Rai University
EVOLVING THINKING MINDS
A LEADING RESEARCH DRIVEN UNIVERSITY

Webinar on

Application of ICT tools in Research

Presented by

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THE RESEARCH - INDEX

ICT Tool INDEX

1. **Statistical and SPSS software tools in research**

Statistical analysis

- Central tendency and Skewness: Mean/combined mean/H.M mean, Median and Mode(s), Quartile, Decile, percentile and skewness
- Dispersion and Distribution: Standard Deviation, Mean Deviation, Quartile Deviation, Variance, CV Range and Poisson & Normal distribution
- Correlation & Regression Analysis: Karl Pearson's Correlation, Regression line as X on Y and Y on X line (Least Square method)
- Time series analysis: Component and math model of time series
- Association of Attributes: Class frequency, number of classes, consistency of data and positive classes

Methodological Analysis

- ANOVA analysis
- T-test & Z-Test
- MANOVA (Multivariate analysis of variance)
- Chi-Square Test
- Data Mining (Apriori algorithm, Market Basket Analysis)

Predictive Analysis

- Probability Analysis of the statistics
- What if Analysis (Goal seek, Scenario from the MS-Excel) and
- Data Mining (Apriori algorithm, Market Basket Analysis)

Numerical Analysis

- Number and String variables form SPSS
- Square root and other inbuilt string and numerical functions
- MAX, MIN, AVARAGE, SUM, COUNT, TOTAL, SUB-TOTAL etc.

2. **Referencing (e-governing) tools**
3. **Communication and transmission tools**
4. **Non-volatile (physical and virtual) storage tools**
5. **Designing tools**
6. **Programming tools for data manipulation using SQL/ NOSQL based database**
7. **Networking tools**
8. **Microsoft Office packages**

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The Research

Search again and again, A new finding

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Basic Research

Descriptive Research: it is the survey and fact finding enquiries of the different kinds. It is also called post facto research which have no control over the variables, that report what has happened or what is happening.

Analytical Research: The researcher use already available information and facts, and analyse these information to make critical evaluation.

Applied Research: It refer scientific study and research that seek and to solve the practical problems, and find the particular problem in specific time period, for example improve agricultural crops, treat and cure specific disease, define the task of the optimization etc.

Action Research: Action research, being a scientific method of solving immediate problems in the academic, social, curricular, administrative and evaluation areas

Fundamental Research: it is basic and pure research, these research mainly concerned with generalization and formulation of the theory. Algebra mathematics and algorithms are the example of the fundamental research

Quantitative Research: quantitative research is based on the measurements of quantity or amount it is applicable to phenomena that can be expressed in term of quantity.

Conceptual Research: conceptual research is base on some abstract idea(s) or theory, it generally used by the philosophers and thinkers to develop the new concepts or to re-interpret existing concepts.

Experimental Research: it is the scientific research design, it include hypothesis and variables that can be manipulated by the researcher. Here, variables can be measured, calculated, compared, compiled and manipulated for achieve pre-defined result/output

