- 5. "It is only through interpretation the researcher can expose the relations and processes that underlie his findings". Explain, giving examples.
- 6. Explain the significance of a research report and narrate the various steps involved in writing such a report. The statement of the property of the propert
- 7. Describe, in brief, the layout of a research report, covering all relevant points.
- 8. Write a short note on 'Documentation' in the context of a research report.
- Mention the different types of report, particularly pointing out the difference between a technical report and a popular report.
- 10. Explain the technique and importance of oral presentation of research findings. Is only oral presentation sufficient? If not, why?
- 11. (a) What points will you keep in mind while preparing a research report? Explain.
 - (b) What are the different forms in which a research work may be reported. Describe.

(M. Phil. Exam. (EAFM) 1979, Uni. of Rajasthan)

12. "We can teach methods of analysis, yet any extensive research... requires something equally important: an organisation or synthesis which provides the essential structure into which the pieces of analysis fit." Examine this statement and show how a good research report may be prepared.

13. Report must be attractive in appearance, near and clean, whether typed or printed.

1. 14. Calculated confidence fluids most be arentioned and the various constrained experienced in

conducting the research study may also be guited to the report to how that he

to spite of all that has been stated above, one should always keep in view the fact report-writing is not

Witten bytel rose of the 'task of interprotution' to the context of research specifical times

less, provident La fundamental component of research provides, Explain Way out

A. Describe the procussions that the resentition should take while be equestry his lindings

art which is learned by terrection and experience, rather than by onere docurrention

15. Objective of the study, the nature of the problem, the methods employed and the analysis

techniques adopted must all be clearly stated in the beginning of the recorf in the form of

(M. Phil. Exam. (EAFM) 1978, Uni. of Rajasthan)

- 13. Write short notes on the following:
 - (a) The techniques of writing report;
 - (b) Characteristics of a good research report;
 - (c) Bibliography and its importance in context of research report;
 - (d) Rewriting and polishing of report.
- 14. "Report writing is more an art that hinges upon practice and experience". Discuss.

or in the second of the second

In brief, computer is a machine capable of receiving, stoday, avaignt lating and yielding information

The computer can be a digital computer or it can be a analogue computer. A divital eco-

Sag

Research Methodology

The Computer: Its Role in Research

present day microcomputer is far name powerful and coats very little, compared to the world's first

electronic computer viz. Electronic Numerical Integrator and Calculator (ENIAC) completed in

1946. The microcomputer works many times feater, is thousands of times more reliable and has a

The salvances in computer technology are usually talked in verms of 'ognerations'. 'To lay we

INTRODUCTION

Problem solving is an age old activity. The development of electronic devices, specially the computers, has given added impetus to this activity. Problems which could not be solved earlier due to sheer amount of computations involved can now be tackled with the aid of computers accurately and rapidly. Computer is certainly one of the most versatile and ingenious developments of the modern technological age. Today people use computers in almost every walk of life. No longer are they just big boxes with flashing lights whose sole purpose is to do arithmetic at high speed but they make use of studies in philosophy, psychology, mathematics and linguistics to produce output that mimics the human mind. The sophistication in computer technology has reached the stage that it will not be longer before it is impossible to tell whether you are talking to man or machine. Indeed, the advancement in computers is astonishing.

To the researcher, the use of computer to analyse complex data has made complicated research designs practical. Electronic computers have by now become an indispensable part of research students in the physical and behavioural sciences as well as in the humanities. The research student, in this age of computer technology, must be exposed to the methods and use of computers. A basic understanding of the manner in which a computer works helps a person to appreciate the utility of this powerful tool. Keeping all this in view, the present chapter introduces the basics of computers, especially it. answers questions like: What is a computer? How does it function? How does one communicate with it? How does it help in analysing data?

THE COMPUTER AND COMPUTER TECHNOLOGY The computer and computer and computer technology The computer and computer and computer technology The computer and computer and computer technology The computer and comp

A computer, as the name indicates, is nothing but a device that computes. In this sense, any device, however crude or sophisticated, that enables one to carry out mathematical manipulations becomes a computer. But what has made this term conspicuous today and, what we normally imply when we speak of computers, are electronically operating machines which are used to carry out computations.

has almost becomeniaced by direct entry devices, such as Visual Director (VDU) which consists

The Computer: Its Role in Research

In brief, computer is a machine capable of receiving, storing, manipulating and yielding information such as numbers, words, pictures.

The computer can be a digital computer or it can be a analogue computer. A digital computer is one which operates essentially by counting (using information, including letters and symbols, in coded form) where as the analogue computer operates by measuring rather than counting. Digital computer handles information as strings of binary numbers i.e., zeros and ones, with the help of counting process but analogue computer converts varying quantities such as temperature and pressure into corresponding electrical voltages and then performs specified functions on the given signals. Thus, analogue computers are used for certain specialised engineering and scientific applications. Most computers are digital, so much so that the word computer is generally accepted as being synonymous with the term 'digital computer'.

Computer technology has undergone a significant change over a period of four decades. The present day microcomputer is far more powerful and costs very little, compared to the world's first electronic computer viz. Electronic Numerical Integrator and Calculator (ENIAC) completed in 1946. The microcomputer works many times faster, is thousands of times more reliable and has a large memory.

The advances in computer technology are usually talked in terms of 'generations'.' Today we have the fourth generation computer in service and efforts are being made to develop the fifth generation computer, which is expected to be ready by 1990. The first generation computer started in 1945 contained 18000 small bottle-sized valves which constituted its central processing unit (CPU). This machine did not have any facility for storing programs and the instructions had to be fed into it by a readjustment of switches and wires. The second generation computer found the way for development with the invention of the transistor in 1947. The transistor replaced the valve in all electronic devices and made them much smaller and more reliable. Such computers appeared in the market in the early sixties. The third generation computer followed the invention of integrated circuit (IC) in 1959. Such machines, with their CPU and main store made of IC chips, appeared in the market in the second half of the sixties. The fourth generation computers owe their birth to the advent of microprocessor-the king of chips-in 1972. The use of microprocessor as CPU in a computer has made real the dream of 'computer for the masses'. This device has enabled the development of microcomputers, personal computers, portable computers and the like. The fifth generation computer, which is presently in the developing stage, may use new switch (such as the High Electron Mobility Transistor) instead of the present one and it may herald the era of superconducting computer. It is said that fifth generation computer will be 50 times or so more faster than the present day superfast machines, suggests as a substitution of the present day superfast machines.

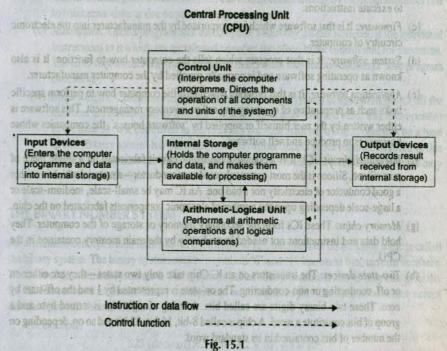
So far as input devices in computers are concerned, the card or tape-based data entry system has almost been replaced by direct entry devices, such as Visual Display Unit (VDU) which consist of a TV-like screen and a typewriter-like key board which is used for feeding data into the computer. Regarding output devices, the teleprinter has been substituted by various types of low-cost high speed printers. VDU is also used as an output device. For storing data, the magnetic tapes and discs

- *(i) First generation computers were those produced between 1945-60 such as IBM 650, IBM 701.
- (ii) Second generation computers were those produced between 1960-65 such as IBM 1401 Honeywell 40.
- (iii) Third generation computers were those produced between 1965-70 such as IBM System 360, 370.
- (iv) Fourth generation computers are those produced between 1971 to this date such as IBM 3033, HP 3000, Burroughs B 7700.

are being replaced by devices such as bubble memories and optical video discs. In brief, computer technology has become highly sophisticated and is being developed further at a very rapid speed.

THE COMPUTER SYSTEM

In general, all computer systems can be described as containing some kind of input devices, the CPU and some kind of output devices. Figure 15.1 depicts the components of a computer system and their inter-relationship:



The function of the input-output devices is to get information into, and out of, the CPU. The input devices translate the characters into binary, understandable by the CPU, and the output devices retranslate them back into the familiar character i.e., in a human readable form. In other words, the purpose of the input-output devices is to act as translating devices between our external world and the internal world of the CPU i.e., they act as an interface between man and the machine. So far as CPU is concerned, it has three segments viz. (i) internal storage, (ii) control unit, and (iii) arithmetic logical unit. When a computer program or data is input into the CPU, it is in fact input into the internal storage of the CPU. The control unit serves to direct the sequence of computer system operation. Its function extends to the input and output devices as well and does not just remain confined to the sequence of operation within the CPU. The arithmetic logical unit is concerned with performing the arithmetic operations and logical comparisons designated in the computer program.

In terms of overall sequence of events, a computer program is input into the internal storage and then transmitted to the control unit, where it becomes the basis for overall sequencing and control of computer system operations. Data that is input into the internal storage of the CPU is available for

processing by the arithmetic logical unit, which conveys the result of the calculations and comparisons back to the internal storage. After the designated calculations and comparisons have been completed, output is obtained from the internal storage of the CPU.

It would be appropriate to become familiar with the following terms as well in context of computers:

- (a) Hardware: All the physical components (such as CPU, Input-output devices, storage devices, etc.) of computer are collectively called hardware.
- (b) Software: It consists of computer programs written by the user which allow the computer to execute instructions.
- (c) Firmware: It is that software which is incorporated by the manufacturer into the electronic circuitry of computer.
- (d) System software: It is that program which tells the computer how to function. It is also known as operating software and is normally supplied by the computer manufacturer.
- (e) Application software: It is that program which tells the computer how to perform specific tasks such as preparation of company pay roll or inventory management. This software is either written by the user himself or supplied by 'software houses', the companies whose business is to produce and sell software.
- (f) Integrated circuit (IC): It is a complete electronic circuit fabricated on a single piece of pure silicon. Silicon is the most commonly used semiconductor—a material which is neither a good conductor of electricity nor a bad one. An IC may be small-scale, medium-scale or a large-scale depending upon the number of electronic components fabricated on the chip.
- (g) Memory chips: These ICs form the secondary memory or storage of the computer. They hold data and instructions not needed immediately by the main memory contained in the CPU.
- (h) Two-state devices: The transistors on an IC Chip take only two states—they are either on or off, conducting or non-conducting. The on-state is represented by 1 and the off-state by zero. These two binary digits are called bits. A string of eight bits is termed byte and a group of bits constitute a word. A chip is called 8-bit, 16-bit, 32-bit and so on, depending on the number of bits contained in its standard word.

IMPORTANT CHARACTERISTICS TO THE TOP OF A SOLVED TO THE TOP OF THE TOP OF A SOLVED TO THE TOP OF THE

The following characteristics of computers are note worthy:

- (i) Speed: Computers can perform calculations in just a few seconds that human beings would need weeks to do by hand. This has led to many scientific projects which were previously impossible.
- (ii) Diligence: Being a machine, a computer does not suffer from the human traits of tireness and lack of concentration. If two million calculations have to be performed, it will perform the two millionth with exactly the same accuracy and speed as the first.
- (iii) Storage: Although the storage capacity of the present day computer is much more than its earlier counterpart but even then the internal memory of the CPU is only large enough to retain a certain amount of information just as the human brain selects and retains what it feels to be important and relegates unimportant details to the back of the mind or just

forgets them. Hence, it is impossible to store all types of information inside the computer records. If need be, all unimportant information/data can be stored in auxiliary storage devices and the same may be brought into the main internal memory of the computer, as and when required for processing.

- (iv) Accuracy: The computer's accuracy is consistently high. Errors in the machinery can occur but, due to increased efficiency in error-detecting techniques, these seldom lead to false results. Almost without exception, the errors in computing are due to human rather than to technological weaknesses, i.e., due to imprecise thinking by the programmer or due to inaccurate data or due to poorly designed systems.
- (v) Automation: Once a program is in the computer's memory, all that is needed is the individual instructions to it which are transferred one after the other, to the control unit for execution. The CPU follows these instructions until it meets a last instruction which says 'stop program execution'.
- (vi) Binary digits: Computers use only the binary number system (a system in which all the numbers are represented by a combination of two digits—one and zero) and thus operates to the base of two, compared to the ordinary decimal arithmetic which operates on a base of ten. (Binary system has been described in further details under separate heading in this chapter.) Computers use binary system because the electrical devices can understand only 'on' (1) or 'off' (0).

