE)"
PRINT TAB(10); "[7] YEARS PURCHASE IN PERPETUITY"
REM TO ENTER VALUES
LOCATE 10, 10: INPUT "ENTER CHOICE"; NUM
IF NUM < 1 OR NUM > 7 THEN GOTO 10
IF NUM = 1 GOTO 20
IF NUM = 2 GOTO 30
IF NUM = 3 GOTO 40
IF NUM = 4 GOTO 50
IF NUM = 5 GOTO 60
```

```
IF NUM = 6 GOTO 70
IF NUM = 7 GOTO 80
20 REM TO CALCULATE AMOUNT OF ₦1
CLS
FOR K = 1 TO 7
LOCATE 5, 10: INPUT "VALUE OF P(%)"; P
LOCATE 6, 10: INPUT "VALUE OF N (YRS)"; N
LET I = P / 100
LET A = (1 + I) ^ N
PRINT TAB(10); "AMOUNT OF ₦1="; A
NEXT K
GOTO 90
30 REM TO CALCULATE PRESENT VALUE OF ₦1 (PV)
CLS
FOR K = 1 TO 7
LOCATE 5, 10: INPUT "VALUE OF P(%)"; P
LOCATE 6, 10: INPUT " VALUE OF N(YRS)"; N
LET I = P / 100
LET A = (1 + I) ^ N
LET PV = 1 / A
PRINT TAB(10); " PRESENT VALUE OF ₦1 ="; PV
NEXT K
GOTO 90
40 REM TO CALCULATE PRESENT VALUE  OF ₦1 PER ANNUM
CLS
FOR K = 1 TO 7
LOCATE 5, 10: INPUT "VALUE OF P(%)"; P
LOCATE 7, 10: INPUT "VALUE OF N(YRS)"; N
LET I = P / 100
LET A = (1 + I) ^ N - 1
LET APA = (A - 1) / I
PRINT TAB(10); "PV OF ₦1 PER ANNUM"; APA
```

```
NEXT K
GOTO 90
50 REM TO CALCULATE ANNUAL SINKING FUND(ASF)
CLS
FOR K = 1 TO 7
LOCATE 5, 10: INPUT "VALUE OF P(%)"; P
LOCATE 7, 20: INPUT "VALUE OF N (YRS)"; N
LET I = P / 100
LET A = (1 + I) ^ N - 1
LET ASF = I / A - 1
PRINT TAB(10); "VALUE OF ASF ="; ASF
NEXT K
GOTO 90
60 REM TO CALCULATE YEARS PURCHASE (YP) SINGLE RATE
CLS
FOR K = 1 TO 7
LOCATE 5, 10: INPUT "VALUE OF P(%)"; P
LOCATE 7, 20: INPUT "VALUE OF N (YRS)"; N
LET I = P / 100
LET A = (1 + I) ^ N
LET PV = 1 / A
LET YP (SINGLE RATE) = (1 - PV) / I
