SET THEORY IN RELATION TO BUSINESS (COMPUTER APPROACH)

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CERTIFICATION

is to certify that this project was carried by Patrick Noah Okolo of the department of iematics/Computer Science and have been found adequate both in scope and quality for the partial nent of the requirement for the award of Post-Graduate Diploma in Computer Science of the Federal ersity of Technology, Minna.

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DATE

DEDICATION

TO

LATE JOHN OKOLO

God used you yesterday for my today

AND

PASTOR CALEB AGOSAAH ANTHONY

A friend that sticks better than a brother this project is dedicated to you.

ACKNOWLEDGEMENT

I bless the name of God almighty, for His goodness, mercy and faithfulness. I am conscious of the fact that without him, these will not be me.

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Finally, I wish to acknowledge my nephews, Solomon, Uyo, Iko for foregoing one or two things for the sake of my studies. I will not forget to mention Victor Churchill, Daniel Moses Mummy Dinatu Agegana, Nuhu Bakwa, F.C.S C.A.S.T Keffi members and members of Chapel of Salvation, thanks for your love and prayers.

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ABSTRACT

This project made a thorough study on how set theory can be used to solve business problems. The concept of sets and its operation was basically used.

Computerized system was designed to replace the manual method of solution. **BASIC** is the programming language used in the software development.

CHAPTER ONE

1.0 INTRODUCTION

A fundamental concept in all branches of mathematics is that of a set. Intuitively, a set is any well-defined list, collection, or class of distinct objects, which are called the members or elements of the set. When x is a member of the set A, we write $x \in A$ meaning x belongs to A. if x is not a member of A, then we write $x \notin A$ meaning x does not belong to A. From the above definition, the concept of sets, and the algebra of sets is gaining ground in business and related subjects. This is because many areas of business mathematics are based on this concept. For example, a business analysis involves such sets of data, sets of business documents, sets of orders and so on.

In this project, the sets of data, sets of business documents and sets of orders will be discussed which will only consist of limited numbers of elements.

The totality of members under consideration is contained in one set, usually called the universal set. μ shall denote this; that is, μ is the umbrellas set that include all the items of particular interest for a specific situation. But in this case, finite set will be used because the data to be discussed are limited.

There are certain requirements for the collection or aggregate of objects that constituted the set such as, the collection off objects must be distinct, the order of the objects with the set must be immaterial, i. e.; a, b, c, is the same set as c, b, a. It is when all these requirements are met in a given problem that it can be called a set.

OBJECTIVE OF THE STUDY.

The objective of this study is to use the concept of set theory to the solution of the problems involving the control of an organisation system so as to provide solution which best serve the interest of the organisation.

It is also intended that the use of set theory will help in further decision making in business in terms of man power development, production, demand and supply in a manufacturing company and in an open completive market.

1.2 SIGNIFICANCE OF THE STUDY

Mathematics is real because it deals with facts, as a matter of facts. Business is based on available facts to make one successful. It is very significant if the important facts can be obtained to help in planning or to know the present situation of the business so as to help in proper judgement.

The study is also significant because it will help erase the notion that mathematics is all about figures and numbers. Mathematics is applicable to business processes among other fields or professions.

1.3 SCOPE/LIMITATION OF THE STUDY.

The scope of this project is to use the established facts to determine or express the behaviour of consumers and producers as regard to production, demand and supply because a particular goods which the demand is high, the supply is expected to be high and that will lead to increase in production of such goods since the demand is competing and the concept of set theory can be used to know the goods that attract high demand. This will be considered in subsequent chapters with limitation to business and its application. A maximum of 3 sets is being used thus poses a limitation.

1.4 SET NOTATIONS AND SYMBOLS.

Sets can be described in two ways. The first way is simple to list the elements of the set. By convention, the elements are listed between a pair of braces, thus the set P of known market items comprises of food stuff such as Rice, Beans, Geri, and Maize may be denoted by P = {Rice, Beans Gari, Maize} the second method of denoting a set is by stating a rule which specifies the elements of the set. Again, by convention, the rule is written out between a pair of braces following a symbol denoting a general element of the set and a colon for example G={g: g is a goods which was produced as at January 1, 1997}. In the notation used to describe the set G, the symbols "G = {g:" are read "G is the set of all g such that". With this notation and alternative way of specifying the set F described above is F = {f: f is a know food items supplied by a market woman}.

In certain cases a list of its elements provides the simplest and most useful representation of a set, while in other cases specifying a rule is preferable. For sets with a large number of elements the specification of a rule is often the only practical way to define a set.

In general, upper case letters such as A, B, C, are use to denote sets while lower case letters such as a, b, c, are used to denotes elements of sets. The set symbols such as written below their definition will be used in this project. Referring to the set of food items or the goods above, to indicate that g is an element of G we write $g \in G$. To indicate that g is not an element of G, we write $g \notin G$;

Other symbols such as intersection, union subset can be represented as $\cap$, $\cup$, $\subset$ respectivel.

1.5 TYPES OF SETS.

There are different types of sets such as universal sets, complement set, Null set and subset.

(a) **UNIVERSAL SET (μ):** This is the set, which contains all possible elements with a particular application under consideration. For example, if we consider an opinion survey conducted of a random sample of goods in Keffi market, the universal set might be defined as all the items in Keffi market.

(b) **COMPLEMENT:** The complement of a set G is the which consists of all elements in the universal set that are not members of G. The complement of set G consist of all positive integers is denoted by G' Example. If set G consist of all positive integers and the universal set (μ) is defined as all integers the complement, G' consists of all negative integers and zero. If

μ={1, 2, 3, 4, 5, 6, 7, 8, 9, 10}

And D = {1, 3, 5, 7, 9}

The complement of set D contains all elements which are members of μ but not D, or D' = {2, 4, 6, 8, 10,}.

(c) NULL SET:

The empty, or null set is a set consisting of no elements. It can easily be verify that $\mu' = \phi$ because it in the set E above, its complement consist no element. By convection, the empty set is considered to be subsets of every set. The following properties of the empty set are direct consequences of the definition of intersection and union. If C is a set as shown above $C \cap \phi, = \phi$ and $C \cup \phi = C$.

(d) SUBSET

A set D is a subset of the set N if and only if every element of set D is also an element of set N. the subset relationship is denoted by D C N which may be read " D is a subset of N". Example, Given the sets of markets in Minna town, any market in Bosso town is contained in Minna Town. Let us represent Minna Market as a set A (universal set) and Bosso marked as set B if

μ ={1, 2, 3, 4, 5, 6, 7, 8, 9, 10}

And B = {1, 2, 3, 5, 6, 7, 8, 10} the elements are the shops in the markets in the above towns, its obviously clear that $B \subset A$.

Note also by definition that Null set is a subset of every set consequently, in the pervious example $\phi \subset A$; $\phi \subset B$.

(e) FINITE AND INFINITE SET

The letter or symbol that is used to denote any element of a specified set is called the variable over the set, and the set is referred to as the domain of the variable. A set may consist of no element, a limited number of elements, or unlimited number of elements. A set that contains no element is the empty or null set and is denoted by ϕ

Or sometimes { }. A finite set is a set that contains no elements or a definite number of elements, while infinite set is a contain unlimited number of elements or infinite interval of elements. But in this project, only finite set will be considered. For instance, the set A and set B above are examples of finite sets.

(f) DISJOINT SET:

Two sets which have the property that their intersection is the empty set are said to be disjoint. For instance, if we consider a set of positive integer A and a set of negative integer B, and intersect them, an empty set will be obtained. Therefore set A and set B are disjoint.

Let A = {1, 2, 3, 4, 5, } and B = { - 1, - 2, - 3, - 4, - 5, } then $A \cap B = \{\} = \phi$ disjoint set.

CHAPTER TWO

2.0 SET OPERATIONS

In arithmetic we learn to add, subtract and multiply, that is, we assign to each pair of numbers say x, and y a number x + y called the sum of x and y, a number x - y called the difference of x and y and a numbers xy called the product of x and y. These assignments are called the operations of addition, subtraction and multiplication of numbers. Here we will define the operations of union and intersection of sets.

(a) UNION OF SETS.

The union of set A and B is the set of all elements, which belong to A or to B to both. We denote the union of A and B by

$A \cup B$

Which is usually read " A union B"

Example 1.1: In the Venn diagram in fig 2 –1-, we have shaded $A \cup B$ i.e.

The area of A and the area of B

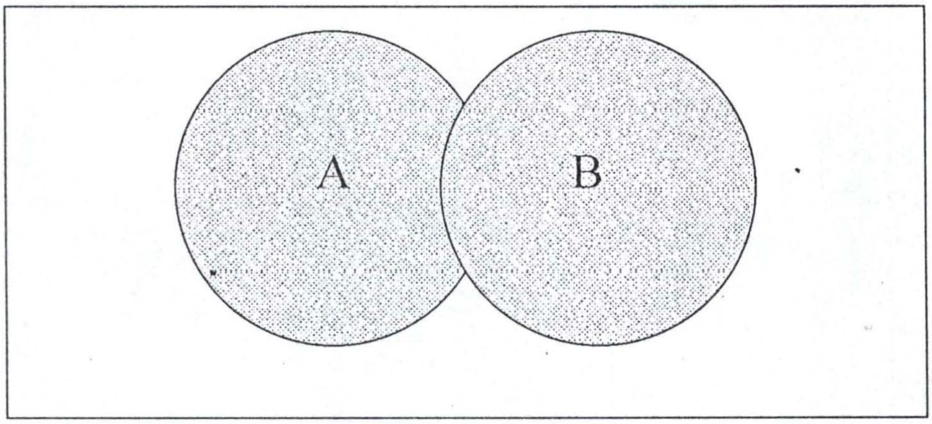


Fig 2.1

$A \cup B$ is Shaded.