THE BINARY NUMBER SYSTEM

An arithmetic concept which uses two levels, instead of ten, but operates on the same logic is called the binary system. The binary system uses two symbols '0' and '1', known as bits, to form numbers. The base of this number system is 2. The system is called binary because it allows only two symbols for the formation of numbers. Binary numbers can be constructed just like decimal numbers except that the base is 2 instead of 10.

For example,

$$523 \text{ (decimal)} = 5 \times 10^2 + 2 \times 10^1 + 3 \times 10^0$$

Similarly,

111 (binary) =
$$1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 = 7$$
 (decimal)

Thus, in the example, we see that in the decimal system, the first place is for 1s, 2nd place is for 10s and the 3rd place is for 100. On the other hand, in the binary system, the factor being 2 instead of 10, the first place is still for 1s but the 2nd place is for 2s, the 3rd for 4s, the 4th for 8s and so on.

Decimal to Binary Conversion: A positive decimal integer can be easily converted to equivalent binary form by repeated division by 2. The method works as follows:

Start by dividing the given decimal integer by 2. Let R_1 be the remainder and q_1 the quotient. Next, divide q_1 by 2 and let R_2 and q_2 be the remainder and quotient respectively. Continue this process of division by 2 until a 0 is obtained as quotient. The equivalent binary number can be formed by arranging the remainders as

where R_{k} and R_{k} are the last and the first remainders respectively, obtained by the division process.

Illustration 1

Find the binary equivalents of 26 and 45.

Solution: Table for conversion of 26 into its Binary equivalent:

ldom lead to	Number to be divided by 2	el gollossal. Quotient accordante bease. Remainder d'appe
mreet or du	nagoro 26 th yel smoln	than to technological weaknesses, i.e., ditt to imprecise this
	3	to thiccurate flats or dee to poorly designed a sterms.
ndividui sel	sa bole on a that la	(v) Automation. Once a program is in the configurer's memory, a
or execution	A time legaco anti o	instructions to it which are transferred one after the other, t

Collecting the remainders obtained in the above table we find that

26(decimal) =11010 (binary)

or

 $(26)_{10} = (11010)_{2}$

Similarly, we can find the binary equivalent of 45 as under:

Table 15.1

Number to be divided by 2	Quotient	Remainder South Desmitter IIA
alodinya owi yino agolla il sona ad-	visitio bella in another of	The binary system. The binary system or The best of this manufective services in 2. The for the boffeeting of the bests. Strates and
Above to man and on the same and on	5	matric Late is Sinacaj of 100
The bosining of the State of th	al) = 5 x 10 + 2 x 10 +	1 523 (decim

Thus, we have $(45)_{10} = (101101)_2^{+}$

i.e., the binary equivalent of 45 is 101101.

Alternative method: Another simple method for decimal to binary conversion is to first express the given integer as a sum of powers of 2, written in ascending order. For example,

$$26 = 16 + 8 + 0 + 2 + 0 = 1 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 0 \times 2^0$$

Then collect the multipliers of the powers to form the binary equivalent. For 26, we get, from the above mentioned expansion 11010 as the binary equivalent. This alternative method is convenient for converting small decimal integers by hand.

Binary to Decimal Conversion: A simple method for converting a binary number to its decimal equivalent is known as double-babble method. This can be described as follows:

Begin the conversion process by doubling the leftmost bit of the given number and add to it the bit at its right. Then again double the sum and add to it the third bit from the left. Proceed in this manner till all the bits have been considered. The final sum obtained by repeated doubling and adding is the desired decimal equivalent.

Illustration 2

Convert 1101 to its decimal equivalent using the double-babble method.

Solution:

- 1. Doubling the leftmost bit we get 2.
- 2. Adding to it the bit on its right we get 2 + 1 = 3
- 3. Doubling again the number obtained we get 6
- 4. Adding to it the next bit we get 6+0=6
- 5. Again doubling we get 12 cam d x d . g a sociatiful firms to seep and ni more viscos et and
- 6. Finally adding the last bit we get 12 + 1 = 13

Thus, we have $(1101)_2 = (13)_{10}$

In other words, the decimal equivalent of binary 1101 is 13.

(Conversion of real number to binary number is also possible but it involves little bit more complicated conversion process. Those interested may read any binary system book.)

Computations in Binary System

(a) Binary addition: Binary addition is just like decimal addition except that the rules are much simpler. The binary addition rules are as shown below:

Step 2. Add this to number from which you are taking aways

Following two examples Hus

All mont ST territory lab

0	0	1	rate his method.
+0	+1	+0	+1
0	solved to I was to	1	10

Note that sum of 1 and 1 is written as '10' (a zero sum with a 1 carry) which is the equivalent of decimal digit '2'. We can now look at two examples of binary additions which make use of the above rules.

DILLET

galo

E 19502

Illustration 3

Add 1010 and 101.

Solution:

Binary	Decimal equivalent
1010 lsm	(10)
+101	+(5)
1111	(15)

Illustration 4

Add 10111000 and 111011.

Na San

doubling and

Hagiration 2

A 530V

at its right. Then again double the sum and

manner till all the bits have been considered adding is the desired decimal equivalent.

Convert 1101 to its decimal equivalent using the

SWOT

Begin the conversion process by doubling the leftenost bit of the given number and and to included

Carry 111	Carry 11
10111000	184
+111011	+59
11110011 bod	iom alddad 243 uch

In Illustration 4, we find a new situation (1+1+1) brought about by the 1 carry. However, we can still handle this by using the four combinations already mentioned. We add the digits in turn. 1+1=10 (a zero sum with a 1 carry). The third 1 is now added to this result to obtain 11 (a 1 sum with a 1 carry).

The computer performs all the other arithmetical operations (viz. \times , -, +) by a form of addition. This is easily seen in the case of multiplication, e.g., 6×8 may be thought of as essentially being determined by evaluating, with necessary carry overs, 8 + 8 + 8 + 8 + 8 + 8. This idea of repeated addition may seem to be a longer way of doing things, but remember that computer is well suited to carry out the operation at great speed. Subtraction and division are handled essentially by addition using the principle of complementing.

- (b) Complementary subtraction: Three steps are involved in this method:
- Step 1. Find the ones complement of the number you are subtracting;
- Step 2. Add this to number from which you are taking away;
- Step 3. If there is a carry of 1 add it to obtain the result; if there is no carry, add 0, recomplement and attach a negative sign to obtain the result.

Following two examples illustrate this method.

Illustration 5

Subtract 10 from 25.

Solution:

number	Season Season St.	manna Smile	are conductors	West to wood with the day to a called the
25	11001		11001	
Subtract 10	01010	Step 1	+10101	(Ones complement of 01010)
15		Step 2	101110	10 and 101.
1122 (112)		Step 3	<u></u>	(add the carry of 1)
		Result	01111	Its decimal equivalent is 15.

Illustration 6

Subtract 72 from 14.

Solution: Decimal	Binary		According	to complementary method
14 Subtract 72	0001110 1001000	Step 1.	0001110 +0110111	(ones complement of 1001000)
	of binary (not in capater arithmet) great speed th	Step 2. Step 3.	01000101	est of carry) of the carry on the carry of the carry on t
		Result	-0111010	(recomplement and attach a negative sign). Its decimal

The computer performs the division operation essentially by repeating this complementary subtraction method. For example, 45 + 9 may be thought of as 45 - 9 = 36 - 9 = 27 - 9 = 18 - 9 = 9 - 9 = 0 (minus 9 five times).

equivalent is -58.

Binary Fractions was internating about a gradual or gradual account one chairing ladge of about seeing an add

Just as we use a decimal point to separate the whole and decimal fraction parts of a decimal number, we can use a binary point in binary numbers to separate the whole and fractional parts. The binary fraction can be converted into decimal fraction as shown below:

$$0.101 \text{ (binary)} = (1 \times 2^{-1}) + (0 \times 2^{-2}) + (1 \times 2^{-3})$$

$$= 0.5 + 0.0 + 0.125$$

$$= 0.625 \text{ (decimal)}$$

To convert the decimal fraction to binary fraction, the following rules are applied:

- (i) Multiply the decimal fraction repeatedly by 2. The whole number part of the first multiplication gives the first 1 or 0 of the binary fraction;
- (ii) The fractional part of the result is carried over and multiplied by 2;
- (iii) The whole number part of the result gives the second 1 or 0 and so on.

Illustration 7

Convert 0.625 into its equivalent binary fraction.

Solution:

Applying the above rules, this can be done as under:

$$0.625 \times 2 = 1.250 \implies 1$$

 $0.250 \times 2 = 0.500 \implies 0$
 $0.500 \times 2 = 1.000 \implies 1$

Hence, 0.101 is the required binary equivalent.

The Computer: Its Role in Research

371

Illustration 8

Convert 3.375 into its equivalent binary number.

Solution:

This can be done in two stages. First $(3)_{10} = (11)_2$ as shown earlier. Secondly, $(0.375)_{10} = (0.011)_2$ as shown above. Hence, the required binary equivalent is 11.011.

From all this above description we find how computer arithmetic is based on addition. Exactly how this simplifies matters can only be understood in the context of binary (not in decimal). The number of individual steps may indeed be increased because all computer arithmetic is reduced to addition, but the computer can carry out binary additions at such great speed that this is not a disadvantage. -0111010 (reconniences and state of

COMPUTER APPLICATIONS

At present, computers are widely used for varied purposes. Educational, commercial, industrial, administrative, transport, medical, social financial and several other organisations are increasingly depending upon the help of computers to some degree or the other. Even if our work does not involve the use of computers in our everyday work, as individuals, we are affected by them. "The motorists, the air passenger, hospital patients and those working in large departmental stores, are some of the people for whom computers process information. Everyone who pays for electricity or telephone has their bills processed by computers. Many people who are working in major organisations and receive monthly salary have their salary slips prepared by computers. Thus, it is difficult to find anyone who in some way or the other does not have some information concerning them processed by computer".1 "Computers can be used by just about anyone: doctors, policemen, pilots, scientists, engineers and recently even house-wives. Computers are used not only in numeric applications but also in nonnumeric applications such as proving theorems, playing chess, preparing menu, matrimonial matchmaking and so on. Without computers we might not have achieved a number of things. For example, man could not have landed on the moon nor could he have launched satellites. We might not have built 100 storied buildings or high speed trains and planes."2

The following table depicts some of the important applications and uses of computers:

Table 15.2

(i) Provide a large data bank of information; and out it \$0.0 novno.
ii) Carry out lengthy or complex calculations;
v) Assist teaching and learning processes;
v) Provide students' profiles;
i) Assist in career guidance.
1

Applications in	Some of the various uses
2 Commerce	(i) Assist the production of text material (known as word processing)
i ylana mich lankenget skyl	such as reports, letters, circulars etc.
ratigograms this menouslable	(ii) Handle payroll of personnel, office accounts, invoicing, records
Nurse of the Commission of the	keeping, sales analysis, stock control and financial forecasting.
3. Banks and Financial	(i) Cheque handling; 212 312 315 300 february of the entire of the
institutions in the land	(ii) Updating of accounts;
and oth of book of air ob of asil	(iii) Printing of customer statements;
wate package on the computer.	(iv) Interest calculations.
4. Management	(i) Planning of new enterprises;
way special solution to	(ii) Finding the best solution from several options;
loved in research methodology.	(iii) Helpful in inventory management, sales forecasting and
nowier is best miled for such	production planning;
sad producing the final result	(iv) Useful in scheduling of projects.
5. Industry	(i) In process control;
the me of the spans	(ii) In production control;
tolp to a researcher for he cam	(iii) Used for load control by electricity authorities;
	(iv) Computer aided designs to develop new products.
6. Communications	(i) Helpful in electronic mail;
and Transportation	(ii) Useful in aviation: Training of pilots, seat reservations, provide
est with the help of comprises.	information to pilots about weather conditions;
ed in the bite so that they can	(iii) Facilitate routine jobs such as crew schedules, time-tables,
	maintenance schedules, safety systems, etc.;
while consulting the computer	(iv) Helpful to railways, shipping companies;
Audit stebit	(v) Used in traffic control and also in space flight.
7. Scientific Research	(i) Model processing; gallow has not been agree such (i)
	(ii) Performing computations; massey on also and gamosz fair
I de la constanta de	(iii) Research and data analysis.
8. The homes	(i) Used for playing games such as chess, draughts, etc.;
	(ii) Can be used as an educational aid;
	A STATE OF THE PARTY OF THE PAR

First of all, researcher must now attention toward dots organisation and coding prior to the input COMPUTERS AND RESEARCHERS

ater on. For this purpose the data must be coded. Causcotical data need to Performing calculations almost at the speed of light, the computer has become one of the most useful research tools in modern times. Computers are ideally suited for data analysis concerning large research projects. Researchers are essentially concerned with huge storage of data, their faster retrieval when required and processing of data with the aid of various techniques. In all these operations, computers are of great help. Their use, apart expediting the research work, has reduced human drudgery and added to the quality of research activity. *25 if from a third single of the codes data some or the coding for the codes of th

(iii) Home management is facilitated.