PRINT TAB (10); "VALUE OF YEARS PURCHASE (YP SINGLE RATE)= "; YP
(SINGLE RATE
NEXT K
GOTO 90
70 REM CALCULATE YEARS PURCHASE (YP) DUAL RATE
CLS
FOR K = 1 TO 7
LOCATE 5, 10: INPUT "VALUE OF P(%)"; P
LOCATE 7, 20: INPUT "VALUE OF N (YRS)"; N
LET I = P / 100
```

```
LET A = (1 + I) ^ N
LET ASF = I / (A - 1)
LET YP (DUAL RATE) = 1 / (I + ASF)
PRINT TAB (10); "VALUE OF YEARS PURCHASE (DUAL RATE)"; YP (DUAL
RATE)
NEXT K
GOTO 90
80 REM TO CALCULATE YEARS PURCHASE (YP) IN PERPEVITY
CLS
FOR K = 1 TO 7
LOCATE 5, 10 INPUT "VALUE OF P(%); P
LET I = P / 100
LET YP IN PERP = 1 / I
PRINT TAB(10); "VALUE OF YEAR PURCHASE IN PERP"; YP IN PERP
NEXT K
INPUT "DO YOU WANT TO CONTINUE Y/N"; N$
IF N$ <> "Y" OR N$ <> "N" THEN 60
IF N$ = "Y" THEN GOTO 10
90 END
```

The variables in the given programs are

I = Interest Rate (P/100)

N = Years

A = Amount of ₦1 $(1+i)^n$

APA = Amount of ₦1 per annum $\frac{(A-1)}{i}$

PV = Present Value of ₦1 $\frac{1}{A}$

ASF = Annual Sinking fund $\frac{i}{(A-1)}$

YP = Years purchase:

Single Rate = $\frac{(1-PV)}{i}$

Dual Rate = $\frac{1}{i + ASF)}$

In perpetuity $\frac{1}{i}$

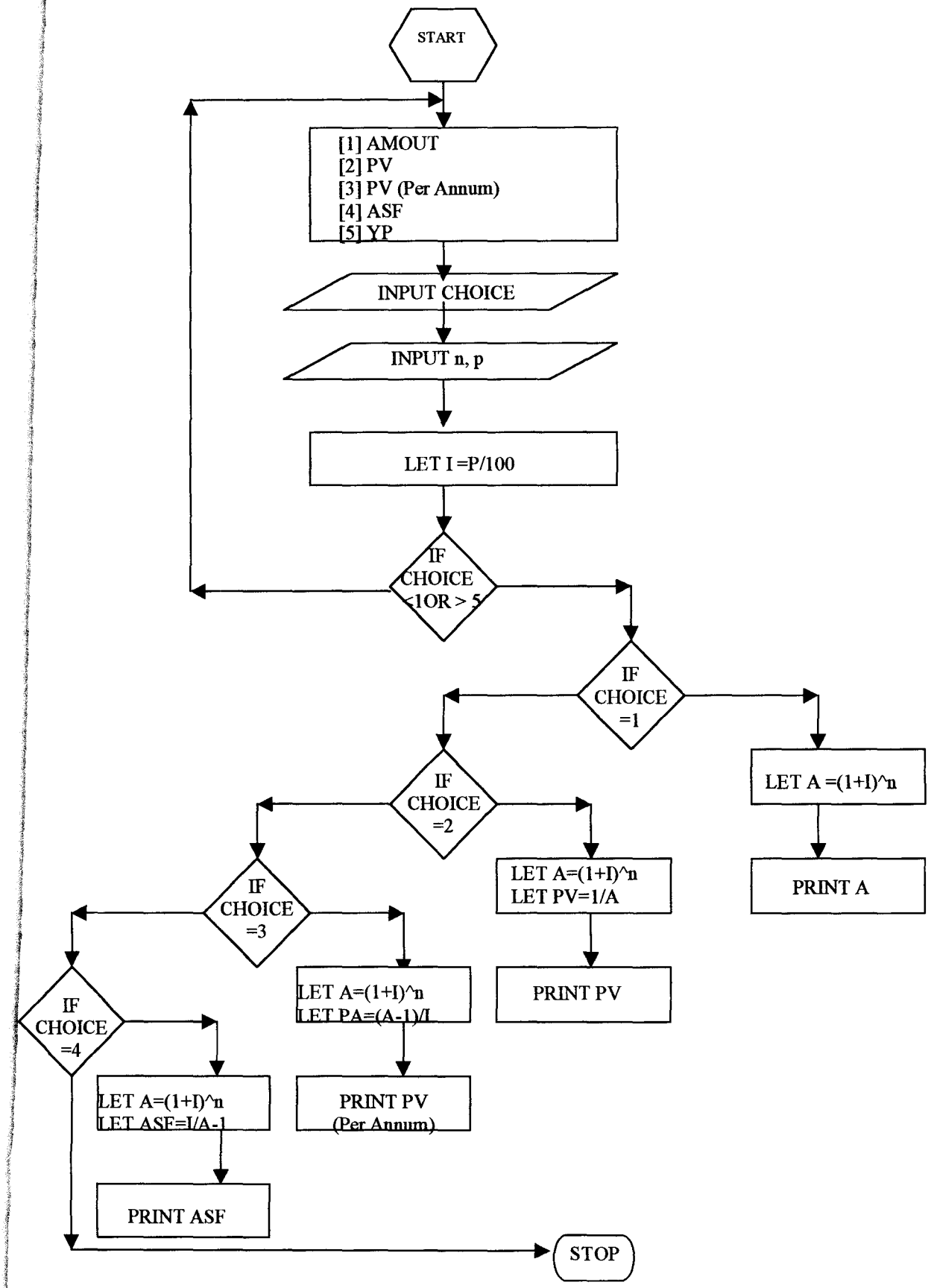
4.3.2 *Program to accept computation of capital values using the investment method of valuation.*

```
REM THIS PROGRAM IS MEANT FOR PROJECT WORK
CLS
COLOR 2, 5
REM THIS PROGRAM CALL ALL SUB PROGRAM
REM *********************************
PRINT TAB(10); " [1] NET INCOME"
PRINT TAB(20); " [2] YEARS PURCHASE"
PRINT TAB(30); " [3] CAPITAL VALUE"
REM TO ENTER CHOICE
LOCATE 5, 10: INPUT " ENTER CHOICE "; NUM
IF NUM < 1 OR NUM > 2 THEN GOTO 10