Example 1. 2: Let A = {1, 2, 3, 4, 5}

B = {1, 3, 5, 7, 9}

And C = {2, 4, 6, 8,10}

Then (a) $A \cup B = \{1, 2, 3, 4, 5,\} \cup \{1, 3, 5, 7, 9\}$

$= \{1, 2, 3, 4, 5, 7, 9\}$

(b) $B \cup C = \{1, 2, 3, 4, 5,\} \cup \{1,2, 3, 4, 5\} \cup \{2, 4, 6, 8, 10\}$

$= \{1, 2, 3, 4, 5, 6, 8, 10\}$

(c) $B \cup C = \{1, 3, 5, 7, 9\} \cup \{2, 4, 6, 8, 10\}$

$= \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

The union of A and B may also be defined concisely by

$A \cup B = \{x \mid x \in A \text{ or } x \in B\}$

It follows directly from the definition of the union of two sets that $A \cup B$ and

$B \cup A$ are the same set, i.e.

$A \cup B = B \cup A$

Also both A and B are always subsets of $A \cup B$ that is,

$A \subset (A \cup B)$ and $B \subset (A \cup B)$.

(b) INTERSECTION OF SETS.

The intersection of sets A and B is the set of elements which are common to A and B, that is, those elements which belong to A and which belong to B. We denote the intersection of A and B by

$A \cap B$.

Which is read " A intersection B "

Example 2.1: in the Venn diagram in fig 2-2, we have shaded $A \cap B$, the area that is common to both

A and B.

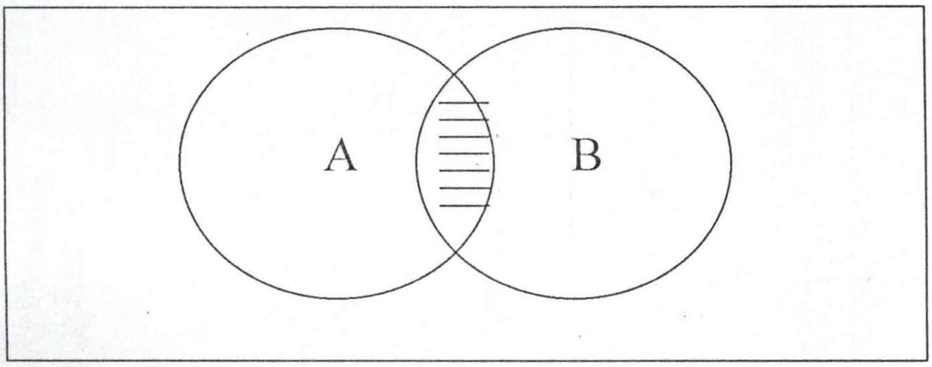


Fig 2.2

$A \cap B$. is shaded

Example 2 .2: Let $\mu = \{1, 2, 3, ..., 18, 19, 20\}$

$A = \{1, 3, 4, 6, 12, 15, 18, 19\}$

And $B = \{1, 5, 7\ 12, 14, 15, 16, 20\}$

Then $A \cap B. = \{1, 12, 15,\}$.

Example 2. 3: Let E be the set of 1000 items manufactured during a particular day. Let A be the set of all items having the defect from Stage i and let B be the set of all items having defect from stage II. Describe $A \cap B$.

Solution:

$A \cap B$. represents the set of all items that have the defect from stage I and II.

The intersection of A and B may also be defined concisely by

$A \cap B = \{x \mid x \in A, x \in B\}$

Here the comma has the same meaning as " and " it follows directly from the definition of the intersection of two sets that

$A \cap B = B \cap A$.

Also each of the sets A and B contains $A \cap B$ as a subset, i.e.,

$(A \cap B) \subset A$ and $(A \cap B) \subset B$.

2.1 VENN DIAGRAMS.

A simple and instructive way of illustrating the relationship between sets is in the use of the so – called Venn – Ruler diagrams or, simply, Venn diagrams. It is customary to use a rectangular area to represents the universe to which a set belongs, while a circular area within the rectangle represents a set of elements in the universe. The diagram in fig 2 –3 represents a set of A in the universe μ.

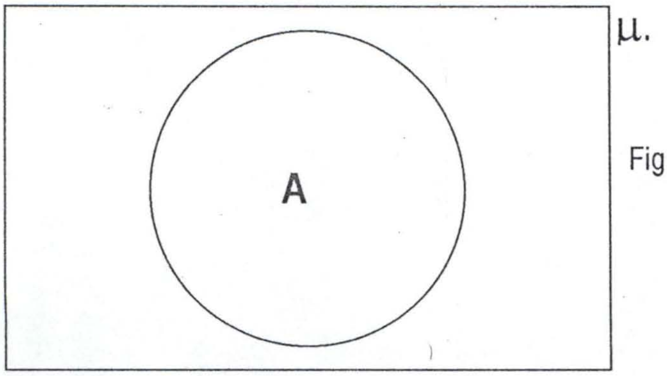


Fig 2 – 3.

Example 3. 1: fig 2-4, shows the Venn diagram of intersection of two sets the shaded area is A ∩ B.

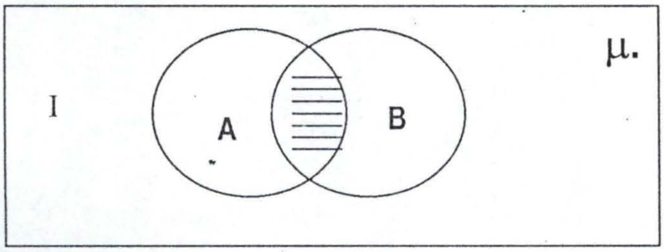


Fig 2- 4

A ∩ B is shaded.

Fig 2 –5 shows the Venn diagram that represents the union of two sets. The shaded area represents the union of two sets i. e. A ∪ B.

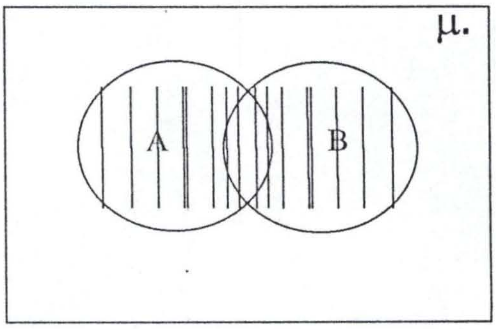


Fig 2.5

A ∪ B is shaded

Fig 2 –6 show two disjoint sets. In this case their intersection is an empty set while their union is not, and it is shown by their shaded area.

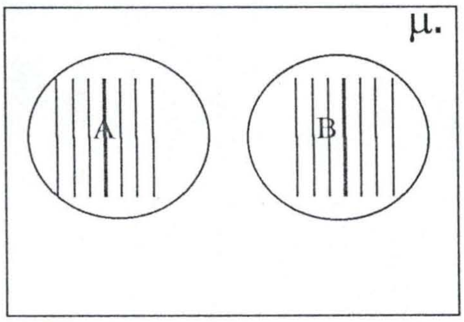


Fig 2 .6

From Fig 2 –6, A ∩ B = ϕ
While the shaded area is A ∪ B.

COMPLEMENT:

The elements in the universe μ. that lie outside A from a set called the complement of A, denoted by A'

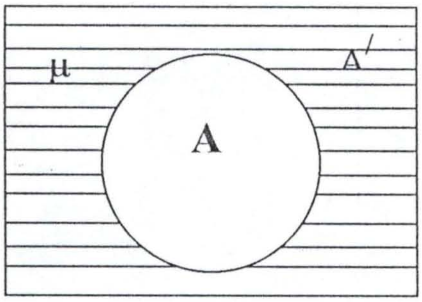


Fig 2.7

A' is shaded

Example 4. 2

Let μ = {1, 2, 3, 4, 5, 6, 7, 8}

And A = {1, 2, 8,}

Then A/ = {3, 4, 5, 6, 7}

Form the definition of complement, it follows that for any set A in a universe μ.

$A \cap A' = \phi$ and $A \cup A' = \mu$

That is, a set and its complement have no elements in common while the union of a set and its complement is the universal set.

VENN DIAGRAMS USING THREE SETS.

A Venn diagram of three sets divides a universe into as many as eight regions. We can use information about the number of elements in some of the regions (subsets) to obtain the number of elements in other subsets.

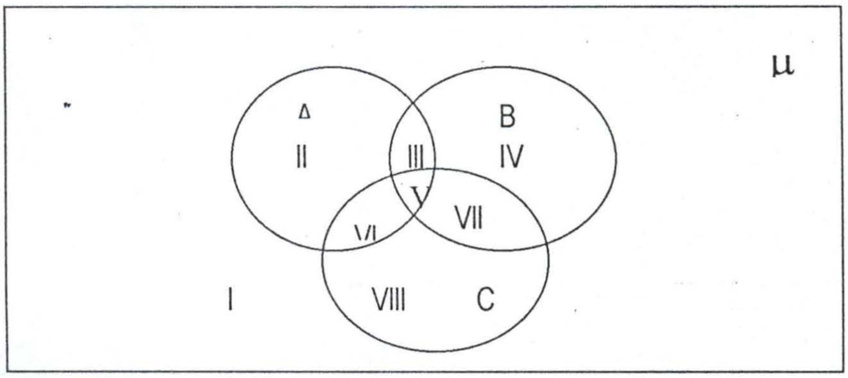


Fig 2 .8

These sets may divide the universe into eight- regions

2.2 RELATIVE COMPLEMENT OF A SET.

The complement of a set A (relative to μ) where μ is the universal set is the set of elements which do not belong to A, that is the difference of the universal set μ and A. we denote the complement of A by A'

Example 5.1: in the Venn diagram in fig 2 –9,

The complement of A is shaded, i.e. the area outside of A.