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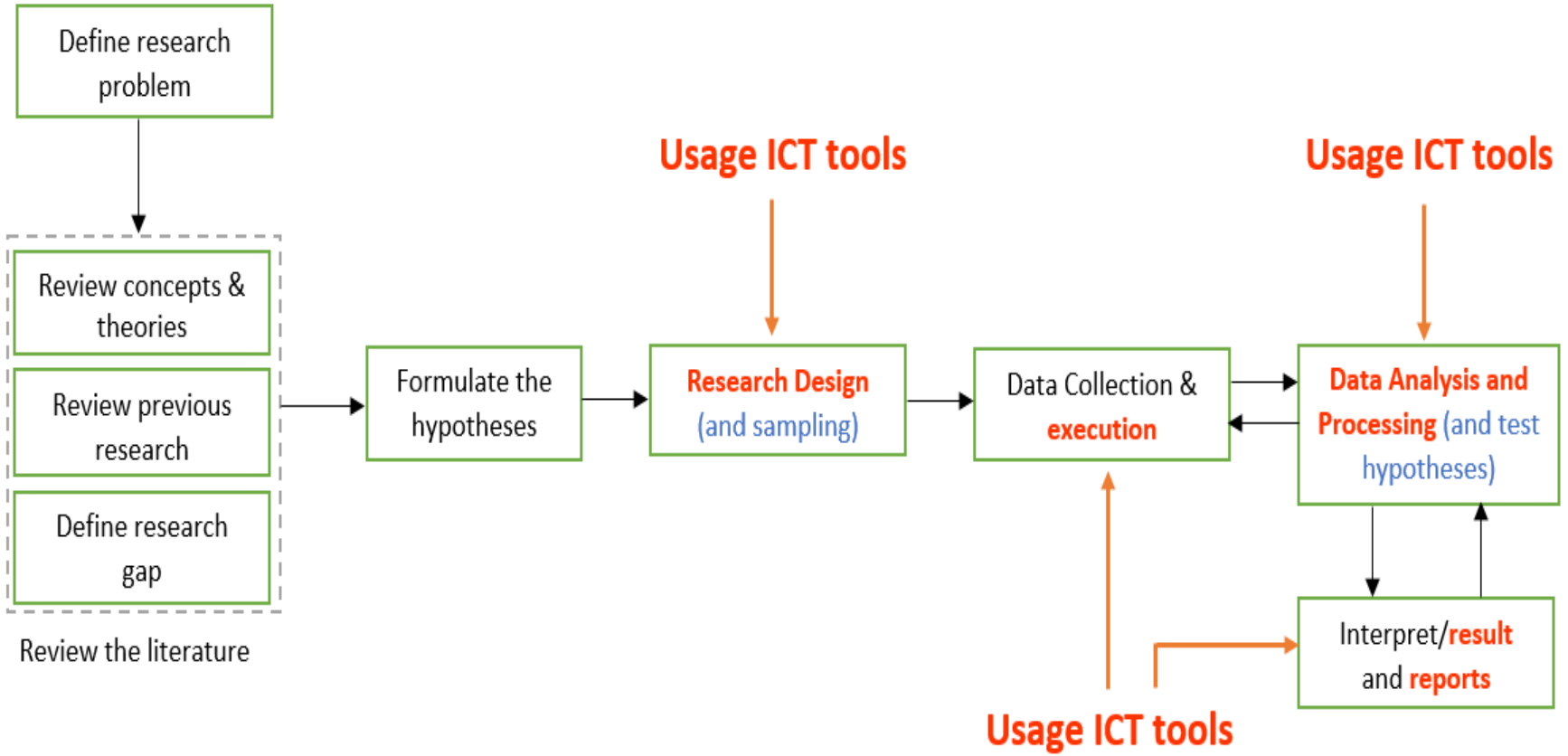
RESEARCH PROCESS FLOW CHART



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Research Design Specification

Split overall research design into the following parts.

- **The sampling design** which deals with the method of selecting items to be observed for the given study.
- **The observational** design which relates to the conditions under which the observation are to be made.
- **Statistical design** concern with how many items are to be observed and how the information and data gathered are to be analysed.
- **Operational design** with deal with the technique by the which the procedures specified in the sampling (Basic statistical methods are used)
- **Informal Experimental Designs** (less sophisticated form of analysis)
- **Formal Experimental Designs** (more sophisticated form of analysis)

following types of formal experimental design

- Completely Randomized Design (C. R Design)
- Randomized Block Design (R. B Design) (ANOVA and MANOVA technique used)
- Latin Square Design (L. S Design) (two-way ANOVA technique used)
- Factorial Design (Central tendency, dispersion, Data mining tools used and z-test)

- **Here Red colour task are defined uses the ICT tools**

Randomized Block Design (R. B Design)

Here subject are divided into group, called blocks. And subject is homogeneous in the respect to some selected variables.