¹ N. Subramanian, "Introduction to Computers", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1986, p. 192.

¹ Ibid., p. 192-93.

Researchers in economics and other social sciences have found, by now, electronic computers to constitute an indispensable part of their research equipment. The computers can perform many statistical calculations easily and quickly. Computation of means, standard deviations, correlation coefficients, 't' tests, analysis of variance, analysis of covariance, multiple regression, factor analysis and various nonparametric analyses are just a few of the programs and subprograms that are available at almost all computer centres. Similarly, canned programs for linear programming, multivariate analysis, monte carlo simulation etc. are also available in the market. In brief, software packages are readily available for the various simple and complicated analytical and quantitative techniques of which researchers generally make use of. The only work a researcher has to do is to feed in the data he/she gathered after loading the operating system and particular software package on the computer. The output, or to say the result, will be ready within seconds or minutes depending upon the quantum of work.

Techniques involving trial and error process are quite frequently employed in research methodology. This involves lot of calculations and work of repetitive nature. Computer is best suited for such techniques, thus reducing the drudgery of researchers on the one hand and producing the final result rapidly on the other. Thus, different scenarios are made available to researchers by computers in no time which otherwise might have taken days or even months.

The storage facility which the computers provide is of immense help to a researcher for he can make use of stored up data whenever he requires to do so.

Thus, computers do facilitate the research work. Innumerable data can be processed and analyzed with greater ease and speed. Moreover, the results obtained are generally correct and reliable. Not only this, even the design, pictorial graphing and report are being developed with the help of computers. Hence, researchers should be given computer education and be trained in the line so that they can use computers for their research work.

Researchers interested in developing skills in computer data analysis, while consulting the computer centers and reading the relevant literature, must be aware of the following steps:

Sciencific Research & Model processing:

- (i) data organisation and coding;
- (ii) storing the data in the computer; who storing the data in the computer;
- (iii) selection of appropriate statistical measures/techniques;
- (iv) selection of appropriate software package;
- (v) execution of the computer program.

A brief mention about each of the above steps is appropriate and can be stated as under:

First of all, researcher must pay attention toward data organisation and coding prior to the input stage of data analysis. If data are not properly organised, the researcher may face difficulty while analysing their meaning later on. For this purpose the data must be coded. Categorical data need to be given a number to represent them. For instance, regarding sex, we may give number 1 for male and 2 for female; regarding occupation, numbers 1, 2, and 3 may represent Farmer, Service and Professional respectively. The researcher may as well code interval or ratio data. For instance, I.Q. Level with marks 120 and above may be given number 1, 90–119 number 2, 60–89 number 3, 30–59 number 4 and 29 and below number 5. Similarly, the income data classified in class intervals such as Rs. 4000 and above, Rs. 3000–3999, Rs. 2000–2999 and below Rs. 2000 may respectively be represented or coded as 1, 2, 3 and 4. The coded data are to be put in coding forms (most systems

call for a maximum of 80 columns per line in such forms) at the appropriate space meant for each variable. Once the researcher knows how many spaces each variable will occupy, the variables can be assigned to their column numbers (from 1 to 80). If more than 80 spaces are required for each subject, then two or more lines will need to be assigned. The first few columns are generally devoted for subject identity number. Remaining columns are used for variables. When large number of variables are used in a study, separating the variables with spaces make the data easier to comprehend and easier for use with other programs.

Once the data is coded, it is ready to be stored in the computer. Input devices may be used for the purpose. After this, the researcher must decide the appropriate statistical measure(s) he will use to analyse the data. He will also have to select the appropriate program to be used. Most searchers prefer one of the canned programs easily available but others may manage to develop it with the help of some specialised agency. Finally, the computer may be operated to execute instructions.

The above description indicates clearly the usefulness of computers to researchers in data analysis. Researchers, using computers, can carry on their task at faster speed and with greater reliability. The developments now taking place in computer technology will further enhance and facilitate the use of computers for researchers. Programming knowledge would no longer remain an obstacle in the use of a computer. To be boulded and the researchers of the researchers and the use of a computer.

In spite of all this sophistication we should not forget that basically computers are machines that only compute, they do not think. The human brain remains supreme and will continue to be so for all times. As such, researchers should be fully aware about the following limitations of computer-based analysis:

- Computerised analysis requires setting up of an elaborate system of monitoring, collection
 and feeding of data. All these require time, effort and money. Hence, computer based
 analysis may not prove economical in case of small projects.
- Various items of detail which are not being specifically fed to computer may get lost sight of.
- 3. The computer does not think; it can only execute the instructions of a thinking person. If poor data or faulty programs are introduced into the computer, the data analysis would not be worthwhile. The expression "garbage in, garbage out" describes this limitation very well.

Questions

- 1. What is a computer? Point out the difference between a digital computer and analogue computer.
- 2. How are computers used as a tool in research? Explain giving examples.
- 3. Explain the meaning of the following terms in context of computers:
 - (a) Hardware and Software
 - (b) The binary number system
 - (c) Computer generations
 - (d) Central Processing Unit.
- 4. Describe some of the important applications and uses of computers in present times.

- 5. "The advancement in computers is astonishing". Do you agree? Answer pointing;out the various characteristics of computers.
- 6. Write a note on "Computers and Researchers".
- 7. "Inspite of the sophistication achieved in computer technology, one should not forget that basically computers are machines that only compute, they do not think". Comment.
- 8. Add 110011 and 1011. State the decimal equivalent of the sum you arrive at.
- 9. Explain the method of complementary subtraction.
 - Subtract 15 from 45 and 85 from 68 through this method using the binary equivalents of the given decimal
- 10. Workout the decimal equivalents of the following binary numbers:
 - (a) 111.110 goldy to of stanger wanty site band and have views and to develop of to so referring
 - of some specialized opency. Finally, the computer may be openied to execute instruct 111.0 (d)
 - and binary equivalents of the following decimal numbers:
 - (a) 4210 heary min but being rates at last that he year and settingness this statements
 - 6) 0.745 one sometime that if the visit of the southern a south gradual work to second ordered
- 11. Convert 842 to binary and 10010101001 to decimal. Why binary system is being used in computer?

only compute, they do not trunk. The number bear contains augment and will continue to be so for all

12. What do you understand by storage in a computer and how is that related to the generations?

L. Computed and property at recovery entities up of an elaborate system of monitoring collection. analysis may not prove occoome at in case of small projects.

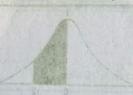
2. Various items of detail which are not being give freally led to computer may get lost optic

3. The compared does not think; it can only execute the insurations of a thinking person. II poor data or faulty programs, are influenced into the competer, the data grateries would not

be wornswhile. The expression "garbage in, sereage out," describes this limitation very

Questions

L. What is a complete? Frint out the difference between a digital computer and analogue camputer I How are computers areal assets in content of the principles.



Appendix (Selected Statistical Tables)

THE RESIDENT PROPERTY CHANGE

value of a Array for occative, where for a pre-

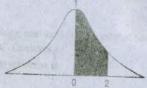
ha enter in the while is the proportion under the

coline care e nich i bernore e figul a produce

(税) 8800 25035 (38/5) MASS PE18 1998 CONT REF 333 200A 3.1 ECH EITA 122h de As (27.8 36589 2.5 (29) 2003 4966 2808 (360)

Table 1: Area Uader Normai Curve

An entry in the table is the proportion under the entire curve which is between z=0 and a positive value of z. Areas for negative values for z are obtained by symmetry.



Z	.0	0.01	.02	_,03	.04	.05	.06	.07	.08	.09
.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
.1	.0398	.0438	.0478	.0517	.0557		.0636	-	.0714	9.55
2	.0793	.0832	.0871	.0910	.0948	-0.570.00	.1026		.1103	1000000
3	.1179	.1217	.1255	.1293	.1331	.1368	.1406		.1480	
4	.1554	.1591	.1628	.1664	.1700	.1736	1772	.1808	.1844	.1517
5	.1915	.1950	.1985	.2019	.2054	2088	.2123	2157	.2190	.1879
.6	.2257	.2291	.2324	2357	.2389	2422	.2454	n 100 100		
.7	.2580	.2611	.2642	2673	.2903	2734		2486	.2517	2549
.8	.2881	2910	.2939	2967	2995	3023	2764	.2794		2852
.9	.3159	.3186	3212	3238	3264		.3051	.3078	3106	.3133
1.0	.3413	3438	3461	3485	3508	.3289	.3315	.3340	.3365	.3389
1.1	-			-	-3308	3531	.3554	3577	3599	.3621
1.2	3643	.3665	.3686	.3708	.3729	3749	.3770	.3790	.3810	.3830
	3849	3869	3888	3907	.3925	3944	3962	3980	3997	.4015
AND I	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	€.4474	.4484	.4495	.4505	.4515	4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	4750	4756	.4761	4767
2.0	.4772	.4778	.4783	.4788	4793	4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
12	.4861	.4864	.4868	.4871	.4875	4878	.4881	.4884	.4887	.4890
3	.4893	.4896	.4898	.4901	4904	.4906	.4909	.4911	.4913	4916
4	.4918	.4920	.4922	.4925	4927	.4929	.4931	.4911	4934	4936
5	.4938	.4940	.4941	.4943	.4945	4946	.4948	4949	.4951	4952
6	4953	.4955	4956	100000	AND POST	-				
7	4965	.4966	4950	.4957	.4959	.4960	.4961	.4962	.4963	4964
8	.4974	.4975	4976	4968	.4969	.4970	.4971	.4972	4973	.4974
9 .	.4981	.4982	.4982	.4977	.4977	.4978	4979	4979	.4980	,4981 ,4986
0	.4987	.4987	.4987	.4988	.4984	.4984 .4989	.4985 -	.4985	,4986 ,4990	,4990

Kito analysis control values of S

Appendix

Table 2: Critical Values of Student's t-Distribution

JOX .	ta. Juna	Level of sig	nificance for tw	vo-tailed test	19.	probably -
d.f.	0.20	0.10	0.05	0.02	0.01	d.f.
9230	SAT PARTY	Level of sig	mificance for or	ne-tailed test	THE	10 3 70
THE !	0.10	0.05	0.025	0.01	0.005	(B) D
088.01	3.078	6.314	12.706	31.821	63.657	1
118.2	1.886	2.920	4.303	6.965	9.925	2
3	1.638	2.353	3.182	4541	5.841	3
resoA	1.533	2.132	2.776	3.747	4.604	4
010.5	1.476	2.015	2.571	3.365	4.032	5
181E (6	1.440 M	1.943	2.447	3.143	3.707	6
255.2	1.415	1.895	2.365	2.998	3,499	7
8,219	1.397	1.860	2.306	2.896	3.355	8
9	1.383	1.833	2.262	2.821	3.250	9
10	1.372	1.812	2.228	2.764	3.169	10
HSTS.	1.363	1.796	2.201	2.718	3.106	11
12	1.356	1.782	2.179	2.681	3.055	12
13	1.350	1.771	2.160	2.650	3.012	13
14	1.345	1.761	2.145	2.624	2.977	14
15	1.341	1.753	2.731	2.602	2.947	15
16	1.337	1.746	2.120	2.583	2.921	16
17	1.333	1.740	2.110	2.567	2.898	17
18	1.330	1.734	2.101	2.552	2.878	18
19	1,328	1.729	2.093	2.539	2.861	19
/to: 20	1.325	. 1.725	2.086	2.528	2.845	20
2)	1.323	1.721	2.080	2.518	2.831	21
22	1.321	1.717	2.074	2.508	2.819	22
23	1.319	1.714	2.069	2.500	2.807	23
24	1.318	1.711	2.064	2.492	2,797	24
25	1.316	1.708	2.060	2.485	2.787	25
35	1.315	1.706	2.056	2.479	2.779	26
27	1.314	1.703	2.052	2.473	2.771	27
28	1.313	1.701	2.048	2.467	2.763	28
29	1.311	1.699	2.045	2.462	2.756	29
Infinity	1.282	1.645	1.960	2.326	2.576	Infinity

ag wifegrees of freedom for smaller variance.