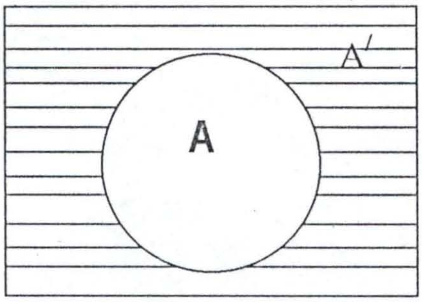


Fig 2.9

A' is shaded

The complement of A may also be defined concisely by

$$A' = \{x \mid x \in \mu, x \notin A\}.$$

Or simply $$A' = \{x \mid x \notin A\}.$$

We state some facts about sets which follows directly from the definition of the complement of a set namely

The union of any set A and its complement A' is the universal set, i.e,

$$A \cup A' = \mu$$

Furthermore, set A and its complement A' are disjoint i.e,

$$A \cap A' = \phi.$$

While the complement of the complement of a set A is the A it self. More briefly

$$(A')' = A.$$

2.3 DETERMINATION OF NUMBER OF ELEMENTS IN A SET.

We now turn our attention to counting the elements in a set. We use the notation n(A) read "n of A" to indicate the number of elements in set A. for instance if A ontains 23 elements, we write n(A) = 23.

The number of element in a given set is sometimes called the cardinality of the set. Suppose that one count 10 people in a group that like brand X cola and 15 that like brand Y. We denote this by n (brand X) = 10 and n (brand Y) = 15. To determine the number of people involued depend on the number who like both brands.

In set theory, the people who like brand X form one set and those who like brand Y form another set. The total number of people involved in the count form the uniuon of the sets and those who like both brands form the interection of the two sets. If from the information above, there are form (4) people who like both brands, then the total count is

$$10 + 15 - 4 = 21.$$

In general, the relationship between the number of elements in each of two sets, their union, and their intersection is given by the following theorm .

Theorem

$$n(A \cup B) = n(A) + n(B) - n(A \cap B).$$

Where n (A) represents the number of elements in set A, n (B) represents the numbers of elements in B and $n(A \cap B)$ represents the numbers of elements in $A \cap B$.

Example 6.1: Let A = { a, b, c, d, e, f }

And B = { a, e, i, o, w, y }

Then n(A) = 6

n (B) = 7

A n B = { a, e }

So $n(A \cap B) = 2$

$A \cup B$ = {a, b, c, d, e, f, I, o, u, w, y }

Thus $n(A \cup B) = 11$

While using the theorem

$n(A \cup B) = n(A) + n(B) - n(A \cap B) = 6 + 7 - 2 = 11.$

2.4 CHARACTERISTICS OF OPERATIONS OF UNION AND INTERSECTION

We can make use of "set containment " relationship to characterize the set unions and intersections. The important priniciple (a) and (b) that follow state each of them where as their intersection is a " largest" set contained in each. For instance, Given any set A and B.

(a) $A \subseteq A \cup B$. and $B \subseteq A \cup B$. Any set C satisfying $A \subseteq C$ and $B \subseteq C$ will contain $A \cup B$.

(b) $A \cap B \subseteq A$ and $A \cap B \subseteq B$. Any set C satisfying $C \subseteq A$ and $C \subseteq B$ will be contained in $A \cap B$.

Example 7.1

Consider the last phrase in principle (b). If indeed we have $C \subseteq A$ and $C \subseteq B$, then we can show that such a set C is contained in $A \cap B$ as follows. Letting $c \in C$ be any element of C, then $c \in A$ and $c \in B$ (Since $C \subseteq A$ and $C \subseteq B$). By the definition of intersection, we must have $c \in A \cap B$ ((since c is any member of c. We can conclude that $c \in A \cap B$)

As required.

Note that principle (b) in deed has the effect of saying that $A \cap B$ is, in some sense, the " largest " set that is contained in both A and B.

LAWS OF OPERATIONS WITH SETS.

(1) $(A')' = A$

(2) $\phi' = \mu$

(3) $A \cup \mu = \mu$

(4) $A \cup \mu = \mu$

(5) $A \cup A = A$ idepotent.

(6) $A \cup A' = \mu$

(2A) $\mu' = \phi$

(3A) $A \cap \mu = A$

(4A) $A \cap \phi = \phi$

(5A) $A \cap A = A$

(6A) $A \cap A' = \phi$

ASSOCIATIVE LAWS.

(7) $(A \cup B) \cup C = A \cup (B \cup C)$

(7A) $(A \cap B) \cap C = A \cap (B \cap C)$

COMMUTATIVE LAWS.

(8) $A \cup B = B \cup A$

(8A) $A \cap B = B \cap A$

DISTRIBUTIVE LAWS.

(9) $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$.

(9A) $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$.

2.5. DE MORGANS LAWS.

(10) $(A \cup B)' = A' \cap B'$

(10) $(A \cap B)' = A' \cup B'$

2.6 COMPUTER SYSTEM

A computer is a symbol-manipulating machine, which adds, subtracts, multiplies, divides, makes comparisons and transfer symbols from place to place. It is controlled by programs-sequence of instructions – stored in its memory, the same memory where it store raw data and interim and final results. Since it is a machine that operates electronically, it can perform its feats at very high speed practically without error if the program and the data are correct.

As a data processing system, the computer inputs data, processes then, and outputs results. These basic functions are performed by five basic components input, storage, arithmetic–logic, control and output.

A computers system consists of a number of components, physical and non-physical, that are inter connected, each carrying out specific function towards the common objectives of processing data. A part from the human beings who engage in the use of computers, the other two major components which constitutes a computer system are hardware and software.

(a) The Hardware refers to the physical components of a computer. It is made up of the mechanical, magnetic, electrical and electronic devices of a computer. The input, storage, processing and control devices are hardware.

(b) The software is the general term used to denote all forms of program that control the activities of a computers. It refers to the set of computer programs, procedures and associated documentation relate to the effective operation of the data processing system. It can be classified into two namely system software programs usually supplied by computer manufacturers which are designed to control the operation of a computer system, and Application software-a general program written with a view to solving a problem. The hardware components of a typical computer system are shown in fig 2.9.

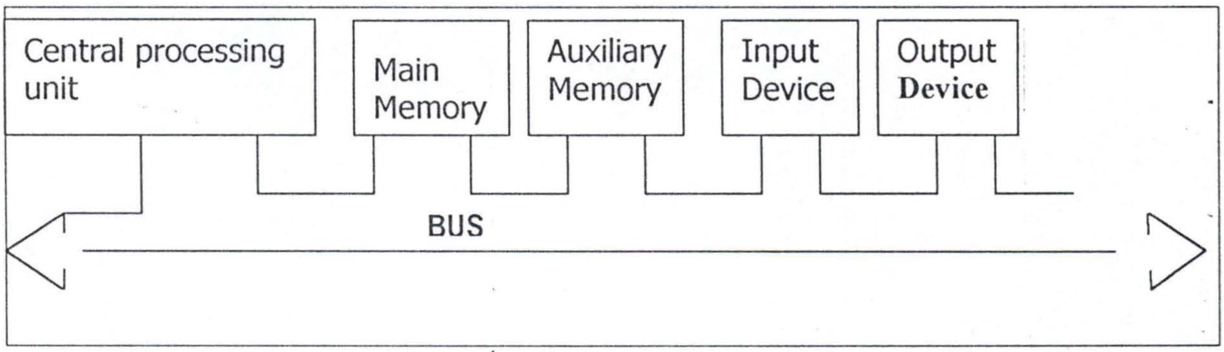


Fig 2.9

CHAPTER THREE

3.0 INTRODUCTION TO BUSINESS

In very many places, one find shops, supermarkets, stores, factories, offices, industries, manufacturing and advertising companies all claiming to be in business. They are in business because they undertake some forms of economic activities which could take the forms of production, distribution or marketing. They are organization, which undertake production or simply institution from which production or any form of economy activity is undertaken.

A business unit is therefore a production unit or an institution which organizes any form of economic activity for the production of goods and services. Every business unit has its objectives to carry out some economic activities and therefore takes its own decisions regarding what to produce, where to undertake such production and how the production would be done. A business unit can be a shop, an office, a firm or a manufacturing company, depending on such factors as capital, capacity or level of production, management, type of operation and the item of production.

There are different forms of business units depending on whether they are private or public business enterprises. Where a business enterprise or unit does not have any form of government involvement in its day-to-day running such enterprise is private. It is a public enterprise when there is a direct or indirect governmental involvement and control in the management of the business. Examples of private business unit inclined sole–proprietorship, partnership, public and private limited companies. Public and private limited company are business units which carry out business under the management and control of a body known as the board of directors but which are fully owned by individuals who are called shareholders.

3.1 BUSINESS APPLICATION

In every business organization, information is very important, it guide and direct the management of such organization to pursue it set down goals. Information is not complete when, the determine fact is not

3.1 SIMPLE PROBLEMS INVOLVING VENN DIAGRAMS.

EXAMPLE 8.1

The Venn diagram in figure 3-1 below gives information about the division of labour about one manufacturing company which shows the number of workers involved in extortion of raw material (E) the number of workers involved in the production that are involved in transport and sales (TS).

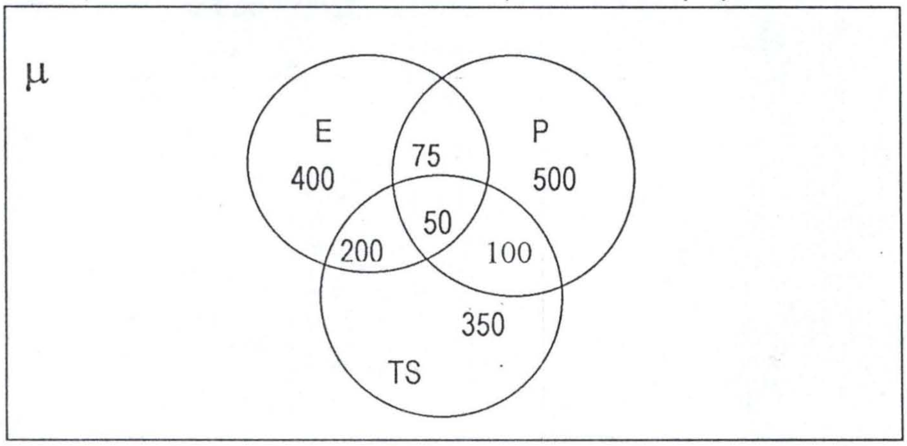


Fig 3.1

From fig 3-1 we can gather some facts about this company, such in formation as

(a) How many workers are involved in extraction of raw materials, production?