Here, variable is selected for grouping the subjects which is related to the measure to be obtained in respect to the dependant variable

The number of subjects in a given block would be equal to the number of treatments and one subject in each block would be randomly assigned to each treatment ,

also refer (refer Research Methodology by C R Kothari) for more details

- **Latin Square Design**
- (refer Research Methodology by C R Kothari)
- **Factorial Design**
- (refer Research Methodology by C R Kothari)

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Data Collection and Execution

There are two types of data collection

- **Primary data collection**
- **Secondary data collection**

Methods of data collection

- **Surveys method**
- **Experimental method**
- **Observation method**
- **Interview method**
- **Questionnaires method**
- **Schedules method**
- **Pantry audit, consumer panel, mechanical device and projective techniques**

data Execution

Data Collection ICT tools

1. Referencing tools
2. Data designing tools
3. MS-office tools
4. Database tools
5. Data storage tools

Data Execution ICT tools

1. Data Mining tools
2. Programming tools
3. Web technology tools
4. Database tools

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Data Analysis and Processing

Data Analysis

- **Statistical Analysis** (also known inferential analysis)
- **Descriptive Analysis** (study of distribution of one variable)
- **Correlation Analysis** (study of distribution of two or more variable)
- **Casual Analysis** (study of how one or more variable affect/change in another variable(s), this is also called functional relationship between two or more variables)
- **Multivariate Analysis** (Use all statistical methods)
- **Multiple regression Analysis** (One dependent variable which is presumed to be a function of two or more independent variables)(to be used statistical regression method)
- **Multiple Discriminant Analysis** (Dependent variables can be classified into two of more groups on the basis of some attributes)
- **Variance Analysis** (Analysis on two or more variables) (Use ANOVA techniques)
- **Canonical Analysis** (Analysis both measurable and non-measureable variable for predicting a set of dependent variable from their joint co-variance with a set of independent variable)

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Data Analysis ICT tools

- **Statistical Analysis** (Central tendency, dispersion, skewness, Kurtosis and Association of Attributes, z-test)
- **Descriptive Analysis** (correlation technique, Association of Attributes, distribution theorem of statistics)
- **Correlation Analysis** (methods of correlation, regression with variance)
- **Casual Analysis** (regression analysis with line of equation, co-efficient of variance, co-efficient of deviation, What is analysis and z-test)
- **Multivariate Analysis** (choose/use required appropriate statistical analysis)
- **Multiple regression Analysis** (regression analysis & distribution theorem of statistics)
- **Multiple Discriminant Analysis** (Association of Attributes, ANOVA, classification methods of data mining)
- **Variance Analysis** (statistical variances and ANOVA techniques)
- **Canonical Analysis** (What if Analysis, Data Mining methods (Apriori algorithm, Market Basket Analysis)

Data Processing

- **Data Adding** (Add related data in form of data analysis)
- **Data Editing** (correct/modify related data in form of data analysis)
- **Data Deleting** (delete related data from the existing data analysis)
- **Data Coding** (data coding is a data manipulation or data execution which is used for generating appropriate output/result/report of the data analysis)
- **Tabulation form of Data** (data are arranged in row and column as a matrix form)
- **Data Classification** (Data are classified by below tow category)
    1. **Classification according to attributes (variables)** (Descriptive such as literacy, gender, honesty or numerical such as weight, height, income etc. analysis attributes)
    2. **Classification according to class-interval** (it is quantitative phenomenon which can be measured through some statistical methods such as age between 18 to 35, income between 12000 to 25000 etc.)