Table 3: Critical Values of X

of freedom	.99 .000157 .0201 .115 .297 .554	.00393 .103 .352 .711	.50 .455 1.386 2.366 3.357	2.706 4.605 6.251	.05 (3.841) 5.991	.02 5.412 7.824	THE PERSON
2 3 4	.0201 .115 .297 .554	.103 .352 .711	1.386	4.605		The state of the state of	6.635
3 4	.115 .297 .554	.352	2.366	ENGLISHED STATE	5.991	7824	100000000000000000000000000000000000000
4	.297 .554	711 ^{(0,0}	The same	6251		1.04-7	9.210
	.554		3 357	0.201	7.815	9.837	11.341
5 1 1900	300	1145	3.331	7.779	9.488	11.668	13.277
		.1140	4.351	9.236	E 11.070	13.388	15.086
6	.872	1.635	5.348	10.645	12.592	15.033	16.812
7	1.239	2.167	6.346	12.017	14,067	16.622	18.475
8	1.646	2.733	7.344	13.362	15.507	18.168	20.090
9	2.088	3.325	8.343	14.684	16.919	19.679	21.666
10 0	2.558	3.940	9.342	15.987	18.307	21.161	23.209
11	3.053	4.575	10.341	17.275	19.675	22.618	24.725
12	3.571	5.226	11.340	18.549	21.026	24.054	26.217
13	4.107	5.892	12.340	19.812	22.362	25.472	72.688
14	4.660	6.571	13.339	21.064	23.685	26.873	29.141
15	4.229	7.261	14.339	22.307	24.996	28.259	30.578
16	5.812	7.962	15.338	23.542	26.296	29.633	32.000
17	6.408	8.672	16.338	24.769	27.587	30.995	33.409
18	7.015	9.390	17.338	25.989	28.869	32.346	34.805
19	7.633	10.117	18.338	27.204	30.144	33.687	36.191
20 01	8.260	10.85182.0	19.337	28.412	31.410	35.020	37.566
21	8.897	11.591	20.337	29.615	32.671	36.343	38.932
22	9.542	12.338	21.337	30.813	33.924	37.659	40.289
23	10.196	13.091	22.337	32.007	35.172	38.968	41.638
24	10.856	13.848	23.337	32.196	36,415	40.270	42.980
25	11.524	14.611	24.337	34.382	37.652	41.566	44.314
26	12.198	15.379	25.336	35.363	38.885	41.856	45.642
27	12.879	16.151	26.336	36.741	40.113	44.140	46.963
28	13.565	16.928	27.336	37.916	41.337	45.419	48.278
29	14.256	17.708	28.336	39.087	42.557	46.693	49.588

Note: For degrees of freedom greater than 30, the quantity $2\chi^2 - \sqrt{2d \cdot f \cdot - 1}$ may be used as a normal variate with unit variance i.e., $z_\alpha = \sqrt{2\chi^2} - \sqrt{2d \cdot f \cdot - 1}$.

1655

V,	1	2	3	4	5	6	8	12	24	00
V ₂	161.4	199.5	215.7	224.6	230.2	234.0	238.9	243.9	249.1	243.3
och	MANAGE STATE OF	MATERIAL STREET		19.25	19.30	19.33	19.37	19.41	19.45	19.50
12	1851	19.00	19.16	9.12	9.01	8.94	8.85	8.74	8.64	8.53
245	10.13	9.55	9.28	1.61	NOT THE STORY	1000	6.04	5.91	5.77	5.63
me	7.71	6.94	6.59	6.39	6.26	6.16	4.82	4.68	4.53	436
88.5	6.61	5.79	5.41	5.19	5.05	4.93	4.15	4.00	3.84	3.67
6	5.99	5.14	4.76	4.53	4.39		3.73	3.57	3.41	3.23
08.7	5.59	4.74	4.35	4.12	3.97	3.87	3.44	3.28	3.12	2.93
8	5.32	4.46	4.07	3.84	3.69	3.58	3.23	3.07	2.90	2.71
9	5.12	4.26	3.86	3.63	3.48	3.37	F F 18	2.91	2.74	2.54
10	4.96	4.10	3.71	3.48	3.33	3.22	3.07 2.95	2.79	2.61	240
11	4.84	3.98	3.59	3.36	3.20	3.09	2.85	2.69	251	230
12	4.75	3.88	3.49	3.26	3.11	3.00	2.77	2.60	2.42	2.21
13	4.67	3.80	3.41	3.18	3.02	2.92	376	2.53	2.35	213
14	4.60	3.74	3.34	3.11	296	2.85	2.70		229	2.07
15	4.54	3.68	3.29	3.06	2.90	2.79	2.64	2.48	39/70	2.01
16	4.49	3.63	3.24	3.01	2.85	2.74	2.59	2.42	2.24	1.96
17	4.45	3.59	3.20	2.96	2.81	2.70	2.55	2.38	2.19	0.00
18	4.41	3.55	3.16	2.93	2.77	2.66	251	2.34	2.15	1.92
19	4.38	3.52	3.13	2.90	274	2.63	2.48	231	2.11	1.88
20	4.35	3.49	3.10	2.87	271	2.60	2.45	2.28	2.08	1.84
21	4.32	3.47	3.07	2.84	2.68	2.57	2.42	2.25	2.05	1.83
2	4.30	3.44	3.05	2.82	2.66	2.55	2.40	2.23	2.03	1.78
23	4.28	3.42	3.03	2.80	2.64	2.53	2.38	2.20	2.01	1.76
24	4.26	3.40	3.01	2.78	2.62	2.51	236	218	1.98	1.78
25	4.24	3.38	2.99	2.76	260	2.49	234	2.16	1.96	1.71
26	4.22	3.37	2.98	2.74	2.59	2.47	232	2.15	1.95	1.66
27	4.21	3.35	2.96	2.73	257	2.46	231	2.13	1.93	THE PROPERTY OF
28	4.20	3.34	2.95	2.71	2.56	2.45	2.29	2.12	1.91	1.60
29	4.18	3.33	2.93	2.70	2.54	2.43	2.28	2.10	190	1.6
30	4.17	3.32	292	2.69	253	2.42		2.09	1.89	1.60
40	4.08	FE 1.50	2.84	2.61	2.45	2.34	2.18	2.00	1.79	1.51
60	4.00	Market Committee	A36.50	2.52	237	2.25	2.10	1.92	1.70	135
120	3.92	ALC: NO PARTY OF THE PARTY OF T	2.68	CHANNE	12.41.45	2.17	2.02	1.83	1.61	12
1317.1	3.84	A S 1 S 2 S 2 S 2 S 2 S 2 S 3 S 3 S 3 S 3 S 3	A STATE OF THE PARTY OF THE PAR	The Section of	A LUNGS	2.10	Marie Control	1.75	1.52	1,00

 v_1 = Degrees of freedom for greater variance.

 v_3 = Degrees of freedom for smaller variance.

380										
							Research Methodolo			
V.		2	3	4	5	6	Q	12	24	
1	26	1	8	1 3	3	0	- 8	12	24	00

									A SECTION	
1	1 26	2	- 3	- 4	5	6	8	12	24	- 00
V ₂				4 2		Marthew C		2	1	4
I I	4052	4999,5	5403	5625	5764	5859	5982	6106	6235	6366
2	98.50	99.00	99.17	99.25	99.30	99.33	99.37	99.42	99.46	99.50
3	34.12	30.82	29.46	28.71	28.24	27.91	27.49	27.05	26.60	26.13
4	21.20	18.00	16.69	15.98	15.52	15.21	14.80	14.37	13.93	13.45
5	16.26	13.27	12.06	11.39	10.97	10.67	10.29	9.89	9.47	9.02
6	13.75	10.92	9.78	9.15	8.75	8.47	8.10	7.72	731	6.88
7	12.25	9.55	8.45	7.85	7.46	7.19	6.84	6.47	6.07	5.65
000	11.26	8.65	7.59	7.01	6.63	6.37	6.03	5.67	5.28	4.86
9	10.56	8.02	6.99	6.42	6.06	5.80	5.47	5.11	4.73	4.31
10	10.04	7.56	6.55	5.99	5.64	5.39	5.06	4.71	4.33	3.91
11	9.65	7.21	6.22	5.87	5.32	5.07	4.74	OL# 4.40	4.02	3.60
12	9.33	6.93	.5.95	5.41	5.06	4.82	4.50	4.16	3.78	3.36
13	9.07	6.70	5.74	5.21	4.86	4.62	4.30	3.96	3.59	3.17
14	8.86	6.51	5.56	5.04	4.69	4.46	4.14	3.80	3.43	3.00
15	8.68	6.36	5.42	4.89	4.56	4.32	4.00	3.67	3.29	2.87
16	8.53	6.23	5.29	4.77	4.44	4.20	3.89	3.55	3.18	2.75
17	8.40	6.11	5.18	4.67	4.34	4.10	3.79	3.46	3.08	2.65
18	8.29	6,01	5.09	4.58	4.25	4.01	3.71	3.37	3.00	257
19	8.18	5.93	5.01	4.50	4.17	3.94	3.63	3.30	3.92	249
20	8.10	5.85	4.94	4.43	4.10	3.87	3.56	3.23	286	2.42
21	8.02	5.78	4.87	4.37	4.04	3.81	351	3.17	2.80	236
22	7.95	5.72	4.82	4.31	3.99	3.76	3.45	3.12	2.75	231
23	7.88	5.66	4.76	4.26	3.94	3.71	3.41	3.07	2.70	226
24	7.82	5.61	4.72	4.22	3.90	3.67	3.36	3.03		221
25	7.77	5.57	4.68	4.18	3.85	3.63	3.32	2.99	2.62	2.17
26	7.72	5.53	4.64	4.14	3.82	3.59	3.20	296	2.58	210
27	7.68	5.49	4.60	4.11	3.78	3.56	3.26	2.93	2.45	213
28	7.64	5.45	457	4.07	3.75	3.53	3.23	2.90	2.52	2.06
29	7.60	5.42	4.54	4.04	3.73	3.50	3.20	2.87	249	2.03
30	7.56	5.39	4.51	4.02	3.70	3.47	3.17	2.84	2.47	201
40	7.31	5.18	431	3.83	3.51	3.29	2.99	2.66	2.29	1.80
60	7.08	4.98	4.13	3.65	3.34	3.12	2.82	2.50	2.12	1.60
120	6.85	4.79	3.95	3.48	3.17	2.96	2.66	2.34	1.95	1.38
00°	6.64	4.60	3.78	3.32	3.02	2.80	251	2.18	1.79	1.00

v = Degrees of Incidom for greater variance.

v, a Degrees of freedings for smaller variance.

Appendix

381

Table 5: Values for Spearman's Rank Correlation (r) for Combined Areas in Both Tails

Control				(n = sa	ample size = 12)		R	
			10% of area		10% of area		12	
		1 - Fa.	~					
			111	motor in	m			
			3986	-07 12 2 2 2 2 2 2	+.3986			
			DO F		DIE!		2	
	n	.20	.10	.05	.02	.01	=	.002
	4	.8000	.8000	- 1 - 1		-	1	-
	5	.7000	.8000	.9000	.9000	-		-
140	6	.6000	.7714	.8236	.8857	.9429	10	-12
	7	5357	.6786	.7450	.8571	.8929	- =	9643
	8	5000	.6190	.7143	.8093	.8571		.9286
	9	.4667	5833	.6833	.7667	.8167		9000
	10	.4424	5515	.6364	.7333	.7818	10:	.8667
	11	.4182	5273	.6091	.7000	.7455	źw.	.8364
	12	.3986	.4965	.5804	.6713	.7273	-	.8182
	13	3791		.5549	.6429	.6978		.7912
	14	3626	4593	5341	.6220	.6747	0	.7670
	15	3500	.4429	5179	.6000	.6536	100	.7464
-	16	3382	.4265	5000	5824	.6324	25	.7265
	17	3260	4118	.4853	5637	.6152	-	.7083
	18	3148	3994	.4716	5480	5975		.6904
	19	3070	3895	A579	.5333	5825	159	.6737
	20	2977	3789	.4451	.5203	5684		.6586
	21	.2909	3688	.4351	3 5078	5545		.6455
	22	2829	3597	.4241	.4963	5426	45	.6318
	23	Ma	3518	.4150	.4852	5306		.6186
	24	2704	.3435	.4061	.4748	5200	8.5	.6070
	25	2646	3362	3977	.4654	5100	N N	5962
-	26	2588	3299	3894	.4564	5002	-	.5856
	27	.2540	3236	3822	.4481	.4915	ree V	.5757
	28	2480	3175	3749	.4401	.4828		5660
	29	.2443	3113	.3685	.4320	.4744	E .	.5567
	30	.2400	3059	3620	.4251	.4665	F-14	5479

 v_1 = Degrees of freedom for greater variance.

 v_1 = Degrees of freedom for smaller variance.