(b) How many workers are Involved in the extraction of raw materials, production and transportation and sales of their products.

EXAMPLE 8.2:

Business organizations (centres) in a certain community were surveyed to find the type of computers being used. The survey focused on three types, namèly I B M (I), Apple (A) and Digital Equipment Corporation (D) the results were as follows

Computer	Number of users
I	50
A	30
D	25
I and A	4
I and D	5
E and A	3
I, A and D	2

Table 1

Construct a Venn diagram giving the complete numerical picture of computer usage in the business centres.

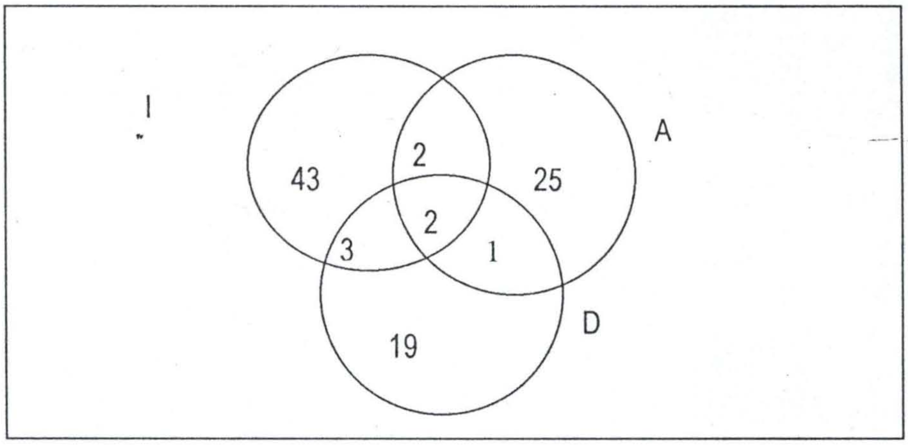
From the Venn diagram determine

(a) The number of business centres that use only IBM computers.

(b) The number of business centres that do not use IBM computers.

Solution.

From table 1, above, and the information obtained, a Venn diagram can be drawn as shown in fig3-2



μ

Fig 3.2

From fig 3-2, we now know that 43 business centres use only IBM computers, while those that do not use IBN computers are 45.

Example 8.3

A survey was carried out among 85 customers at a fast food restaurant. They were asked whether they liked or disliked the hamburgers (H), French fries (F) and coffee (C). Their reactions were as follows.

Item	Liked
H	57
F	55
C	55
H and F	45
H and C	47
F and C	46
H, F and C	40

Table 2

From Table 2,

Determine the number of customers that

(a) Disliked the coffee

(b) Disliked the French fries

(c) Disliked the hamburgers

(d) Disliked the hamburgers or fries but like the coffee

(e) Liked the hamburgers only.

Solution:

Venn Diagram in figure 3.3 shows the information in Table 2.

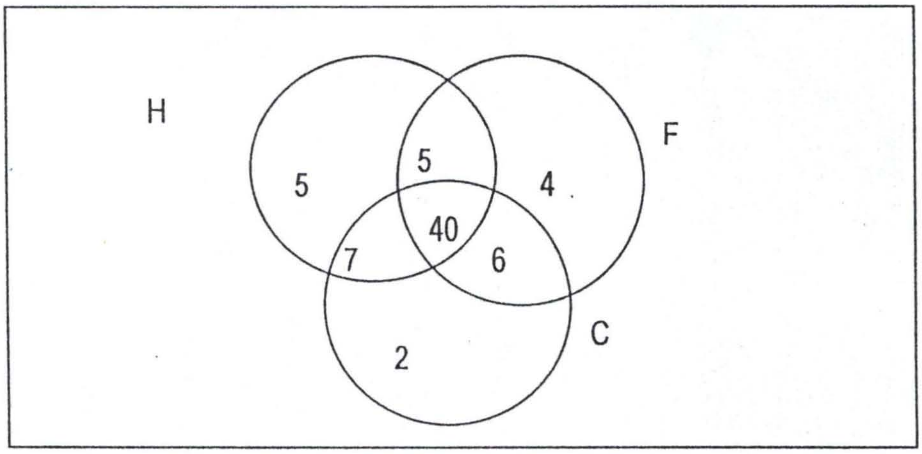


Fig 3.3

Number that

(a) Disliked coffee = 14 people

(b) " the French fries = 14 people

(c) " the hamburgers = 12 people

(d) Disliked the hamburgers or fries but liked the coffee = 2 customers

(e) Disliked the hamburgers only = 5 customers.

Example 8. 4

Certain manufacturing companies were involved in production of glass cup and Rubber plates due to high cost of production. If the companies in the town are denoted by E and X = {the companies that produce glass cup}

= {Lenny Company Ltd, Sylvia company Ltd., Jack Company Ltd

Scott Company Ltd, Pat Company Ltd}.

And Y = {the companies that produce Rubber plates}.

= {Richard Company Ltd, Adam Company Ltd., Jack Company Ltd.,

Scott Company Ltd, Kemmy Company Ltd, Pat Company Ltd}

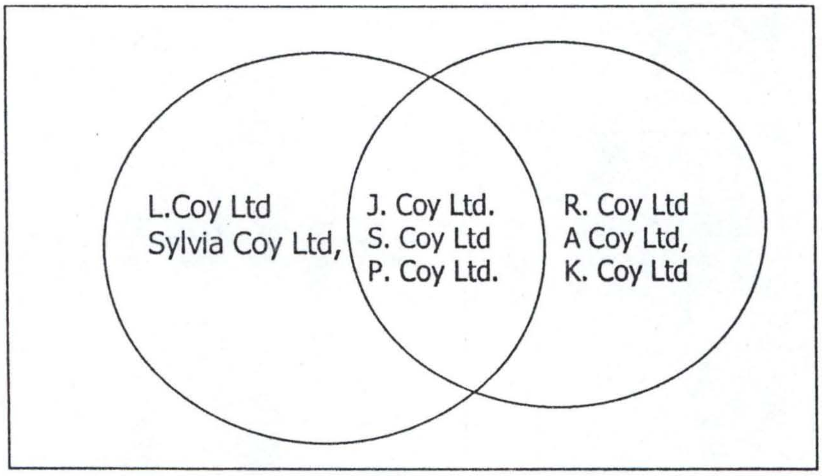


Fig 3-4

From figure 3-4, the companies that can produce glass cup are Lenny Company Ltd., Sylvia Company Ltd., Scott Company Ltd.; Jack Company Ltd.; Pat Company Ltd., while those that can produce Rubber plates are Richard Company Ltd.; Adam Company Ltd.; Kemmy Company Ltd.; Jack Company Ltd.; Scott Company Ltd. and Pat Company Ltd.

From the Venn diagram it can deduce that the cost of production of rubber plate is less than that of glass cup since the number of companies involves in production of Rubber plates is higher than that of glass cup.

3.3 SOLUTION TO BUSINESS PROBLEMS.

Example 9.1:

In a market of certain town 20 customers buy Rice, 12 buy Beans and 9 buy Gari. 12 customers buy Rice, 4 customers buy Gari, and 5 customers buy Beans. In this market every customer bought at least one of the three food items but no customer bought all three. We want to know how many customers are then in this town to enable the producer know the rate at which his company will produce.

Solution.

Let R, B, G denote the set of customers who bought Rice, Beans and Gari respectively. If we denote the number of customers who bought Gari and Beans only by x, we can show in a Venn diagram the number of elements represented by each separate region

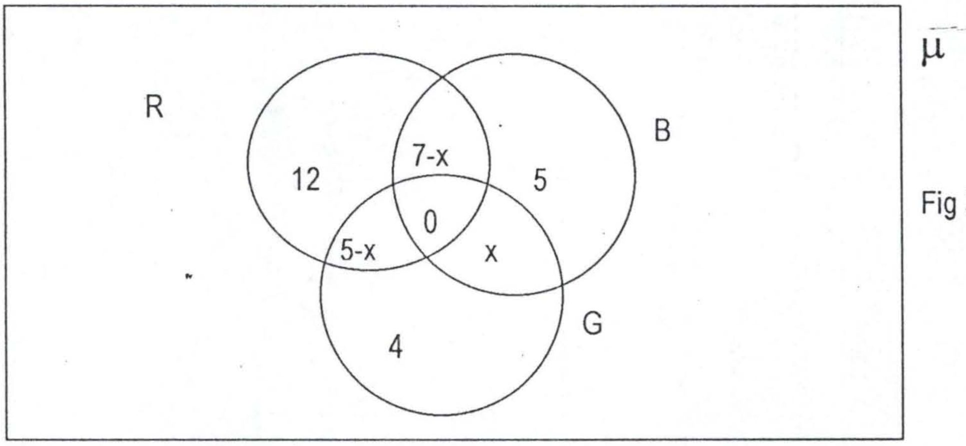


Fig 3.5

Now since n (R) = 20 From figure 3.5

$12 + (7 - x) + (5 - x) = 20$

$24 - 2x = 20$

$x = 2$

The total number of customers is n (R) + 2 + 4 + 5 = 20 + 11 = 31. There are thirty-one (31) customers in that town. We want to know the number of customer that bought two food items. From fig 3.5, the number of customers that bought exactly two food items is (7-x) + 5 – x + x = 12-x = 10

The number of customers that do not buy rice is 4 + x + 5 = 4 + 2 +5 =11 Out of eleven (11) customers who do not buy Rice 5 bought only Beans.

Example 9:2

A certain producer is interested in the consumer's habit in a certain small city. A survey indicates that the number of people (in thousands) that used to take tea with milk is 25, and the number of consumer that used to take tea with sugar is 18 and the number of consumers that used to take tea with honey is 12. The number of consumers that used to take tea with both milk and sugar is 10, the consumers that used to take tea with both milk and honey is 1; the number of consumers that used to take tea with both sugar and honey is 2; the number of consumer that takes tea with milk, sugar and honey is 1. Determine the number of consumers that used to take tea with one of these tea ingredients.

Solution:

We will represent the sets as A; B and C denoting the sets of consumers that take milk; sugar and honey respectively.