IF NUM = 1 GOTO 20
IF NUM = 2 GOTO 30
IF NUM = 3 GOTO 40
20 REM TO CALCULATE THE VALUE OF NET INCOME
CLS
FOR K = 1 TO 5
INPUT "VALUE OF GROSS INCOME (GI)"; GI
INPUT "VALUE OF OUTGOINGS (Q)"; Q
LET NI = GI - Q
LOCATE 12, 10: PRINT "VALUE OF NET INCOME = "; NI
NEXT K
GOTO 50
30 REM PROGRAM TO CALCULATE YEARS PURCHASE (YP)
CLS
FOR K = 1 TO 5
LOCATE 5, 10: INPUT "VALUE OF P(%)"; P
LOCATE 7, 20: INPUT "VALUE OF N (YRS)"; N
```

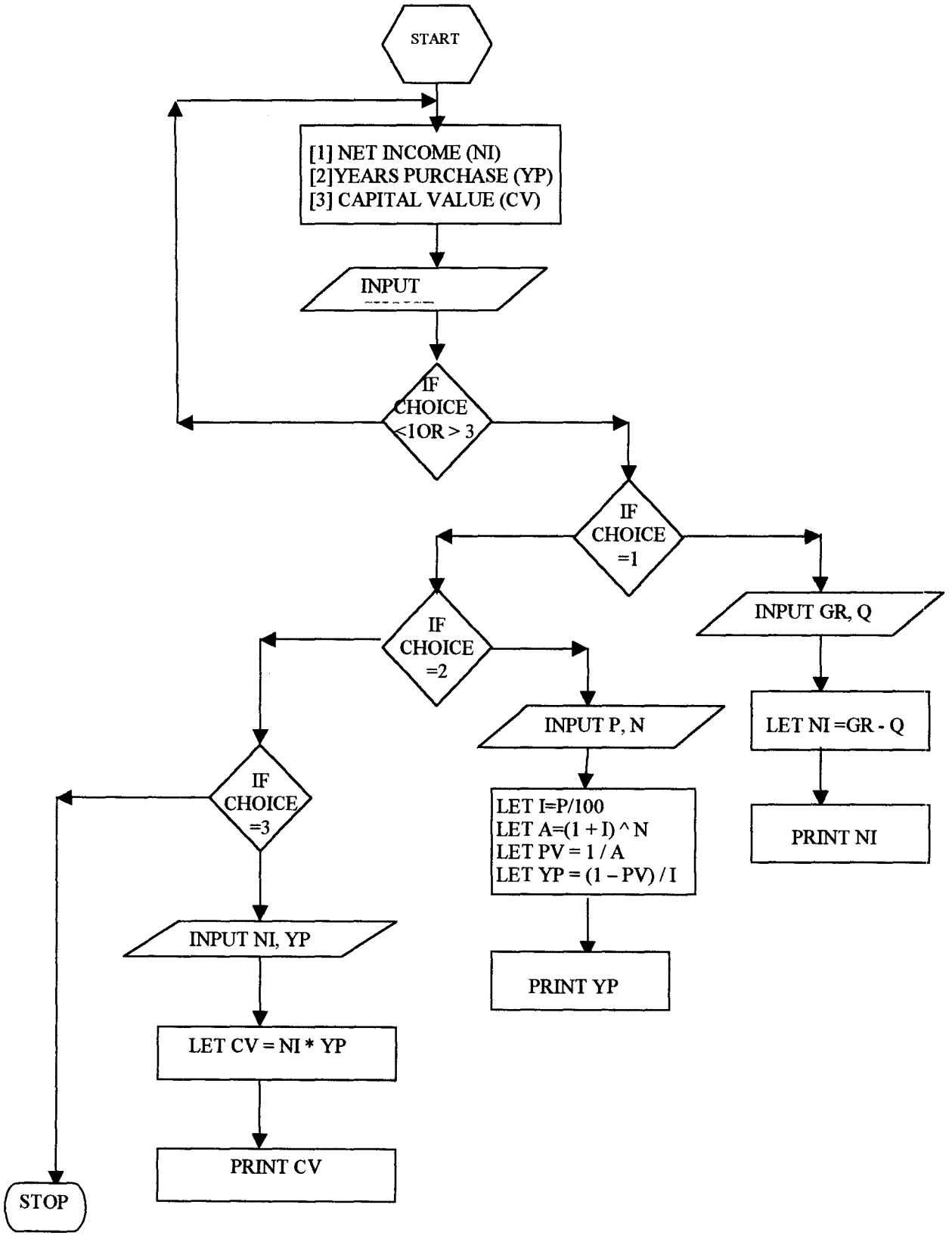
```
LET I = P / 100
LET A = (1 + I) ^ N
LET PV = 1 / A
LET YP  = (1 - PV) / I
PRINT TAB (10) "VALUE OF YEARS PURCHASE = "; YP
NEXT K
GOTO 50
40 REM TO CALCULATE CAPITAL VALUE (CV)
CLS
FOR K = 1 TO 5
LOCATE 5,10 INPUT "VALUE OF NET INCOME (NI)"; NI
LOCATE 7,20 INPUT "VALUE OF YEARS PURCHASE (YP)"; YP
LET CV = NI * YP
LOCATE 12, 10: PRINT "VALUE OF CV="; CV
NEXT K
INPUT "DO YOU WANT TO CONTINUE Y/N "; N$
IF N$ <> "Y" OR N$ <> "N" THEN 50
IF N$ = "Y" THEN GOTO 10
50 END
```

4.4 VALUATION FLOWCHART

4.4.1 *Arithmetic of Valuation (Valuation Table)*



2 *Investment Method of Valuation (Income Capitalization)*



4.5. HARDWARE/SOFTWARE REQUIREMENT:

The hardware in use include

1. The input devices – the keyboard and mouse;
2. The system unit i.e. the central processing unit (CPU);
3. The storage devices – flopping disks and hard disks; and
4. Output devices – the monitors (visual displayment unit) and the printers.