Distribution	
(Unpaired)	Common Common Marie
of Wilcoxon's	CONTRACTOR STATES
lues of W	The state of the state of the
Selected Values	
Table 6;	7

M	20			1	1			OE 8	an	958	=1	1) =	-								-				
	61	1							-						1						1				
					100	0H								1	1	68	10 1	30	01						
	90							35	1						N.	1									
	11						101		8	9					R	1									
	91	1							10						The second	390									
																3									
-	15								181																
	4		10									THE REAL PROPERTY.	0.		0.5						-05				316
1	13	n								10						Of	X 8.		1750		0000	-4	*		1
	6		4				00	18					JD.		17						GOON				N
1	12	10	245				12	38.				AL.					TO				050				
	=	1 8	892				£S	23.	The state of				er.								1257				THE STATE OF THE S
	0	841	23				88	38	051			53		*	108	· OR	16.				CEUK		NE.		085
-			816									Q.	Pa.		AD.	H	38				1834			3 /3	
1	6	8	187				RE.	FF.				桐	£a.		×.	Č)	ce.				4426				064
	- 00	0	M.				(0)	X.				10	(A)			23	17	V	2	107	4182			27.	5
	1	6	72				É	141					4			65			115	770	3996		000	680	033
		5	100				60	80.						139	X	(18		67		055	1000			7	-
-	9	1	43				003	1				TA	3							193	NO32		200	200.	-
	0	di	26,			13						19	.133	760.		6	143	80	.05	.036	3500	14	0.0	2 2	0
1	4	45					TO SERVICE	20				1	.092	190		300	~	057		024	**	060	048	070	00
1	6	12	10.				762			000		125	1	1000				33	21	4	125	90	27	2 8	35
		13	59		0	13	000	100				1.3000	1 2	VALUE OF	1 18			Senor.	(3)		Seattle St.	200		ALSS	1000
1	2	183	58		5	7	H	30.			=	170.	.00	.02		-	9 6	0.	10.	8	170	3.	5 8	3 8	8
1	-	\$8	àc.	124	960	170	056	944		100	057	036	017	012		057	910	010	900	8	036	010	2 2	3 6	000
		23	220																			-	-	-	
1	0	100	2	8	.048	.08	.02	.02	01.	.05	9	810.	8	00	8	.02	8	9.	8	8	810.	3 8	3 8	3 8	8
	*	. 00	E				28					785				186		4			SAL.				22
	Max	111 100		-	22	33	42	52	5		22	30	49	9	=	18	35	45	56	89	21	3 5	3 -	63	76
	Min	00	36	. "	-	3	3	6	9	9	9	9 4	9	9	0	9 9	2 0	01	10	9	15	2 .	2	2 5	15
1	-	,	4 ~	4	2	9	7	00	7	3	4	2 0	1	00	7	6 4	, 0	9	1	00	. 3	* *	0 4		00
-	5	1	-				SA SA					, MS	-		4	135				1	8				360
II.			N.				97.	1					4/15	1		GET				-					

	di Malched Pair		
	the balou and	April 10 miles	
800.		10	080
10	sest balla) ere o	9	911.
-		1994	
		6 .095	.095
2		970.	976
	4	10.00	.060
2	160	.082	.047
2 6	711.	.064	.036
_ E	.090	080	.054 .027 .014
5 10	069	.036	020
-83		051 .027 .014	
*		0.019	
8 E			
0		.053 .026 .013	2 12
0	.063 .032 .010	- 000 - 000 - 000 - 000	010
•	.041 .021 .005	055 000 000 000	200.
4 85	.0057 .0026 .003 .004	.036 .003 .003 .003	900 900
6	033 015 008 004	9002	.002
2	0009		The same of the sa
_	. 024 • 010 0004 • 0002 0001 0001	900 000	000
	.012 .0 .005 .0 .000 .0 .001 .0 .000 .0		
0	0 0 0 0 0 0	96969	99999
Max W,	2.4 2 2 5 3	* 8 8 5 5 8	3.88 € ₹ §
Min ≱	สลล์ลลล	****	***
-	W 4 N 6 L 20	4 v & c ×	40000

Appendix

Table 7: Critical Values of Tin the Wilcoxon Matched Pairs Test

DECEMBER 1	2 Level	of significance for one-tailed test	9 -
	.025	.01	.005
	Level	of significance for two-tailed test	
n	.05	.02	.01
6	0		_ 2
7	2 30	9. 0	
8		0 2.	0
9	6 8 =	3 2	2
10	8	5	3
11	11 5 5	3 7 3	5 =
12	14 3 7	882 10 22	7
13	17	音音 10 13	10
14	21 25	12 2 2 16 2 3	13
15	25	20	16
16	30 8 8	24 3 5	20
17	35 1 0 0		23
18	40	23	28
19	46	18838 5385	32
20	52 2 2 2	8 2 R 43 UR 2 B	38
21	59	49	43
22	66	56 8888	49
23		60	55
24	73 8 8 8 8	69	61
25	89 8 8 8	THE REPORT OF THE RESERVE	68

Table 8: Cumulative Binomial Probabilities: P (r < rln, p)

Appendix

n	r _o	.10	.25	.40	50
Ivi.	, O(((X))	.9000	.7500	.6000	.5000
NXXI	1,07,030	1.0000	1.0000	1.0000	1.0000
(2)	0.610	.8100	.5625	.3600	.2500
(0)58	10000.	.9900	.9375	.8400	.7500
050	2011.	1.0000	1.0000	1.0000	1.0000
5	O(MATC	5905	.2373	.0778	.0313
ME	18814	.9185	.6328	.3370	.1875
THE .	22708	.9914	.8965	.6826	.5000
415	3.22	.9995	.9844	.9130	.8125
885	4000	.9999	.9990	.9898	.9687
748.	51/10	1.0000	1.0000	1.0000	1.0000
10	0	.3487	.0563	.0060	.0010
SHE	1,500	.7361	2440	.0463	.0108
t59	2 200	.9298	5256	.1672	.0547
\$/Q.	3000	.9872	.7759	.3822	.1719
3856	4/1001	.9984 0001	.9219	.6330	.3770
Me	5 CERRIT	.9999	.9803	.8337	.6230
OXII	6 000	1.0000	.9965	.9452	.8281
FERRI	7/XXXXI	1.0000	.9996 XXIII	.9877	.9453
EXCL	8(3333)	1,0000	1.0000	.9983	.9892
	9	1.0000	1.0000	.9999	.9990
	• 10	1.0000	1.0000	1.0000	1.0000
12	0	.2824	.0317	.0022	.0002
	1	.6590	.1584	.0196	.0031
	2	.8891	3907	.0835	.0192
	3	.9740	.6488	.2254	.0729
	4	.9963	.8424	.4382	.1937
	5	.9999	.9456	.6652	.3871
	6	1.0000	.9857	.8418	.6127
	7	1.0000	.9972	.9427	.8064
	8	1.0000	.9996	.9847	.9269
3	9	1.0000	1.0000	.9972	.9806
	10	1.0000	1.0000	.9997	.9977
	11	1.0000	1.0000	1.0000	1,0000
	12	1.0000	1.0000	1.0000	1.0000

(Contd.)

n

20

DON'T

30108

3770

THE THE

 r_{θ}

0

POED.

2

3

4

5

6

7

8

9

10

Home

12

13

14 01

15

16

17

18

19

20

PREC

. .

.10

.1216

3917

.6768

.8669 .

.9567

.9886

.9975

.9995

.9999

1.0000

1.0000

1.0000

1.0000

1.0000

1.0000

1.0000

1.0000

1.0000

1.0000

1.0000

1.0000

50

(XXX).

(XXX)

.(XX)2

10013

.0059

.0207

.0577

.1316

.2517.

4119

.5881

.7483

.8684

.9423

.9793

.9941

.9987

.9338

1.0000

L(XXX)

L(XXX)

.40

(XXX).

.0036

.0159

.0509

.1255

.2499

.4158

.5955

.7552

.8723

.9433

.9788

.9934

.9983

.99%

1.0000

1.0000

LOXXXX

(XXXX).

CXXXI.I

axxis .

.25

.0032

.0243

.0912

2251

.4148

.6171

.7857

.8981

.9590

.9861

.9960

.9990

.9998

1.0000

1.0000

1.0000

1.0000

1.000

1.0000

1.0000

1.0000

0000

00000.1

Appendix

Table 9: Selected Critical Values of S in the Kendall's Coefficient of Concordance

Values at 5% level of significance

k		an in	no special s	outstand of	Some additional values for $N=3$				
- 2000	3	4	5	6	7	k	s		
3		31315	64.4	103.9	157.3	9/	54.0		
4		49.5	88.4	143.3	217.0	12	71.9		
5		62.6	1123	182.4	276.2	14	83.8		
6		75.7	136.1	221.4	335.2	16	95.8		
. 8	48.1	101.7	183.7	299.0	453.1	18	107.7		
io	60.0	127.8	231.2	376.7	571.0	THE REAL PROPERTY.			
15	89.8	192.9	349.8	570.5	864.9				
20	119.7	258.0	468.5	764.4	1158.7	SLEU.			

Values at 1% level of significance

Committee (10)	11 34-174-09		CTIED DO	The Laborat		0.360	8
3			75.6	122.8	185.6	9	75.9
4		61.4	109.3	176.2	265.0	12	103.5
5		80.5	142.8	229.4	343.8	14	121.9
6		99.5	176.1	282.4	422.6	16	140.2
8	66.8	137.4	242.7	388.3	579.9	18	158.6
10	85.1	175.3	309.1	494.0	737.0	80CU	4
15	131.0	269.8	475.2	758.2	1129.5		
20	177.0	364.2	641.2	1022.2	1521.9		1
	100000000000000000000000000000000000000		1071 1000			The second second	

40.196

~	-	
- /		

Table 10: Table Showing Critical Values of A-Statistic for any Given Value of n-1, Corresponding to Various Levels of Probability

(A is significant at a given level if it is \ the value shown in the table)

n ≤ 4° N yot analay		Level of significance for one-tailed test					
FLACE	.05	1.50	.025	.01	2.7	.005	0005
GIV.	9	Leve	lofsignifican	ce for two-taile	d test		24/2
217	. 10	21,10	.05	.02-		.01	.001
. 1	2	2302	3	4	4.12A	. 5	6
tal	0.5125	1204	0.5031	0.50049		0.50012	0.5000012
2	0.412	2773	0.369	0.347	8.72	0.340	0.334
. 3	0.385	63-88	0.324	0.286		0.272	0.254
4	0.376	T.8211	0.304	0.257		0.238	0.211
5	0,372		0.293	0.240		0.218	0.184
6	0.370		0.286	0.230		0.205	0.167
7	0.369		0.281	0.222		0.196	0.155
8	0.368		0.278	0.217		0.190	0.146
9	0.368		0.276	0.213		0.185	0.139
10	0.368	0.00	0.274	0.210	1.47	0.181	0.134
(e 11)	0.368	8118	0.273	0.207	MUS	0.178	0.130
12	0.368	4225	0.271	0.205	T.(8) *	0.176	0.126
13	0.368	5365	0.270	0.204		0.174	0.124
14	0.368	O'ET	0.270	0.202		0.172	0.121
15	0.368		0.269	0.201		0.170	0.119
16	0.368	1521.0	0.268	0.200	7643	0.169	0.117
17	0.368		0.268	0.199		0.168	0.116
18	0.368		0.267	0.198		0.167	0.114
19	0.368		0.267	0.197		0.166	0.113
20	0.368		0.266	0.197		0.165	0.112
21	0.368		0.266	0.196	V. Co.	0.165	0.111
22	0.368		0.266	0.196		0.164	0.110
23	0.368		0.266	0.195		0.163	0.109
. 24	0.368		0.265	0.195		0.163	0.108
25	0.368		0.265	0.194		0.162	0.108
26	0.368		0.265	0.194		0.162	0.107
27	0.368		0.265	0.193		0.161	0.107
28	0.368		0.265	0.193.		0.161	0.106
29	0.368		0.264	0.193		0.161	0.106
30	0.368		0.264	0.193		0.160	0.105

1	2	3	4	5	6
40	0.368	0.263	0.191	0.158	0.102
60	0.369	0.262	0.189	0.155	0.099
120	0.369	0.261	0.187	0.153	0.095
00	0.370	0.260	0.185	0.151	0.092

n = number of pairs

Source: The Brit. J. Psychol, Volume XLVI, 1955, p. 226.

t. Actob Stores L. Var Besign of Constituence Change, Conversity of Chicago From 1961. . . . 2 Autoff, Kussell I., Scientific Method, New York: John Wiley & Sons, 1962.