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Data Processing ICT tools

- **Data Adding** (Programming and database tools)
- **Data Editing** (Programming and database tools)
- **Data Deleting** (Programming and database tools)
- **Data Coding** (Programming and database tools)
- **Tabulation form of Data** (SQL based database software)
- **Data Classification** (Data are classified by below tow category)
    1. **Classification according to attributes (variables)** **(**NOSQL based database software, XML database, classification technique, Apriori algorithm and Market Basket Analysis of data mining**)**
    2. **Classification according to class-interval** (central tendency, dispersion classification technique of data mining and Association of Attributes of statistics)

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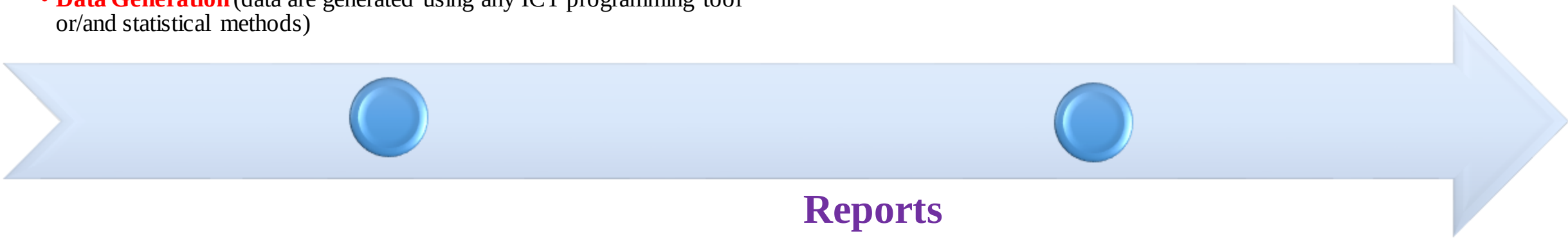
Result and Reports

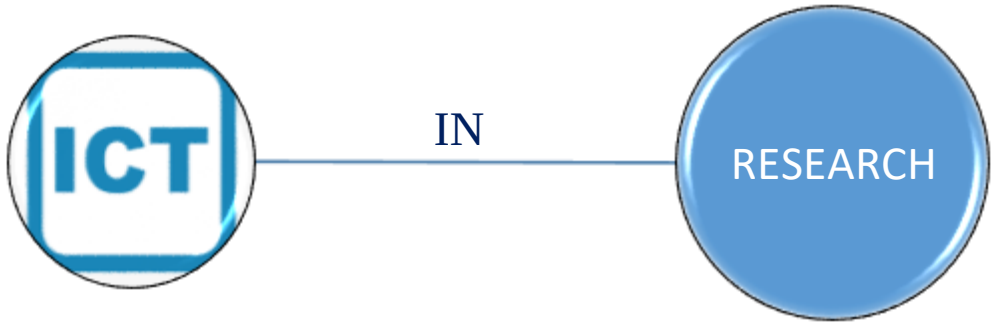
Result

- **Data Manipulation** (Data are manipulated using any ICT tools like programming, databases, miming tools, statistical methods, graphical tools,)
- **Data Execution** (data are executed using any ICT programming tool)
- **Data Evaluation** (Use appropriate statistical methods)
- **Data Assessment** (Use appropriate statistical methods)
- **Data Generation** (data are generated using any ICT programming tool or/and statistical methods)



Reports

- **Data Mining formation** (tabular, cubic, multidimensional, cluster etc.)
- **Statistical formulation** (Data formed using different statistical formulations)
- **Matrix representation** (Row and column wise arrangement of numerical data/information)
- **Graphical representation** (line, bar-chart, histogram, multi-gram, multi-bar chart and UML etc.)



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Statistical and SPSS software tools in research

Statistical analysis

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Referencing (e-governing) tools

SWAYAM Prabha: 32 DTH channel telecast high quality educational programs 24*7. Each program every day repeat five times in a day, new contents of the related subjects (program list mentioned earlier) this channel are uplinked by BISAG gandhinagar, Gujarat.

Contents provided by IITs, NPTEL, UGC, CEC, INFLIBNET bodies, and contents of the all faculties as arts, science, commerce, engineering, medical, social science etc.