Again we draw a Venn diagram and indicate the number of elements in each region of the Venn diagram.

Let begin with $A \cap B \cap C$; then proceed to $A \cap B \cap C'$; $A \cap C \cap B'$ and $B \cap C \cap A'$. Finally indicate the number of elements in $A \cap B' \cap C'$, $B \cap A' \cap C'$ and $C \cap A' \cap B'$.

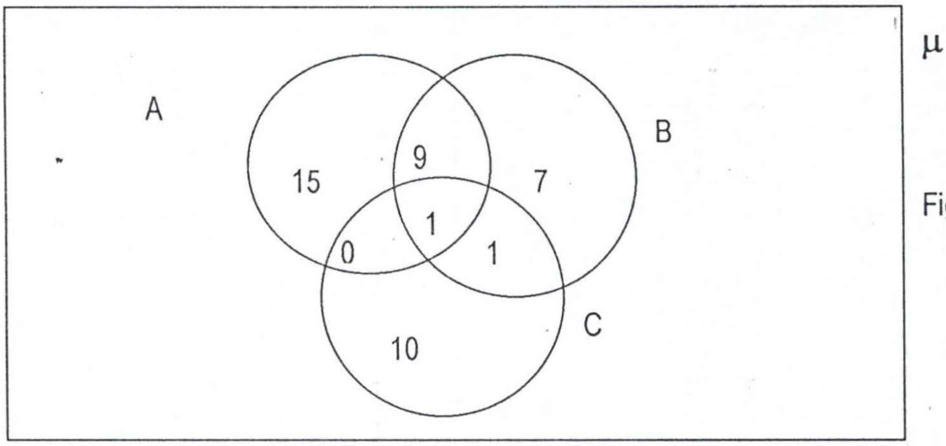


Fig 3.6

The total number of consumers habits that used to take tea with just one tea ingredient as shown above is 15 + 7 + 10 = 32 (thousand).

3.4 ADVANCED PROBLEM

Example 10.1

A transport trade association wants to determine the number of drivers that own more than one Bus and do not have either a conductor or a security man. These drivers are regarded as potential owners of these staff. There is a brief questionnaire attached to the warranty notification card assigned to each conductor and a security man attached to drivers. Using questionnaire from a certain Urban Area, the transport trade association determines the numbers of drivers (in thousands) who own certain combination of responsibility. Below is a list of each combination with the number of owners (in thousands.)

(a) The number of security man, 12

(b) The number of security man, no conductor and only one bus, 2.

(c) The number of conductor, 60

(d) The number of conductor, no security man, and only one bus

(e) The number of security man, the number of conductor, 9

(f) The number of security man, the number of conductor and more than one bus: 8

(g) More than one Bus: 50

Determine the number sought for by the trade association.

Solution

Let the set A be all drivers who own security men; B for those who own move than one Bus; and C those who own conductors we draw a Venn diagram and indicate the number of drivers represented by each region.

The set suggested by (f) has the characteristics of all the three sets, so we know that n $(A \cap B \cap C) = 8$

Next, we note that the set suggested by (e) has the properties of $A \cap C$ and it has 9 members, 8 of those are in the central region, so $n(A \cap C \cap B') = 9-8 = 1$.

Now, the set suggested by (a) is exactly A, so n (A) = 12. Also, the set suggested by (b) is $A \cap B' \cap C'$, with 2 members. Thus the region in A that we have not yet filled in must have $n(A \cap B \cap C') = 12 - 8 - 1 - 2 = 1$ element.

Similarly, the set suggested by (c) is exactly C, with n (c) = 60, so the remaining region in c has $n(C \cap B \cap A') = 60 - 15 - 8 - 1 = 36$ members. Finally, the set suggested by (g) is exactly B with n (B) = 50 so we compute $n(B \cap A' \cap C') = 50 - 36 - 8 - 1 = 5$.

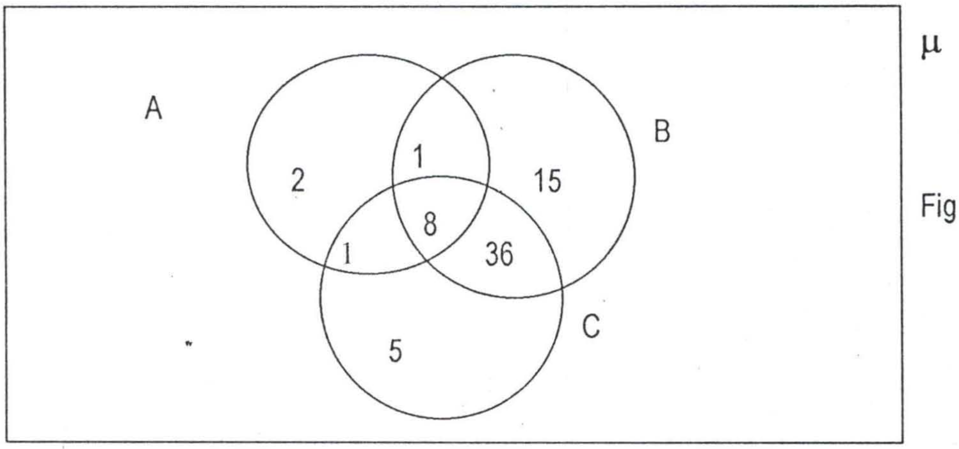


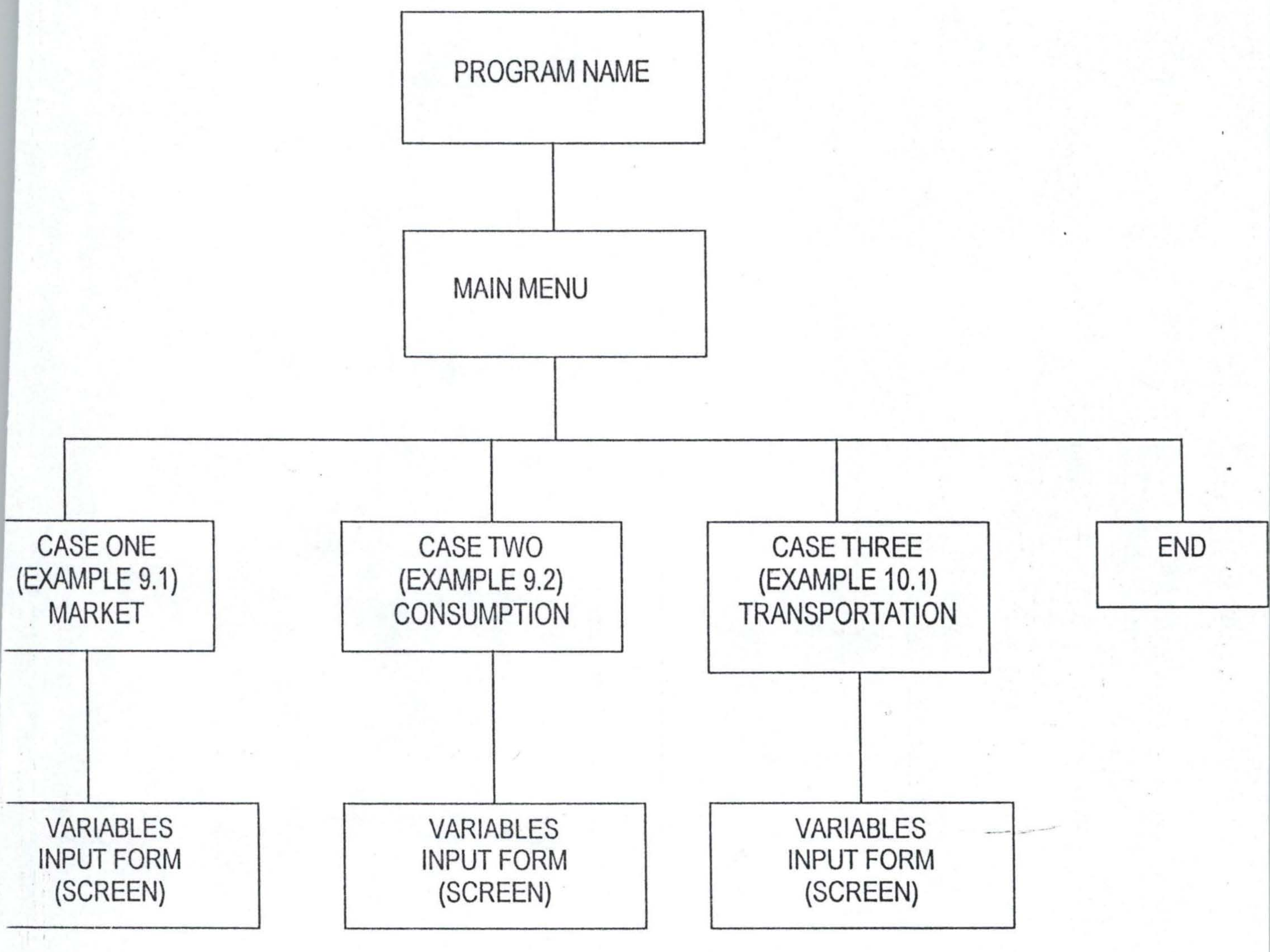
Fig 3.7

From fig 3.7; 5000 drivers own more than one Bus and do not own either a security man or a conductor.