Anderson, H.M., and Anderson, G.L., imformation to Convening Techniques and Other devices for Understanding the Agreement of Harmon Returnion, New York: Penancy Hall, 1951. S. Anderson, T.W., in hundardon to Multisuriate Analysis New York, John Wiley & Sons, 1958.

6 Builey Kennedi D. "Merkedyoff, and Resourts, New York, 1978. T. Baker R. P. and Howell, A.C., The Preparation of Reports, New York: Found Press, 1815.

A Allen, E. Harrell, New Methods in Secret Science Research, New York, Principles, 1975.

S. Barner, T.C., "Digital Computer Fundamentals," 5th Ed., McGraw-Hill, International Book Co. 1981.

9. Barrent, Jacquez sind Groff, Henriver, The Markon Researcher towed. New York: Marconn. Brace & Secret S. North Hall State of the Secret Sec

10. Rell, W. Projectice Techniques A. Drussei, Asperoach to the Such of Personality, New Yorks Longress

Il Ballenger, Burny, N., and Greenberg, Surest, A., Marketing Research - A. Marcyconest Information Agreement, Homewood, Elizadin Richard D. Irwin Inc., 1978.

The Senting Deputies R., and Anderson, John E., Constitunishers, October and the Metachen N.J.: The

Scarecow Press Inc., 1974.

13 Bereleva, Bernard, Castint Analysis in Communication Research, New York: Free Press, 1952.

14. Brienson Connel, and Colum Revisiond, Revision Wrating for Buriness and Economists

Tow York: Random House, 1971. 15. Best John W. and Kaing Junes V., "Research in Education." 5th Ed. New Delhic Promoce-Hall of India

TVL EM. 1986

16. Bhatachan a Scialità Psychomenica & Behaviouri Jereurch, New John Stellan Publisher

the Bowley A to Flewight of Staffware, Otto C. Tondon, P.S. King and Staffer Ltd., 1977

Selected References and Recommeded Readings

- 1. Ackoff, Russell L., The Design of Social Research, Chicago: University of Chicago Press, 1961.
- 2 Ackoff, Russell L., Scientific Method, New York: John Wiley & Sons, 1962.

Secretal Day Bell J. Proched, Volunta XI.VI. 1958 c. 236

- 3. Allen, T. Harrell, New Methods in Social Science Research, New York: Praeger Publishers, 1978.
- Anderson, H.H., and Anderson, G.L., An Introduction to Projective Techniques and Other Devices for Understanding the Dynamics of Human Behaviour, New York: Prentice Hall, 1951.
- 5. Anderson, T.W., An Introduction to Multivariate Analysis, New York: John Wiley & Sons, 1958.
- 6. Bailey, Kenneth D., "Methods of Social Research," New York, 1978.
- 7. Baker, R.P., and Howell, A.C., The Preparation of Reports, New York: Ronald Press, 1938.
- 8. Bartee, T.C., "Digital Computer Fundamentals," 5th Ed., McGraw-Hill, International Book Co., 1981.
- Barzun, Jacques, and Graff, Henery, F., The Modern Researcher, rev. ed., New York: Harcourt, Brace & World, Inc., 1970.
- Bell, J.E., Projective Techniques: A. Dynamic Approach to the Study of Personality, New York: Longmans Green, 1948.
- Bellenger, Danny N., and Greenberg, Barnett A., Marketing Research—A Management Information Approach, Homewood, Illinois: Richard D. Irwin, Inc., 1978.
- Berdie, Douglas R., and Anderson, John F., Questionnaires: Design and Use, Metuchen N.J.: The Scarecrow Press, Inc., 1974.
- 13. Berelson, Bernard, Content Analysis in Communication Research, New York: Free Press, 1952.
- Berenson, Conard, and Colton, Raymond, Research and Report Writing for Business and Economics, New York: Random House, 1971.
- Best, John W., and Kahn, James V., "Research in Education," 5th Ed., New Delhi: Prentice-Hall of India Pvt. Ltd., 1986.
- Bhattacharya, Srinibas, Psychometrics & Behavioural Research, New Delhi: Sterling Publishers Pvt. Ltd., 1972.
- *17. Boot, John C.G., and Cox, Edwin B., Statistical Analysis for Managerial Decisions, 2nd ed. New Delhi: McGraw-Hill Publishing Co. Ltd., (International Student Edition), 1979.
- 18. Bowley, A.L., Elements of Statistics, 6th ed. London: P.S. King and Staples Ltd., 1937.

Selected References and Recommeded Readings

 Burgess, Ernest W., "Research Methods in Sociology" in George Gurvitch and W.E. Moore (Ed.), Twentieth Century Sociology, New York: New York Philosophical 1 rary, 1949;

391

- 20. Chance, William A., Statistical Methods for Decision Making. bay: D.B. Taraporevala Sons & Co.
 Pvt. Ltd., 1975.
- 21. Chaturvedi, J.C., Mathematical Statistics, Agra: Nok Jhonk Karyalaya, 1953.
- Chou, Ya-Lun, Statistical Analysis with Business and Economic Applications, 2nd ed. New York: Holt, Rinehart & Winston, 1974.
- 23. Clover, Vernon T., and Balsley, Howard L., Business Research Methods, Columbus, O.: Grid, Inc., 1974.
- 24. Cochran, W.G., Sampling Techniques, 2nd ed. New York: John Wiley & Sons., 1963.
- Cooley, William W., and Lohnes, Paul R., Multivariate Data Analysis, New York: John Wiley & Sons., 1971.
- Croxton, F.E., Cowden, D.J., and Klein, S., Applied General Statistics, 3rd ed., New Delhi: Prentice-Hall of adia Pvt. Ltd., 1975.
- 27. Dass, S.L., Personality Assessment Through Projective Movie Pictures, New Delhi: S. Chand & Co. (Pvt.) Ltd., 1974.
- 28. Davis, G.B., "Introduction to Computers," 3rd ed., McGraw-Hill International Book Co., 1981.
- 29. Deming, W. Edwards., Sample Design in Business Research, New York: John Wiley & Sons., Inc., 1960.
- 30. Dennis, Child, The Essentials of Factor Analysis, New York: Holt, Rinehart and Winston, 1973.
- 31. Denzin, Norman, The Research Act, Chicago: Aldine, 1973.
- 32. Edwards, Allen, Statistical Methods, 2nd ed., New York: Holt, Rinehart & Winston, 1967.
- 33. Edwards, Allen L., Techniques of Attitude Scale Construction, New York: Appleton-Century-Crofts,
- 34. Emory, C. William, Business Research Methods, Illinois: Richard D. Irwin, Inc. Homewood, 1976.
- 35. Ferber, Robert (ed.), Handbook of Marketing Research, New York: McGraw-Hill, Inc., 1948.
- Ferber, R., and Verdoom, P.J., Research Methods in Economics and Business, New York: The Macmillan Company, 1962.
- 37. Ferguson, George A., Statistical Analysis in Psychology and Education, 4th ed., New York: McGraw-Hill Book Co., Inc., 1959.
- 38. Festinger, Leon and Katz, Daniel (Eds.), Research Methods in the Behavioral Sciences, New Delhi:
 Amerind Publishing Co. Pvt. Ltd., Fourth Indian Reprint, 1976.
- 39. Fiebleman, J.K., Scientific Method, Netherlands: Martinus Nijhoff, The Hague, 1972.
- 40. Fisher, R.A., Statistical Methods for Research Workers, 13th ed., New York: Hafner Publishing Co., 1958.
- 41. Fisher, R.A., The Design of Experiments, 7th rev. ed., New York: Hafner Publishing Co., 1960.
- 42. Fox, James Harold, Criteria of Good Research, Phi Delta Kappa, Vol. 39 (March 1958).
- 43. Freedman, P., The Principles of Scientific Research, 2nd ed., New York: Pergamon Press, 1960.
- 44. Fruchter, Benjamin, Introduction to Factor Analysis, Princeton, N.J.: D. Van Nostrand, 1954.
- 45. Gatner, Elliot S.M., and Cordasco, Francesco, Research and Report Writing, New York: Barnes & Noble, Inc., 1956.
- 46. Gaum, Carl G., Graves, Harod F., and Hoffman, Lyne, S.S., Report Writing, 3rd ed., New York: Prentice-Hall, 1950.
- 47. Ghosh, B.N., Scientific Methods and Social Research, New Delhi: Sterling Publishers Pvt. Ltd., 1982.
- 48. Gibbons, J.D., Nonparametric Statistical Inference, Tokyo: McGraw-Hill Kogakusha Ltd., (International Student Edition), 1971.

TELL BELL STE

- 49. Giles, G.B., Marketing, 2nd ed., London: Macdonald & Evans Ltd., 1974.
- 50. Glock, Charles Y., Survey Research in the Social Sciences, New York: Russell Sage Foundation, 1967.
- 51. Godfrey, Arthur, Quantitative Methods for Managers, London: Edward Arnold (Publishers) Ltd., 1977.
- 52. Good, Carter V., and Douglas, E. Scates, Methods of Research—Educational, Psychological, Sociological, New York: Appleton-Century-Crofts, Inc., 1954.
- 53. Goode, William J., and Hatt, Paul K., Methods in Social Research, New York: McGraw-Hill, 1952.
- 54. Gopal, M.H., An Introduction to Research Procedure in Social Sciences, Bombay: Asia Publishing 1. Clover Vernon T, and Blancy Howard L., Business Netcon F. Jestines. Colonback Colonback
- 55. Gopal, M.H., Research Reporting in Social Sciences, Dharwar: Karnatak University, 1965.
- 56. Gorden, Raymond L., Interviewing: Strategy, Techniques and Tactics, rev. ed., Homewood, Ill.: Dorsey Press, 1975.
- 57. Green, Paul E., Analyzing Multivariate Data, Hinsdale, Ill.: Dryden Press, 1978,
- 58. Green, Paul E., and Carmone, F.J., Multidimensional Scaling in Marketing Analysis, Boston: Allyn & Bacon, Inc., 1970. There S.L. Personnilly Assessment Library Property Monic Parenter New D.
- 59. Guilford, J.P., Psychometric Methods, New York: McGraw Hill, Inc., 1954.
- 60. Harnett, Donald L., and Murphy, James L., Introductory Statistical Analysis, Philippines: Addison-Wesley Publishing Co., Inc., 1975.
- 61. Hillway, T., Introduction to Research, 2nd ed., Boston: Houghton Mifflin, 1964.
- 62. Hollander, Myles, and Wolfe, Douglas A., Nonparametric Statistical Methods, New York: John Wiley, M. Edwardt, Allen, findities a Memodit, Titll ed., Mare York, Hort, Rinchert & Winstein, 1967.
- 63. Hunt, R., and Shelley, J., "Computers and Common Sense," 3rd ed., New Delhi: Prentice-Hall of India Ltd., 1984.
- 64. Hyman, Herbert H., et al., Interviewing in Social Research, Chicago: University of Chicago Press, 1975.
- 65. John, Peter W.M., Statistical Design and Analysis of Experiments, New York: The Macmillan Co., 1971.
- 66. Johnson, Ellen, The Research Report: A Guide for the Beginner, New York: Ronald Press, 1951.
- 67. Johnson, Rodney D., and Siskin, Bernard R., Quantitative Techniques for Business Decisions, New Delhi: Prentice-Hall of India Pvt. Ltd., 1977.
- 68. Kahn, Robert L. and Cannell, Charles F., The Dynamics of Interviewing, New York: John Wiley & Sons, M. Perintett Loon um Kery Thanes (Eds.), F. Freutt, Methods to the Reign and Sciences.
- 69. Karson, Marvin J., Multivariate Statistical Methods, Ames, Iowa: The Iowa State University Press, 1982.
- 70. Kendall, M.G., A Course in Multivariate Analysis, London, Griffin, 1961.
- 71. Kerlinger, Fred N. and Pedhazur, Elazar J., Multiple Regression in Behavioral Research, New York: Holt, Rinehart and Winston, 1973, well show well be senting attended to make the safe of the saf
- 72. Kerlinger, Fred N., Foundations of Behavioral Research, 2nd ed., New York: Holt, Reinhart and Winston, Preschoug P. The Principles of Knewing Research, 2nd ed. New York: Fergusion Press 1966.
- 73. Kish, Leslie, Survey Sampling, New York: John Wiley & Sons, Inc., 1965.
- 74. Kothari, C.R., Quantitative Techniques, 2nd ed., New Delhi: Vikas Publishing House Pvt. Ltd., 1984.
- 75. Lastrucci, Carles L., The Scientific Approach: Basic Principles of the Scientific Method, Cambridge, Mass.: Schenkman Publishing Co., Inc., 1967.
- 76. Lazersfeld, Paul F., "Evidence and Inference in Social Research," in David Lerher, Evidence and Inference, Glencoe: The Free Press, 1950, in this stand the part of the part
- 77. Leonard Schatzman, and Anselm L. Strauss, Field Research, New Jersey: Prentice-Hall Inc., 1973.
- 78. Levin, Richard I., Statistics for Management, New Delhi: Prentice-Hall of India Pvt. Ltd., 1979.