National Digital Library: (text-books, articles, notes, video Lectures, etc.) initiated by MHRD

e-Shodh Sindhu: (different Journals, E-books, created by IITs, IIMs, initiated by IIT Gandhinagar)

e-yantra: initiated by MHRD video lecturers for engineering students using hand- on application of mathematics, computer science and engineering principles, handled by IIT Bombay

e-Acharya: E-content and e-books portal for all subjects and all faculties eacharya.inflibnet.ac.in initiated by MHRD, and implemented by IIT Kharagpur

Referencing (e-governing) tools continue….

Sodhganga/INFLIBNET initiated by MHRD for collection of thesis and research articles of the PhD completed scholars as year wise of the each university of India

ERIC (Education Resources Information Center) it the full text database materials for the researchers, educators of the all faculties with the subjects

NPTEL (online video lecturers) initiated by MHRD provide online video lecturers and materials of the all faculties of all subject as topic and chapter wise. lectured by the professor of IITs. NITs, IIS, and IIITs

E-vidwan Information and library network, which expert database and National researcher's network for the following purpose

- **Collect experts profile and research scientist profile, and provide to all as need**
- **Provide information of funding agencies.**
- **Establish directly communication of expert to research scholars.**
- **Identify/Support to search peer review journals and research proposal as requirement of the person**
- **Create platform for information exchange between expert and scientists**

Referencing (e-governing) tools continue….

Research Identification

Indexed of journal (DBLP, UGC, IEEE, ACM, Springer's and SCOPUS, etc.) verification

Journal Impact Factor JIF-(Journal Impact Factor) and ISSN (International Standard Serial Number) verification

Plagiarism (ternitin, urkund, SmallSEOTools.com etc.) for grammar and plagiarism checking platforms

Paid journals and free journals: peer reviewed and reputed journals are available as paid and free of cost on different webs

UGC approved journals: UGC maintains the list of reputed journals, which is updated and available on web link www.ugc.ac.in

E-research papers web sites (like as IAEME journals,(Scopus journals) etc. represents their papers on their own web sites) with year, subject and volume wise in the PDF form.

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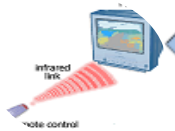
Communication and Data transmission tools

Wireless tools for communication and data transmission

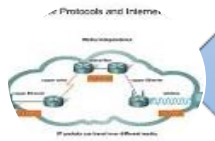
1. Wi-Fi and Li-Fi -Li-Fi (short for *light fidelity*) is wireless communication technology which utilizes light to transmit data and position between devices, In technical terms, Li-Fi is a light communication system that is capable of transmitting data at high speeds over the visible light, ultraviolet, and infrared spectrums. In its present state, only LED lamps can be used for the transmission of visible light.

In terms of its end use, the technology is similar to Wi-Fi -- the key technical difference being that Wi-Fi uses radio frequency to induce a voltage in an antenna to transmit data. Whereas Li-Fi uses the modulation of light intensity to transmit data. Li-Fi can theoretically transmit at speeds of up to 100 Gbit /s. where Wi-Fi 10Gbit/s

2. Blue tooth - Bluetooth is a wireless technology standard used for exchanging data between fixed and mobile devices over short distances using short-wavelength UHF radio waves, from 2.402 GHz to 2.480 GHz, transmitting at 100 mW with a range of 100 meters or 328 feet. Blue tooth wave support Omni directional and does not die with solid object.



3. Infrared – it is also wireless data transmission technology, used for short term data transmission, approximately 24 to 40 foot of range of data live. Infrared wave does not support Omni directional and die with solid object.