4.2 PROGRAM DESIGN

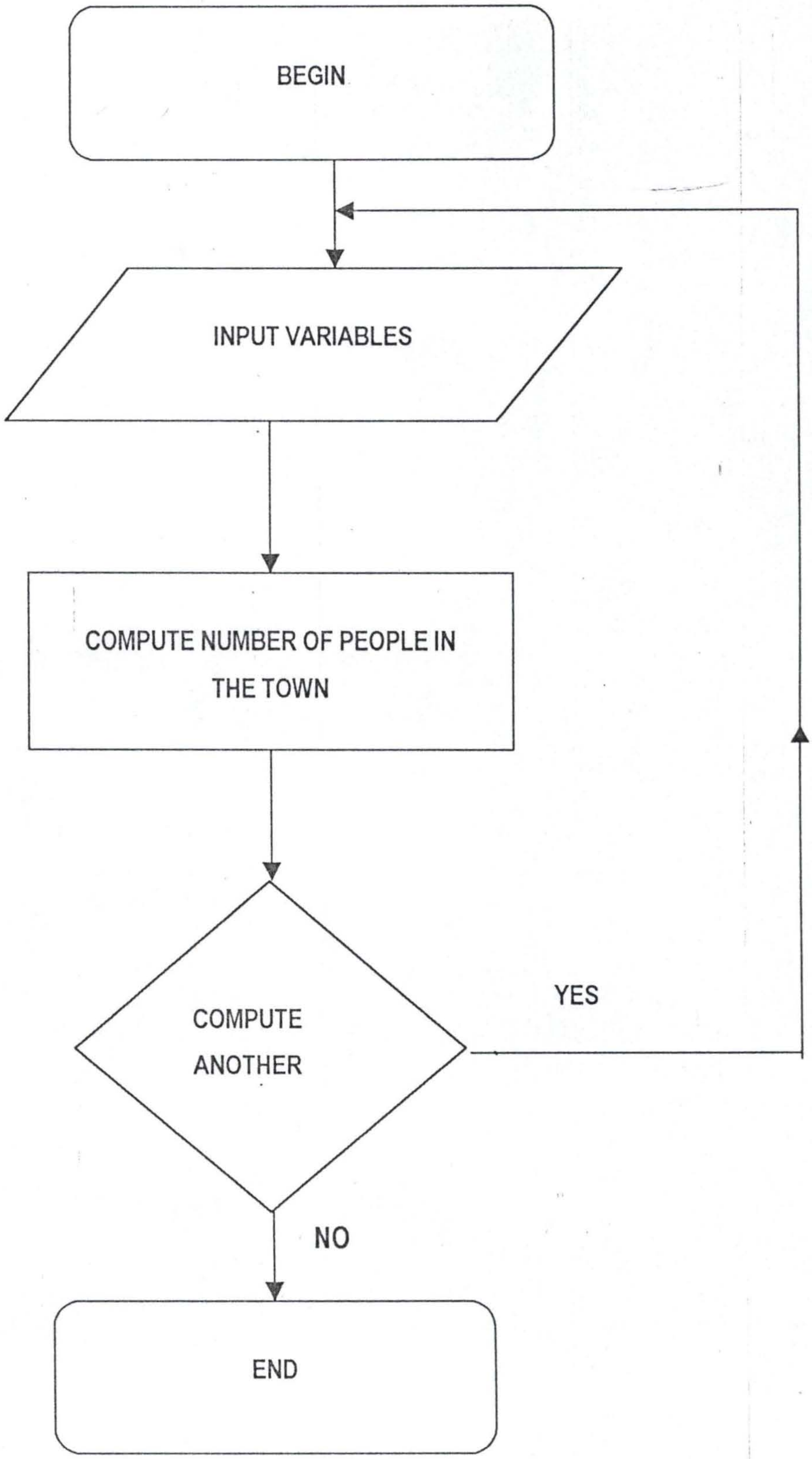
This stage outlines and defines the set of rules required to the solution of business problems using set theory. This involves first, the use of algorithm – step-by-step method of solving a problem. The tools mostly used are pseudocodes, flow charts, N – S diagrams, but for the purpose of this study flowcharts is used. Due to time constraints Example 9.1, 9.2 and Example 10.1 are used as a case study. The figure below show the flowchart for the different cases.

FIG. 4-1 FLOW CHART SHOWING THE THREE CASES.

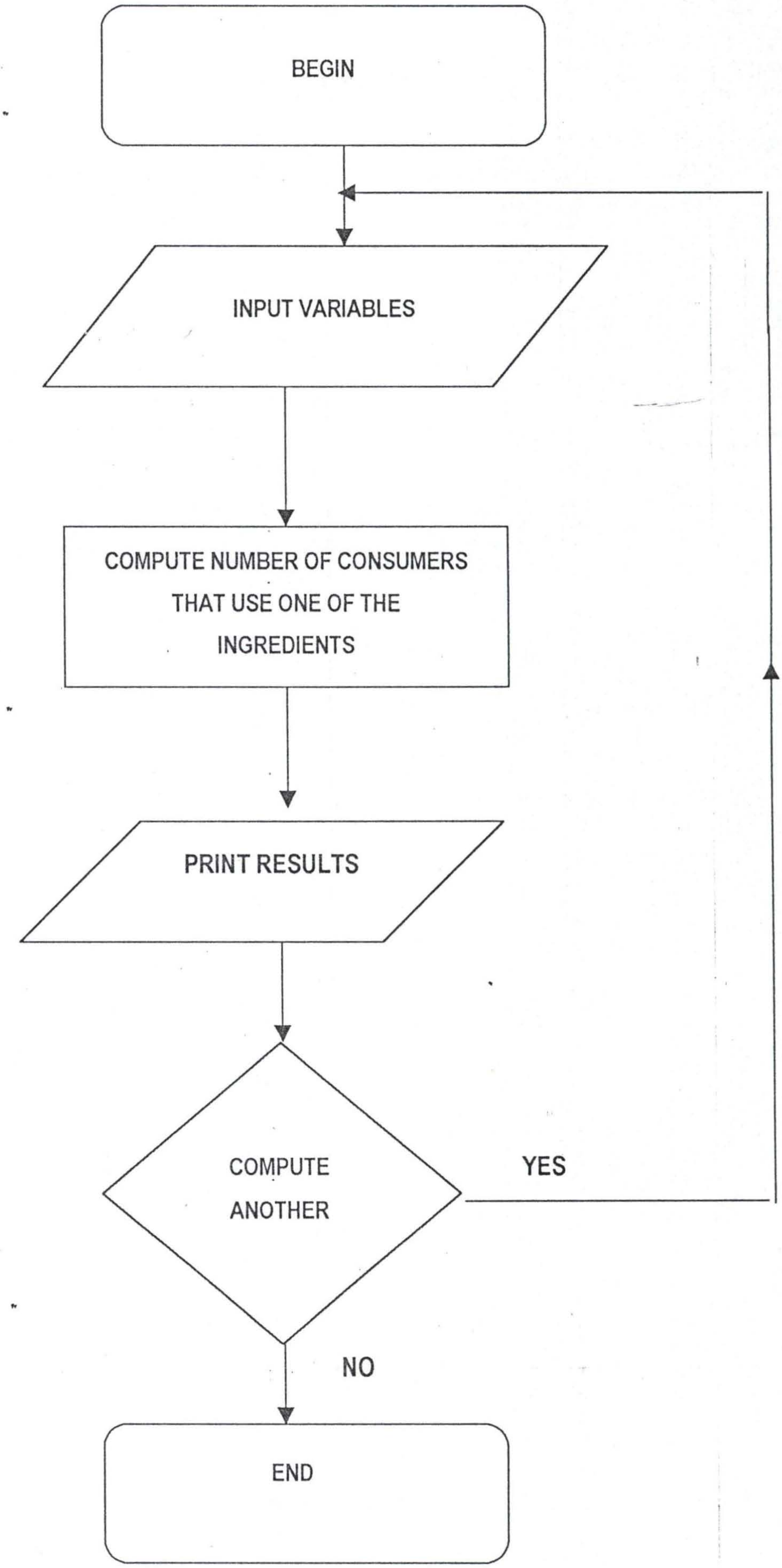


While the flowcharts below show each of the different case.