- 79. Levine, S. and Elzey, Freeman F., A Programmed Introduction to Research, California: Wods Worth Publishing Co., 1968.
- 80. Maranell, Gary M. (ed.), Scaling: A Source Book for Behavioral Scientists, Chicago: Aldine, 1974.
- 81. Maxwell, Albert E., Analyzing Qualitative Data, New York: John Wiley & Sons, 1961.

Selected References and Recommeded Readings

- 82. Meadows, R., and Parsons, A.J., "Microprocessors: Essentials, Components and Systems," Pitman, 1983.
- 83. Meir, Robert C., Newell, William T., and Dazier. Harold L., Simulation in Business and Economics, Englewood Cliffs, N.J: Prentice Hall. Inc., 1969.
- 84. Miller, Delbert C., Handbook of Research Design & Social Measurement, 3rd ed., New York: David Mckay Company, Inc., 1977. Wheel New York Isla Willy 2 Sons 1971
- 85. Moroney, M.J., Facts from Figures, Baltimore: Penguin Books, 1956.
- 86. Morrison, Donald F., Multivariate Statistical Methods, New York: McGraw-Hill, 1967.
- 87. Nagel, Stuart S., and Neef, Marian, Policy Analysis in Social Science Research, London: Sage Publications,
- 88. Nie, N.H., Bent, D.H., and Hull, C.H., Statistical Package for the Social Sciences, New York: McGraw-Hill, 1970.
- 89. Noether, G.E., Elements of Nonparametric Statistics, New York: John Wiley & Sons, Inc., 1967.
- 90. Nunnally, Jum C., Psychometric Theory, 2nd ed., New York: McGraw-Hill, 1978.
- 91. Odum, H.W., and Jocher, Katharine, An Introduction to Social Research, New York: Henry Holt and Co.,
- 92. Oppenheim, A.N., Questionnaire Design and Attitude Measurement, New York: Basic Books, 1966.
- 93. Ostle, Bernard, and Mensing, Richard W., Statistics in Research, 3rd ed., Ames Iowa: The Iowa State University Press, 1975.
- 94. Payne, Stanley, The Art of Asking Questions, Princeton: Princeton University Press, 1951.
- 95. Pearson, Karl, The Grammar of Science, New York: Meridian Books, Inc., 1957.
- 96. Phillips, Bernard S., Social Research, Strategy and Tactics, 2nd ed., New York: The Macmillan Company, 1971.
- 97. Piaget, Jean, Main Trends in Interdisciplinary Research, London: George Allen and Unwin Ltd., 1973.
- 98. Popper, Karl R., The Logic of Scientific Discovery, New York: Basic Books, 1959.
- 99. Rajaraman, V., "Fundamentals of Computers," New Delhi: Prentice-Hall of India Pvt. Ltd., 1985.
- 100. Ramchandran, P., Training in Research Methodology in Social Sciences in India, New Delhi: ICSSR
- 101. Redman, L.V., and Mory, A.V.H., The Romance of Research, 1923.
- 102. Roscoe, John T., Fundamental Research Statistics for the Behavioral Sciences, New York: Holt, Rinehart and Winston, Inc., 1969:
- 103. Runyon, Richard P., Inferential Statistics, Philippines: Addison-Wesley Publishing Company, Inc., 1977.
- 104. Sadhu, A.N., and Singh, Amarjit, Research Methodology in Social Sciences, Bombay: Himalaya Publishing House, 1980.
- 105. Seboyar, G.E., Manual for Report and Thesis Writing, New York: F.S. Crofts & Co., 1929.
- 106. Selltiz, Claire: Jahoda, Marie, Deutsch, Morton, and Cook, Stuart W., Research Methods in Social Relations, rev. ed. New York: Holt, Rinehart and Winston, Inc., 1959.
- 107. Sharma, B.A.V., et al., Research Methods in Social Sciences, New Delhi: Sterling Publishers Pvt. Ltd.,
- 108. Sharma, H.D., and Mukherji, S.P., Research in Economics and Commerce, Methodology and Surveys, Varanasi: Indian Biographic Centre, 1976.

- Siegel, S., Nonparametric Statistics for the Behavioral Sciences, New York: McGraw-Hill Publishing Co., Inc., 1956.
- 110. Subramanian, N., "Introduction to Computers," New Delhi: Tata McGraw-Hill Publishing Co. Ltd., 1986.
- 111. Summers, Gene F., (Ed.), Attitude Measurement, Chicago: Rand McNally & Co., 1970.
- Takeuchi, K., Yanai, H. and Mukherjee, B.N., The Foundations of Multivariate Analysis, New Delhi: Wiley Eastern Ltd., 1982.
- 113. Tandon, B.C., Research Methodology in Social Sciences, Allahabad: Chaitanya Publishing House, 1979.
- Thorndike, Robert L. and Hagen, Elizabeth P., Measurement and Evaluation in Psychology and Education, 4th ed., New York: John Wiley & Sons, 1977.
- 115. Thurstone, L.L., The Measurement of Values, Chicago: University of Chicago Press, 1959.
- 116. Torgerson, W., Theory and Methods of Scaling, New York: John Wiley & Sons, 1958.
- Travers, Robert M. W., An Introduction to Educational Research, 4th ed., New York: Macmillan Publishing Co., Inc., 1978.
- 118. Tryon, R.C., and Bailey, D.E., Cluster Analysis, New York: McGraw-Hill, 1970.
- 119. Ullman, Neil R., Elementary Statistics, New York: John Wiley & Sons, Inc., 1978.
- 120. Whitney, F.L., The Elements of Research, 3rd ed., New York: Prentice-Hall, 1950.
- Wilkinson, T.S. and Bhandarkar, P.L., Methodology and Techniques of Social Research, Bombay: Himalaya Publishing House, 1979.
- Willemsen, Eleanor Walker, Understanding Statistical Reasoning, San Francisco: W.H. Freeman and Company, 1974.
- 123. Yamane, T., Statistics: An Introductory Analysis, 3rd ed., New York: Harper and Row, 1973.
- 124. Young, Pauline V., Scientific Social Surveys and Research, 3rd ed., New York: Prentice-Hall, 1960.

the Newsconners of Company New Delta Progress and of the Person News News 1985

Author Index

Ackoff, R.L., 25, 390 Allen, T. Harrell, 390 Angerson, G.L., 390 Anderson, H.H., 390

Anderson, H.H., 390 Anderson, John F., 390 Anderson, T.W., 390

Bailey, D.E., 338, 394
Bain, Read, 116
Baker, R.P., 390
Balsey, Howard L., 391
Bartee, T.C., 390

Barzun, Jacques, 390 Bell, J.E., 390

Bellenger, Danny N., 20, 91, 390 Bent, D.H., 393

Berdie, Douglas R., 390

Berelson, Bernard, 110, 390

Berenson, Conard, 390

Best, John W., 86, 121, 390

Bhandarkar, P.L., 394

Bhattacharya, Srinibas, 337, 390

Boot, John C.G., 390

Bowley, A.L., 18, 113, 390

Burgess, Ernest W., 113, 391

Cannell, Charles F., 392 Chance, William A., 391, 192 Chaturvedi, J.C., 158, 391
Chou, Ya-Lun, 229, 391
Clover, Vernon T., 391
Cochran, W.G., 391
Colton, Raymond, 390
Cook, Stuart W., 6, 350, 393
Cooley, C.H., 115
Cooley, William W., 391
Cordasco, Francesco, 347, 391
Cox, Edwin B., 390
Croxton, F.E., 391

Dass S.L., 109, 391
Davis, G.B., 391
Dazier, Harold L., 5, 393
Deming, W. Edwards, 391
Dennis, Child, 391
Denzin, Norman, 391
Deutsch, Morton, 6, 350, 393
Douglas, E. Scates, 392

Edwards, Allen, 391 Edwards, Allen L., 86, 391 Elzey, Freeman F., 393 Emory, C. William, 53, 89, 130, 168, 185, 344, 391

Ferber, Robert, 28, 92, 319, 337, 338, 391 Ferguson, George A., 275, 391

Festinger, Leon, 391 Fiebleman, J.K., 391 Fisher, R.A., 39, 61, 256, 391 Fox, James Herold, 20, 391 Freedman, P., 391 Fruchter, Benjamin, 391

Gatner, Elliott S.M., 347, 391 Gaum Carl G., 391 Ghosh, BN., 391 Gibbons, J.D., 391 Giles, G.B., 92, 110, 122, 392 Glock, Charles Y., 392 Godfrey, Arthur, 392 Good, Carter V., 110, 392 Goode, William J., 392 Gopal, M.H., 392 Gorden, Raymond L., 392 Gosset, Sir William S., 160 Graff, Henry F., 390 Graves, Harod F., 391 Green, Paul E., 91, 92, 392 Greenberg, Barnett A., 20, 91, 390 Guilford, J.P., 80, 392 Gurvitch, Georges, 113

Hagen, Elizabeth P., 73, 394 Harnett, Donald L., 158, 195, 214, 257, 392 Hatt, Paul K., 392 Healy, William, 114 Hillway, T., 392 Hoffman, Lyne S.S., 391 Hollander, Myles, 392 Holtzman, W.H., 108, 109 Hotelling H., 321, 330 Howell, A.C., 390 Hull, C.H., 393 Hunt, R., 392 Hyman, Herbert H., 392

Guttman, Louis, 87, 88, 89

Jahoda, Marie, 6, 350, 393 Jocher, Katharine, 393 John, Peter W.H., 392 Johnson, Ellen, 392 Johnson, Rodney D., 175, 392

Kahn, James V., 86, 121, 390 Kahn, Robert L., 392 Karson, Marvin J., 392 Katz, Daniel, 391 Kendall, M.G., 307, 311, 392 Kenny, K.C., 86 Kerlinger, Fred N., '392 Kish, Leslie, 392 Klein, S., 391 Kothari, C.R., 348, 392

Lastrucci Carlos L., 10, 392 Lazersfeld, Paul F., 76, 392 Leonard, Schatzman, 392 Levin, Richard I., 158, 188, 392 Levine, S., 393 Likert, 84,85 Lohnes, Paul R., 391

Mahalanobis, 320 Maranell, Gary M., 393 Maxwell, Albert E., 393 McQuitty, 338 Meadow, R., 393 Meir, Robert C., 5, 393 Mensing, Richard W., 9, 393 Miller, Delbert C., 393 Moore, W.E., 113 Moroney, M.J., 393 Morrison, Donald F., 393 Mory, A.V.H., 1,393 Mukherji, B.N., 316, 393, 394 Mukherji, S.P., 393 Mulaik, S.A., 335

Murphy, James L., 158, 195, 214, 257, 392

Nagel, Stuart S., 393 Neiswanger, W.A., 12 Newell, William T., 5, 393 Nie, N.H., 393 Noether, G.E., 393

Odum, H.W., 113, 393 Oppenheim, A.N., 393

Nunnally, Jum C., 92, 324, 393

Osgood, Charles E., 90 Ostle, Bernard, 9, 393

ACL SERVICE OF THE STREET

skewness, 137

del moissimy.

Payne, Stanley, 393 Pearsons, A.J., 393 Pearson, Karl, 9, 393, 138-41 Pedhazur, Elazar, 392 Phillips, Bernard S., 77, 393 Piaget, Jean; 393 CO-TOE . SOURCE 300 Play Frederic Le, 114 Charolation 139-10 Popper, Karl R., 393

Rajaraman, V., 393 Ramachandran, P., 393 Redman, L.V., 1, 393 Collection of data 95-116 Roscoe, John T., 393 Runyon, Richard P., 162, 393

Sadhu, A.N., 393 Sandler, Joseph, 162 Scates Douglas E., 110, 392 Seboyar, G.E., 393 Selltiz Claire, 31, 38, 350, 358, 393 Sharma, B.A.V., 393 Sharma, H.D., 393 Shedecor, 257 Shelley, J., 392 Sheth, Jagdish N., 91, 130, 317, 337

Siegel, S., 298, 301, 394 Singh, Amariit, 393 Siskih, Bernard R., 175, 392 Slesinger, D., 1 Spearman, Charles, 138, 302 Spencer, Herbert, 114 Stephenson, M., 1 Strauss, Anselm L., 392 Student, 160, 162 Subramaniam, N., 370, 394 Suci, G.J., 90

Summers, Gene F., 394

Takeuchi, K., 316, 339, 394 Tandon, B.C., 394 Tannenbaum, P.H., 90 Thorndike, Robert L., 73, 394 Thurstone, L.L., 80, 83, 84, 324, 394 Tippett, 61 Torgerson, W., 394 Travers, Robert M.W., 53, 394 Tryon, R.C., 338, 394

har-only with compal decion.