The application software in use is a series of program which accepts and processes the computation of capital values using the investment method of property valuation. The software is tailored to work in the environment of a system software called the Ms-Dos (Microsoft-Disk operating system). This is necessary in order to allow for effective management of flow of information to and from the various parts of the computer system. The Ms-Dos in this regard prompt the user with a command prompt indicated by the sign c:\> which is usually seen on the computer screen (the monitor). From which various commands are given to begin operation.

4.6. MAIN MENU:

There are two programs with sub programs as indicated in 4.3 above and the flow charts. In the first program, (Arithmetic of valuation or the valuation Tables) there are ~~five~~ Seven main menus which include:

1. Amount of ₦1 (A)
2. Present value of ₦1 (PV)
3. Amount of ₦1 per annum (APA)
4. Annual sinking fund (ASF)

5. Years purchase (YP) or present value of ₦1 per annum - Single Rate.
6. Years purchase (YP) – dual rate
7. Years purchase (YP) in perpetuity

On the other hand the second program has three menus, which are given below:

1. Net Income (NI)
2. Years purchase (YP)
3. Capital Value (CV)

In program A, that is a program to accept the arithmetic of valuation, press F5 or Shift + F5 for the program to run, the menu will be displayed. On selecting (1), the system will prompt you to enter for the variables 'i' and 'n'. The operation will be repeated five times and terminates displaying the value of 'A'.

On selecting (2), the operation will be repeated and the values for "PV" will be display five times on the screen and the operation terminate after the fifth operation.