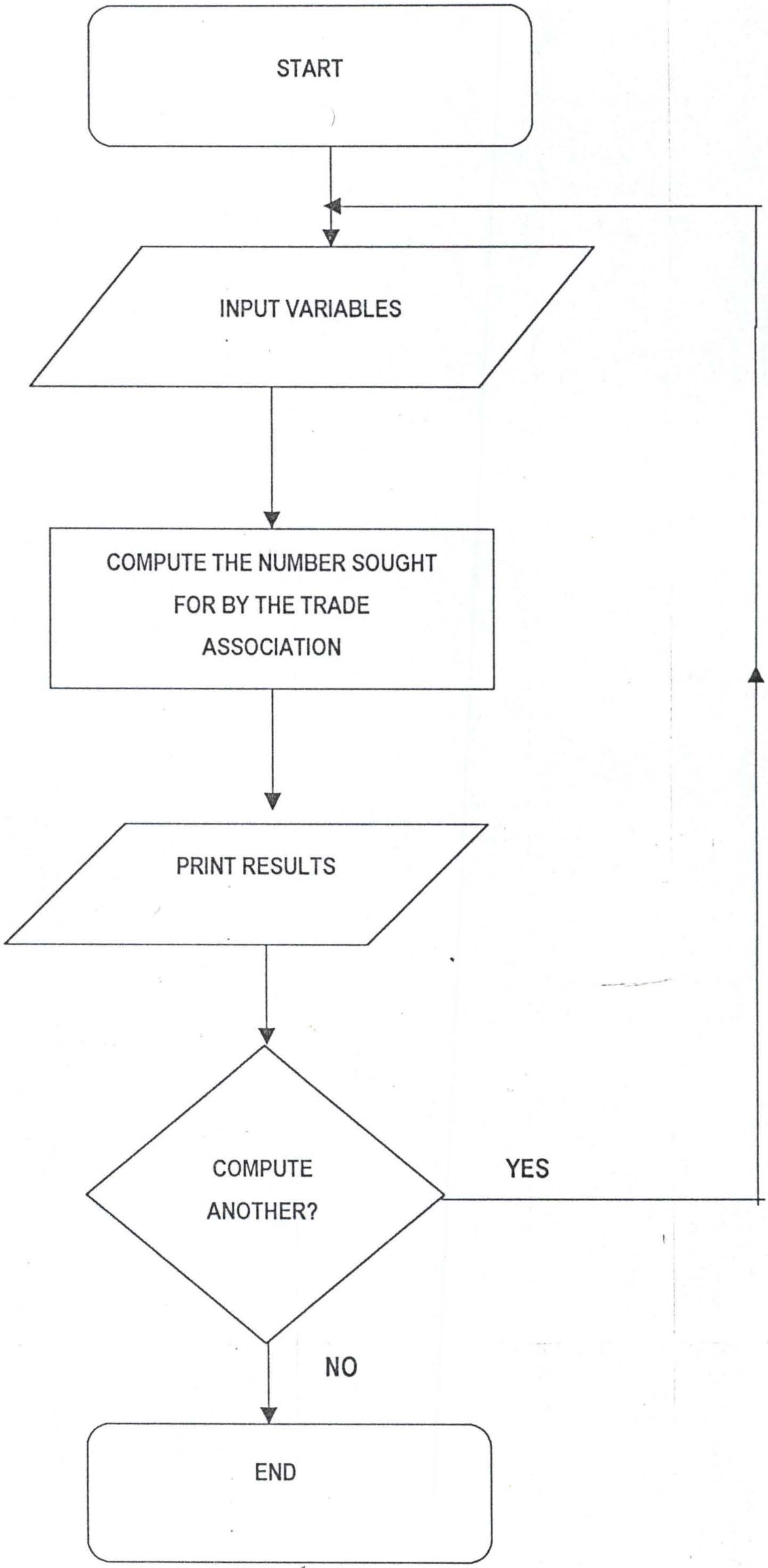
CASE ONE – PROGRAM FLOW CHART



CASE TWO – PROGRAM FLOWCHART



CASE THREE – PROGRAM FLOWCHART



CASE ONE INPUT SCREEN

TITLE OF PROGRAM: MARKET CUSTOMER HABIT
Enter total number of customers buying Rice:
,, ,, ,, ,, ,, ,, Beans:
,, ,, ,, ,, ,, ,, Gari:
Enter number of customers that bought Rice:
,, ,, ,, ,, ,, ,, Beans:
,, ,, ,, ,, ,, ,, Gari:

Data OK (Y/N)

Calculating number of customers in the town

Result
Number of customers in the town =

Do you want to compute another? (Y/N)

CASE TWO: INPUT SCREEN

TITLE OF PROGRAM: PRODUCT CONSUMER HABIT

Enter number of consumers taking tea with Milk
,, ,, ,, ,, ,, ,, ,, Sugar
,, ,, ,, ,, ,, ,, ,, Honey
,, ,, ,, ,, ,, ,, ,, both Milk and Sugar
,, ,, ,, ,, ,, ,, ,, Honey
,, ,, ,, ,, ,, ,, ,, Sugar and Honey
,, ,, ,, ,, ,, ,, ,, Milk, Sugar and Honey

Data OK (Y/N)

Calculating number of consumers that used to take tea with one of these tea ingredients

Result

Number of consumers that used to take tea with one of the ingredient =

Do you want to compute another (Y/N)

CASE THREE: INPUT SCREEN

PROGRAM TITLE: TRANSPORT OWNER SURVEY

Enter number of security men:

,, ,, ,, ,, man no conductor and one bus:

,, ,, ,, ,, conductor

,, ,, ,, ,, ,, no Security man and one bus:

,, ,, ,, Security man and number of conductor:

,, ,, ,, ,, number of conductor and more than one bus:

Enter more than one bus:

Data OK (Y/N)

Calculating the number sought for by the trade association

Result

The number sought for by trade association =

Do you want to compute another (Y/N).

4.3 DESCRIPTION OF THE PROGRAM:

The program is designed to be user friendly. In this regard it is designed to be MENU driven. This allows the operator a choice of different transactions for implementation. This application program comes in floppy diskette (3.5 inches) and it needs to be loaded into the computer memory before operation. For result of out put see the appendix.

4.4 TESTING AND DEBUGGING

The program is tested using both the data in chapter three and other random data to see whether it is working correctly. During the testing of the program design, error may be found. The process of detecting, locating and correcting of these errors in the program is known as debugging.

(b) The main menu comprises of four options namely

1. Market customer Habit
2. Product consumer Habit
3. Transport owner survey
4. End program

To select an option press the option number and press enter key

Option 1 – market customer Habit

In this option – solution to problem in Example 9.1 is given

Step 1: To select this option, type1 and press – enter key.

Step 2: Enter values for the variables when the input screen is displayed

Step 3: Enter " Y " if entries are correct or 'N' if you want to repeat the entries.

Once this is completed, the system draws the Venn diagram, computer the result and displays it at the bottom of the screen.

Step 4: The message Do you want to compute another (Y/N) will be displayed. In which case, you will enter 'N' if you want to exit or 'Y' if another attempt is desired. For option 2 and 3 repeat the steps above. While option 4: the option 4 closes the program files and terminates the execution of the program.

To select this option, type 4 and press enter key you can finally exit by clicking file and click exit.

5.2 CONCLUSION

Set theory has gone a long way in proffering solution to business problems using computers with a view to obtain reliable and accurate information that will help maximize business out put.

Much more, from the study, it can be concluded that mathematics is not just only about figures but it is an important and viable tool that will help bring solution to the numerous business problems among other fields and disciplines.

5.3 RECOMMENDATIONS.

From this study of set theory and it application to business (computer approach) it is hoped that the knowledge obtained from sets and its operation will be a readable tool in the hands of business operators, planners or administrators that will help in getting information for its establishment.

Union of sets, intersection, complements and cardinality of set was widely used in this study due to time constraints, hence if other areas of set theory like power set, infinite set e.t.c. Can be examine as it related to business.

This study restrict itself to the use of at most three sets, there is need to go beyond this if possible using Venn diagram and with the aid of computer.

Further more if other areas of application of mathematics to the business could be examine, it will go a long way in enhancing business performances

Finally the knowledge of computer operation, software development can assist mathematicians in writhing programs, since computer execute the same problem at a high speed and with great precision and accuracy.

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APPENDIX

SET THEORY IN RELATION TO BUSINESS
PROGRAM MENU

1 ... MARKET CUSTOMER HABIT

2 ... PRODUCT CONSUMER HABIT

3 ... TRANSPORT OWNER SURVEY

4 ... END PROGRAM

SELECT 1,2,3, or 4?

WRITTEN BY:- PATRICK NOAH OKOLO (PGD/MCS/99/780

SET THEORY IN RELATION TO BUSINESS
PROGRAM MENU

1 ... MARKET CUSTOMER HABIT

2 ... PRODUCT CONSUMER HABIT

3 ... TRANSPORT OWNER SURVEY

4 ... END PROGRAM

SELECT 1,2,3, or 4?