Ullman, Neil R., 233, 394

Verdoorn, P.J., 28, 391

Wells, William D., 337 Whitney, F.L., 394 Wilkinson, T.S., 394 Willemsen, Eleanor W., 321, 394 Wolfe, Douglas, A., 392

Yamane, T., 394 Yanai, H., 316, 394 Yate, F., 61, 246 Young, Pauline V., 3, 113, 116, 346, 394 Yule, 145

Subject Index

Subject Index

Marries SparC. 92, 128, 193 no. (assessed a Street Arestmit., 39).

After-only with control design, 41 APERTER N. NEWSCHIT Alpha error, 187 Analysis of covariance (ANOCOVA), 275-79 Analysis of data, 18-19, 122-23, 130-31, 151 classification, 123-27 coding, 18, 123 editing, 18, 122-23 tabulation, 18, 127-29 Lipnett 61 types of analysis, 130-31 Analysis of variance (ANOVA), 256-75 one-way, 258-61 two-way, 264-71 ANOVA in Latin square design, 271-75 Analytical research, 2-3 Applied research, 3 Area sampling, 16,65

Before-and-after design: with control, 41-42 without control, 41 Beta error, 187 Bibliography, 19, 347-48, 358 Binary digits, 365 Bipolar factor, 329

Canonical correlation analysis, 130, 321 Case-study method, 113-16 Census survey, 55 Central limit theorem, 157-58 Central processing unit, 363-64 Centroid method of factor analysis, 324-30 Chi-square test, 195, 233-50

Classification, 123-27 according to attributes, 124 according to class-intervals, 124-25 Cluster analysis, 337-38 Cluster sampling, 16,65 Coding, 18, 123 Coefficient ofassociation, 144-47 concordance, 307-09 contingency, 147 correlation, 139-40 reproducibility, 89 skewness, 137 standard deviation, 135 variation, 136 Collection of data, 95-116 Redunential Light interview method, 97-100, 110, 119 depth interviews, 110 personal interviews, 97 telephone interviews, 100 observation method, 96-97 questionnaires, 100-104 through schedules, 104-105 Completely randomized design (C.R. Design), 42-45 Composite standard method, 80 Computer: 362-63 Stemate 8 CV 365 analogue, 362 digital, 362 Confidence level, 155 Confounded relationship, 34 Construct validity, 74 Consumer panels, 106

Content analysis, 110 Content validity, 74 Contingency table, 146 Continuous variable, 34, 318 Control, 34 Control groups, 35 Convenience sampling, 15 Correlation analysis, 130 Criteria of good research, 20-21 Criterion-related validity, 74 Cross tabulation, 138–39 Delibe ate sampling, 15 Depth interviews, 110 Descriptive research, 2-3 Descriptive research studies, 37-39 Developing a research plan, 53-54 Diffe rential scales, 83-84 Discrete variable, 34,318 Distributor audits, 106 Distribution—free tests, 283-312 (See non-parametric tests) "Don't know" responses, 129 Editing, 122-23 central editing, 123 field editing, 122 Empirical research, 4 Estimation, 167–74 interval estimate, 168 point estimate, 168 Experience survey, 28, 36 Experiment, 35 Experimental designs, 120-21 formal, 41-52 C.R. design, 42-45 Factorial design, 47-52 L.S. design, 46-47 R.B. design, 45 informal, 41-42 Experimental group, 35 C all politorito t Experimental research, 34-35 Experimental unit, 35 Exploratory research studies, 35-37 Ex-post facto research, 3, 71 Extraneous variable, 34 lossesuch hypodiesis 341 AVI F-distribution, 157, 196

F-test, 196, 225-28

Hypothesis: Interval. harmonic mean, 133-34

mean, 132

Factor analysis, 321-37 factor loadings, 323 factor scores, 324 Factorial designs, 47-52 Fundamental research, 3 Holtzman Inkblot test (H.I.T), 108-109 alternative, 185-86 characteristics of, 185 meaning, 184-85 null, 185-86 Hypothesis testing, 191–92 Hypothesis testing, research studies, 39 Index numbers, 147-48 Interaction effect, 47-50, 270-71 Interaction variation, 267 estimates, 167 scales, 71-72 Interview method, 97-100, 110, 119 depth interviews, 110 personal interviews, 97 clinical, 98 focussed, 98 non-directive, 98 mass landanger & man structured, 97 9-19 .dosozogu soled unstructured, 98 telephone interviews, 100 Judgement sampling, 15 Kendall's coefficient of concordance, 307-10 Kruskal-Wallis test, 298-300 Latent structure analysis, 338 Latin square design (L.S. Design), 46-47 Law of comparative judgement, 80 Level of significance, 186 Likert-type scales, 84-87 Literature survey, 13, 28 Longitudinal research, 4 Maximum likelihood method, 335 Measures of central tendency, 132-34 geometric mean, 133

Continuous va

le gargo is visit

40

), 45

Experience

Experiment

Experiment

dudinale-A

Research Plan, 53-54

median, 132–33 TE-15E Haylons some	Observation method, 96–97
mode, 133–34	controlled observation, 97
Measures of dispersion, 134–37	disguised observation, 96
mean deviation, 134-35	participant observation, 96
range, 134	
standard deviation, -135-36	unstructured observation, 96
Measures of relationship, 138-42	and the second
Measures of skewness, 136–37	Paired t-test, 196 (R.) and
Kurtosis, 137	Pantry audits, 106 2-02 Amazes to
Measurement in research, 69-70	Parametric tests, 195-96
interval data, 70	Partial correlation, 143-44
interval data, 70 mominal data, 70	Path analysis, 339-40
ordinal data, 70 20 401 paules in adequal	Pilot survey, 27
ratio data, 70 hate diversion suffers sussilicousts	Post factum interpretation, 344
Measurement scales, 71-72	Precision, 154-55
interval scale, 71-72 and the application reshall	Primary data, 95
nominal scale, 71	
ordinal scale, 71	Principal-components method, 330-3
ratio scale, 72	Principles of experimental designs: 39
Measuring the power of a hypothesis test, 193–95	local control, 40
Memory chips, 364	randomization, 40
Motivation research, 3	replication, 40 - 35 mest con-
Multicollinearity, 142	Problems of researchers, 21-22
	Processing operations, 122-29
Multi stage sampling, 16, 65–66	Projective techniques, 107-10
Multivariate analysis techniques: 315-40	Marie Contractor, No. 1981 - ES-
factor analysis, 321–37	Q-type factor analysis, 336
multidimensional scaling, 91-92, 338	· Quartimax rotation, 336
metric approach, 91-92	Questionnaire, 100-104
non-metric approach, 92	Quota sampling, 16, 59
multiple correlation, 142-43	Should Britain 501 Alamit
multiple discriminant analysis, 130, 319-21	Randomized Block Design (R.B. Design
multiple regression, 130, 318–19	Random sampling, 15, 59-60
multivariate analysis of variance, 130, 321	Ranking scales, 80
Kondall's coefficient of concernance 307-10	Rating scales, 78-80
Nominal scale, 71 DW-201 about allow-Index X	graphic rating, 78-79
Non-parametric tests, 283+312	itemized rating, 79
Chi-square test, 195-96, 233-50	Regression, 141-43
Fisher-Irwin test, 288-89	Report writing, 19-20, 344-59
Kendall's coefficient of concordance, 307-310	Research:
McNemer test, 289-91	meaning of, 1-2
Vull-hypothesis, 185–86	motivation în, 2
One sample runs test, 300–302	objectives of, 2 days and
Signed rank test, 291-93	significance of 5-7
Sign tests, 284–88	types of, 2-4
Spearman's rank correlation, 302-307	Research approaches, 5.
Rank sum tests: 293	Research design, 14, 31–39
H-test, 298-300	Research hypothesis, 34
U-test, 293-98	Research methods 7–8
Off minn	Research methodology, 8

Research Problem, 24-29 Research Process, 10-20 Roarhach test, 108 Rosenzweig test, 108 R-type factor analysis, 336 Sample design, 14-17, 153 non-probability sampling, 59 probability sampling, 60 random sampling, 59-60 stratified sampling, 62-65 Sample size, 56, 174-81 Sample survey, 55 Sampling: 152-81 design, 31, 153 distribution, 156 meaning, 152 need, 152 theory, 158-60 Sampling error, 58, 153-54 Sampling frame, 56-57, 153 Sampling unit, 56 Sandler's A-test, 162-63 Scale construction techniques, 82-92 arbitrary scales, 83 cumulative scales, 87-89 differential scales, 83-84. factor scales, 89-92 multidimensional scaling, 91-92 semantic differential scales, 90-91 summated scales, 84-87 Scaling, 76-77 Scalogram analysis, 87-88 Scientific method, 9-10 Secondary data, 95, 111-12 collection of, 111-12 Sequential sampling, 16,67 Significance level, 155 Sociogram, 110 Sociometry, 109-10 Source list, 56 Sources of error in measurement, 72-73 Standard error, 163-65 Stores audit, 106 Stratified sampling, 16, 62-65 Student's t-test, 160, 196 Survey design, 38, 120-21 Systematic sampling, 15, 62

Tabulation, 127-29 accepted principles of, 128-29 Tally sheet, 126 Technique of developing, measurement tools, 75-76 Testing of Hypotheses, basic concepts concerning, 185-90 Tests of hypotheses non-parametric tests, 283-312 parametric tests, 184-229 Tests of sound measurement, 73-75 Thematic apperception test (T.A.T.), 108 Thurstone-type scales, 83-84 Time-series analysis, 148-49 Tomkins-Horn picture arrangement test, 109 t-test, 195-96 Two-tailed and one-tailed test, 195-96 Type I and Type II errors, 187 Types of analysis, 130-31 bivariate, 130 causal, 130 correlation, 130 descriptive, 130 inferential, 131 multivariate, 130 unidimensional, 130 Variable, 33-34,318 continuous, 34,318

Variable, 33-34,318
continuous, 34,318
criterion, 318
dependent, 34,318
discrete, 34,318
dummy, 318
explanatory, 318
extraneous, 34
independent, 34
latent, 318
observable, 318
pseudo, 318
Varimax rotation, 336

Warranty cards, 106
Wilcoxon-Mann-Whitney test, 293-94

Yate's correction, 246–49
Yule's coefficient of association, 145–46

Z-test, 196

Research Methodology

Methods & Techniques

Second Edition

C. R. KOTHARI

This second edition has been thoroughly revised and updated and efforts have been made to enhance the usefulness of the book. In this edition a new chapter *The Computer: Its Role in Research* have been added keeping in view of the fact that computers by now become a indispensable part of research equipment. The other salient feature of this revised edition, subject contents have been developed and restructured at several places. New problems have also been added in various chapters.

Adoption of appropriate methodology is an essential characteristic of quality research studies irrespective of the discipline with which they are related. The present book provides the basic tenets of methodological research so that researchers may become familiar with the art of

using research methods and techniques.

The book contains introductory explanations of several quantitative methods enjoying wide use in social sciences. It covers a fairly wide range, related to Research Methodology. The presentations are uniformly economical and cogent. Illustrations given are meaningful and relevant. The book can be taken as a well-organised guide for researchers whose metholological background is not extensive.

The book is primarily intended to serve as a textbook for social science students of all Indian universities. It will also serve as a text for the students of M.Phil, Management, and students of various institutes. It will serve all practitioners doing research of one from or other in s general way.

Dr. C. R. Kothari was principal, Commerce College, and Associate Professor in the Department of Economic Administration and Financial Management, University of Rajasthan, Jaipur. He is known for his Quantitative Techniques all over the country including An Introduction to Operational Research. Some of his Hindi books, written in co-authorship, are Antarrashtriya Vitta, Arthashastra-ke-Sidhhant and Arthik Niyojan Evam Vikas.

ISBN 81-224-1522-9

NEW AGE INTERNATIONAL (P) LIMITED, PUBLISHERS

New Delhi • Bangalore • Chennai • Cochin • Guwahati • Hyderabad Jalandhar • Kolkata • Lucknow • Mumbai • Ranchi