The same operation goes for (3), (4), (5), (6), and (7), and their various values displayed at the end of each operation.

In the same vein, program B, to accept investment method of valuation, press F5 or Shift + F5 for the program to run, the menu will be displayed. On selecting (1), the system will prompt you to enter for the variables "GR" and "Q". The

operation will be repeated five times and terminates displaying the value of "NI".

On selecting (2), the system will demand for the values of "A" and "PV". The operation will equally be repeated five times and terminate displaying the value of "YP".

And lastly when (3) is selected, the system will demand for the values of the variables "NI" and "YP" and then runs for five times and terminates displaying the variable "CV".

4.7. OPERATION OF THE SYSTEM:

Program A to accept Arithmetic formulae (the valuation Tables)

To load the program in a QBASIC environment, at C prompt (i.e. c:\>) type cd Dos, press enter key from the keyboard to change to Dos Directory (i.e. c:\Dos>). Then type QBASIC and press enter key.

To open the program from QBASIC Environment press Alt + f and enter. On opening, locate the file and press enter. This process is simpler using the mouse. From the menu bar, click to access the file and open to begin operation.

To run the program, therefore, press shift + F5 or F5 key from the keyboard.

The system will demand for a choice. On selecting (1), the system will prompt you to enter values for the variables 'n' and 'p'. These operations will be repeated five times and the values for the

Amount of ₦1 will be displayed on the screen. The running will terminate after the fifth operation and the computer will ask you to press any key to continue.

4.8. EXIT/QUIT MENU:

To quit or exit the QBASIC environment activate the menu by pressing Alt key and f, then select exit using either the arrow key on the keyboard and enter or using the mouse select exit and click.

CHAPTER FIVE

CHAPTER V

5.0 ANALYSIS AND INTERPRETATION OF THE STUDY

5.1. SIGNIFICANCE OF THE STUDY TO THE PROFESSION OF ESTATE SURVEYING AND VALUATION

Since the most commonly used method of valuation is the income capitalisation (Investment) method, the relevance of this application software to the profession of Estate Surveying and valuation cannot be over emphasised. Such relevance includes:

(a) Speed: Computation of the capital values could be done at a flash with the use of the computer to the extent that capital values could be computed and relayed within a space of telephone conversation given the urgency.

(b) Accuracy: Results of such computation are error free, provided that all variables are entered accurately.

(c) Efficiency: The system is effective provided that users are trained to manipulate and operate the system right.

(d) Simplicity: The system is easy to operate with the aid of the operating system which is the interface between the Hardware and software.

(e) In the preparation of a valuation certificate, the system is

most required since the certificate is a page report which requires basically the major features of properties in question. Such features include location, property type, title to land, date of inspection, opinion of value, etc.

(f) It improves the professional services of an Estate Surveyor and valuer especially in the valuation of lands, and buildings vis-à-vis the accuracy, efficiency, simplicity etc. of a valuation Report.

(g) With the help of a storage device, informations are safe-guarded.

(h) Processed data could as well be stored and retrieved at a later day when required.

(i) It helps greatly in Asset Valuation especially when the assets are in large magnitude.

(j) It will provide a platform for further researches into the subject matter.

5.2. RECOMMENDATION:

Having gone through the relevances of the system, it is hereby recommended as follows:

1. Estate surveying and valuation outfit should be encouraged to install the package into their systems.

2. This system should be built upon by developing programs for other methods of valuation and subsequently come out with a software package that will encompass all the methods.

3. Every member of the Nigerian Institution of Estate Surveyors and Valuers (NIESV) should be encouraged to be computer literate so that the application of the system into the profession will be easier and gain wide recognition.

4. Computer science should be included in the curriculum of Estate Management in all institutions of higher learning.

5.3 CONCLUSION

A computerised investment method of valuation can be seen as a system for capturing, storing, checking, integrating, manipulating, analysing and displaying property related data with the aim of computing values.

In Nigeria today, the performance of Property valuation is not as effective as it could be. One of the major reasons for this is the absence of a computerised information system in many Nigerian Estate Management firms. However, with the introduction of this package into the profession many tedious tasks will be done with ease; errors of computation and manipulation of figures will be averted; and speed, accuracy and efficiency will be the end result.