WRITTEN BY:- PATRICK NOAH OKOLO (PGD/MCS/99/780

SET THEORY IN RELATION TO BUSINESS
PROGRAM MENU

1 ... MARKET CUSTOMER HABIT

2 ... PRODUCT CONSUMER HABIT

```
3    ...   TRANSPORT OWNER SURVEY

4    ...   END PROGRAM

SELECT 1,2,3, or 4?
```

WRITTEN BY:- PATRICK NOAH OKOLO (PGD/MCS/99/780)

```
CASE ONE DATA ENTRY SCREEN(FORM)

Number of customers buying Rice          :  ?
Number of customers buying Beans         :
Number of customers buying Gari          :
Number of customers that bought Rice  :
Number of customers that bought Beans:
Number of customers that bought Gari  :
```

```
CASE ONE DATA ENTRY SCREEN(FORM)

Number of customers buying Rice          :  ?
Number of customers buying Beans         :
Number of customers buying Gari          :
Number of customers that bought Rice  :
Number of customers that bought Beans:
Number of customers that bought Gari  :
```

```
'**********************************************************
'**********   PROGRAM:- SET THEORY IN RELATION TO BUSINESS
'*********    NAME:-    PATRICK NOAH OKOLO
'**********   REG.NO.   PGD/MCS/99/780
'**********   DEPT.     MATHEMATICS/COMPUTER SCIENCE
'**********   DATE:     AUGUST, 2000
'**********************************************************

1
        SCREEN 0
        WIDTH (80)
        CLS
        FOR J = 4 TO 70
        LOCATE 1, J
        PRINT CHR$(220)
        NEXT
        FOR J = 4 TO 70
        LOCATE 20, J
        PRINT CHR$(220)
        NEXT
        FOR J = 4 TO 70
        LOCATE 16, J
        PRINT CHR$(196)
        NEXT
        FOR J = 4 TO 70
        LOCATE 5, J
        PRINT CHR$(196)
        NEXT


LOCATE 3, 20: PRINT "SET THEORY IN RELATION TO BUSINESS"
LOCATE 18, 15: COLOR 2
PRINT "WRITTEN BY:- PATRICK NOAH OKOLO (PGD/MCS/99/780"
COLOR 7

LOCATE 4, 20: PRINT "           PROGRAM MENU"
LOCATE 6, 20: PRINT "1    ...   MARKET CUSTOMER HABIT"
   LOCATE 8, 20: PRINT "2    ...   PRODUCT CONSUMER HABIT"
     LOCATE 10, 20: PRINT "3    ...   TRANSPORT OWNER SURVEY"
     LOCATE 12, 20: PRINT "4    ...   END PROGRAM"

5  LOCATE 14, 20: INPUT "SELECT 1,2,3, or 4"; k$
   IF k$ = "1" THEN 100
   IF k$ = "2" THEN 200
   IF k$ = "3" THEN 300
   IF k$ = "4" THEN 400 ELSE 5
```

```
100
' CASE ONE
form1:
    CLS
    SCREEN 1
    WIDTH (80)

    LINE (45, 10)-(540, 180), , B

    'LET NR = NO OF CUSTOMERS BUYING RICE
     'LET BN = NO OF CUSTOMERS BUYING BEANS
       'LET NG = NO OF CUSTOMERS BUYING GARI
         'LET BR = NO OF CUSTOMERS THAT BOUGHT RICE
           'LET BB = NO OF CUSTOMERS THAT BOUGHT BEANS
            'LET BG = NO OF CUSTOMERS THAT BOUGHT GARI

    LOCATE 8, 20: PRINT "Number of customers buying Rice       : "
    LOCATE 10, 20: PRINT "Number of customers buying Beans     : "
    LOCATE 12, 20: PRINT "Number of customers buying Gari      : "
    LOCATE 14, 20: PRINT "Number of customers that bought Rice : "
    LOCATE 16, 20: PRINT "Number of customers that bought Beans: "
    LOCATE 18, 20: PRINT "Number of customers that bought Gari : "
    LOCATE 4, 21: PRINT "CASE ONE DATA ENTRY SCREEN(FORM)"

      LOCATE 8, 60: INPUT NR
      LOCATE 10, 60: INPUT BN
      LOCATE 12, 60: INPUT NG
      LOCATE 14, 60: INPUT BR
      LOCATE 16, 60: INPUT BB
      LOCATE 18, 60: INPUT BG


    LOCATE 20, 30: INPUT "Data OK ? (Y/N)"; k$

    IF k$ = "n" OR k$ = "N" THEN GOTO form1


   SCREEN 1
    CIRCLE (130, 70), 40
   ' PAINT (100, 70)
    CIRCLE (180, 70), 40
    'PAINT (150, 70)
    CIRCLE (150, 100), 40
    'PAINT (120, 70), 3

  LINE (15, 10)-(300, 160), 1, B

  LOCATE 6, 8: PRINT "RICE"
  LOCATE 8, 29: PRINT "BEANS"
  LOCATE 16, 25: PRINT "GARI"

  LOCATE 8, 15: PRINT "12"
         LOCATE 8, 19: PRINT "7-x"
         LOCATE 9, 25: PRINT "5"

  LOCATE 12, 16: PRINT "5-x"
         LOCATE 10, 20: PRINT "0"
         LOCATE 12, 22: PRINT "x"
```

```
 LOCATE 15, 19: PRINT "4"
   LOCATE 19, 13: COLOR 1: PRINT "VENN DIAGRAM"

   ' LET X=NUMBER OF CUSTOMERS WHO BOUGHT GARI AND BEANS ONLY

   X = (NR.- BN - 7 - 5) / -2

   'LET T=TOTAL NUMBER OF CUSTOMERS
   T = NR + X + BG + BB

   LOCATE 22, 3
   PRINT "RESULT:": LOCATE 23, 3
   PRINT "THERE ARE "; STR$(T) + " CUSTOMERS IN THAT TOWN"


101
        LOCATE 24, 1
        INPUT "DO YOU WANT TO COMPUTE ANOTHER (Y/N)"; I$

   IF I$ = "y" OR I$ = "Y" THEN 100
GOTO 1


200
form2:
    CLS
    SCREEN 1
    WIDTH (80)

    LINE (45, 10)-(580, 180), , B
    'COLOUR 1
    'LET NTM = NO OF PEOPLE TAKING TEA WITH MILK
     'LET NTS = NO OF CONSUMERS TAKING TEA WITH SUGAR
       'LET NTH = NO OF CONSUMERS TAKING TEA WITH HONEY
    'LET NTMS = NTMS OF PEOPLE TAKING TEA WITH BOTH MILK AND SUGAR
     'LET NTS = NTMH OF CONSUMERS TAKING TEA WITH BOTH MILK AND HONEY
       'LET NG = NTSH OF CONSUMERS TAKING TEA WITH BOTH SUGAR AND
HONEY
        'LET NG = NTMSH OF CONSUMERS TAKING TEA WITH BOTH MILK, SUGAR
AND HONEY

    LOCATE 7, 11:  PRINT "Number of consumers taking tea with milk
: "
    LOCATE 9, 11: PRINT "Number of consumers taking tea with sugar
: "
    LOCATE 11, 11: PRINT "Number of consumers taking tea with honey
: "
    LOCATE 13, 11: PRINT "Number of consumers taking tea with milk &
sugar    : "
    LOCATE 15, 11: PRINT "Number of consumers taking tea with milk &
honey     : "
    LOCATE 17, 11: PRINT "Number of consumers taking tea with sugar &
honey   : "
    LOCATE 19, 11: PRINT "No of consumers taking tea with milk, sugar
& honey : "
    LOCATE 4, 13: PRINT "CASE TWO DATA ENTRY SCREEN(FORM)"

       LOCATE 7, 67: INPUT NTM
       LOCATE 9, 67: INPUT NTS
       LOCATE 11, 67: INPUT NTH
```

```
        LOCATE 13, 67: INPUT NTMS
        LOCATE 15, 67: INPUT NTMH
        LOCATE 17, 67: INPUT NTSH
        LOCATE 19, 67: INPUT NTSMH


      LOCATE 21, 30: INPUT "Data OK ? (Y/N)"; k$

      IF k$ = "n" OR k$ = "N" THEN GOTO form2

     SCREEN 1
      CIRCLE (130, 70), 40
     ' PAINT (100, 70)
      CIRCLE (180, 70), 40
      'PAINT (150, 70)
      CIRCLE (150, 100), 40
     ' PAINT (120, 100)
      'PAINT (120, 70), 3

    LINE (15, 10)-(300, 155), 1, B
    LOCATE 6, 8: PRINT "MILK"
    LOCATE 8, 29: PRINT "SUGAR"
    LOCATE 16, 25: PRINT "HONEY"

    LOCATE 8, 15: PRINT "15"
           LOCATE 8, 20: PRINT "9"
           LOCATE 9, 25: PRINT "7"

    LOCATE 12, 17: PRINT "0"
           LOCATE 10, 20: PRINT "1"
           LOCATE 12, 22: PRINT "1"
    LOCATE 15, 19: PRINT "10"

      LOCATE 19, 17: COLOR 1: PRINT "VENN DIAGRAM"

     ' LET N=NUMBER OF CONSUMERS TAKING TEA WITH ONLY ONE INGREDIENT

      N = (NTMS + 15 + 7)

      LOCATE 21, 5
      PRINT "RESULT:": LOCATE 22, 5
      PRINT "NUMBER OF CONSUMERS THAT TAKE TEÀ"
      LOCATE 23, 5
      PRINT "WITH JUST ONE TEA INGREDIENT IS "; N


201
         LOCATE 24, 1
         INPUT "DO YOU WANT TO COMPUTE ANOTHER (Y/N)"; I$
   IF I$ = "y" OR I$ = "Y" THEN 200

GOTO 1
```

```
form3:
    CLS
    SCREEN 1
    WIDTH (80)

    LINE (45, 10)-(580, 180), , B
    'COLOUR 1
    'LET NS = NO OF SECURITY MEN
     'LET NSCOB1= NO OF SECURITY MEN, NO CONDUCTOR AND ONLY ONE BUS
       'LET NC = NO OF CONDUCTORS
    'LET NCSOB1 = NO OF CONDUCTORS, NO SECURITY AND ONLY ONE BUS
     'LET NSC = NO OF SECURITY MEN AND NO OF CONDUCTORS
       'LET NSCBM1 = NO OF SECURITY MEN, NO OF CONDUCTORS AND MORE
THAN ONE BUS
        'LET NBM1 = MORE THAN ONE BUS



    LOCATE 7, 11:  PRINT "Number of security men
: "
    LOCATE 9, 11: PRINT "Numb of security men, no conductor and only
one bus      : "
    LOCATE 11, 11: PRINT "Number of conductors
: "
    LOCATE 13, 11: PRINT "Number of conductors, no security and only
one bus      : "
    LOCATE 15, 11: PRINT "Number of security men and number of
conductors         : "
    LOCATE 17, 11: PRINT "Numb of security, numb of conductors more
than one bus : "
    LOCATE 19, 11: PRINT "More than one bus
: "
    LOCATE 4, 13: PRINT "CASE THREE DATA ENTRY SCREEN(FORM)"

      LOCATE 7, 67: INPUT NS
      LOCATE 9, 67: INPUT NSCOB1
      LOCATE 11, 67: INPUT NC
      LOCATE 13, 67: INPUT NCSOB1
      LOCATE 15, 67: INPUT NSC
      LOCATE 17, 67: INPUT NSCBM1
      LOCATE 19, 67: INPUT NBM1


    LOCATE 21, 30: INPUT "Data OK ? (Y/N)"; k$

    IF k$ = "n" OR k$ = "N" THEN GOTO form3

    SCREEN 1
    CIRCLE (130, 70), 40
   ' PAINT (100, 70)
    CIRCLE (180, 70), 40
    'PAINT (150, 70)
    CIRCLE (150, 100), 40
   ' PAINT (120, 100)

  LINE (15, 10)-(300, 180), 1, B
  LOCATE 7, 3: PRINT "(SECURITY)"
  LOCATE 6, 8: PRINT "A"
  LOCATE 6, 27: PRINT "(CONDUCTOR)"
  LOCATE 5, 32: PRINT "C"
```

```
 LOCATE 16, 25: PRINT "B (BUS)"

 LOCATE 8, 15: PRINT "2"
        LOCATE 8, 20: PRINT "1"
        LOCATE 9, 25: PRINT "15"

 LOCATE 12, 17: PRINT "1"
        LOCATE 10, 20: PRINT "8"
        LOCATE 12, 22: PRINT "36"

 LOCATE 15, 19: PRINT "5"
   LOCATE 21, 15: COLOR 1: PRINT "VENN DIAGRAM"

   'LET N=NUMBER SOUGHT FOR BY THE TRADE ASSOCIATION

   CENTRAL = NSC - NSCBM1
   A = NS - NSCBM1 - NSCOB1 - CENTRAL
   C = NC - NCSOB1 - NSCBM1 - CENTRAL
   N = NBM1 - C - NSCBM1 - A

   LOCATE 22, 5
   PRINT "RESULT:": LOCATE 23, 20
   PRINT "NUMBER SOUGHT FOR BY THE TRADE ASSOC="; N

301
  LOCATE 24, 1
       INPUT "DO YOU WANT TO COMPUTE ANOTHER (Y/N)"; I$
  IF I$ = "y" OR I$ = "Y" THEN 300
GOTO 1


400
CLS : LOCATE 10, 20: PRINT "TERMINATING PROGRAM..."
FOR J = 1 TO 50000
H = H + 1
NEXT
CLS
END
```