4. TCP/IP protocol – (the protocol used for data transmit from web browser to web server and back web server to client machine browser using identifying address of client by IP)

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Wired tools for communication and data transmission

Coaxial cable

Electronic wave

Optical fibre cable

Light wave

Twisted pair cable

Electronic wave

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Non-volatile (virtual and physical) storage tools

Physical data storage tools

- 1. CD/DVD (compact disc /Digital Versatile Disc)
- 2. Hard Drive
- 3. Portable HD
- 4. Pen Drive and zip drive (removable floppy disk)

Virtual data storage tools

- 1. Cloud computing (data storage as dynamic web servers)
- 2. National academic depository
- 3. 'Baadal' (Central Cloud Infrastructure) initiated by MHRD (Services: Virtual Machine, Public IP, Baadal Storage, etc)

Designing tools

for general design and diagram with UML (Unified Modelling Language) diagrams

The following packages are used for designing diagrams for the different purpose as the requirements. Each software has number of functionality for designing the useful diagram

1. **Edraw max**
2. **Gliffy diagram**
3. **Click Chart**
4. **Creately**
5. **MS-visio**

for engineering and graphics design

1. **Corel draw (use for Graphics, engineering and architecture designing tasks)**
2. **MechDesigner (specially robot tool designing, it has cam, motion etc.)**
3. **Autodesk product design suite (Use 2D and 3D drawing)**
4. **MATLAB (used for numerical computation and mathematical function to engineers and mathematician)**
5. **Also available designing software as your specific requirements**

Programming tools for data manipulation using SQL/ NOSQL database

Programming Technology Tools

1. **Java Based technology** (for stand alone and web based output designing) Core Java, Applet, JSP, JDBC, Servlet
2. **Dot Net Technology** (VB.NET & C#.NET programming for stand alone functionality and ASP.NET for web based functionality, .NET also gives the cross platform utility with pure object oriented system)
3. **Web based technology** (HTML, DHTML, XML, PHP, Python and android)

Database Technology tools

1. **SQL based database software**
   1. MS-Access
   2. SQL server
   3. MySQL, SQL plus
   4. Oracle, Sybase, ingress and Progress (these are advanced databases)
2. **NOSQL based database software**
   1. Mongo DB
   2. Neo4j
   3. Cassandra
   4. Hadoop HBASE

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Microsoft Office tools

Use Microsoft Word in Research

MS-word is used for research documentation as for research proposal to thesis. The documentation is created using MS-word with each types of functionality, variations, updating, delete, and modifications facilities

Use MS-Word in research in following tasks

1. Text/File documentation (New, Open, Save, save as)
2. Cut Copy paste (text, paragraph, and page)
3. Formatting text Documents (Correct, delete, update, etc.)
4. Text align (Left , Right, Justify)
5. Find and replace text and string
6. Increase/Decrease font , Bullets and numbering to chapters, heading, sub heading and regular text
7. Page formatting and setting with page margin
8. Font size, font face, color to text, and font italic/bold/regular form
9. Table, Picture and chart
10. Shapes (symbols) and word art

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11. Page numbering and Header/Footer
12. Cover page setting
13. Page orientation and page size
14. Page columns
15. Page color and page border
16. Citation and bibliography
17. Spelling & Grammar (from review menu)
18. Full Screen reading (read book type manually reading)
19. Screen zoom and Pages view (One page, double pages etc.)
20. Print Document (print, print preview)

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Use Microsoft Excel in Research

MS-excel is used for designing tabular/Matrix form documents and numerical calculation of the tabular data and draw the graphs of the related data or tabular data as for supporting research documents. The documentation is created using MS-excel with each types of functionality, variations, updating, delete, and modifications facilities

Use MS-Excel in research in following tasks

1. **File creation (New, Open, Save, save as, Sheet1,Sheet2,Sheet3)**
2. **Raw and Column**
3. **Cut Copy paste (text, paragraph, and page)**
4. **Formatting Excel file (Correct, delete, update, etc.)**
5. **Font size, font face, color to text, and font italic/bold/regular form**
6. **Shapes (symbols) and word art**
7. **Print Document (print, print preview)**
8. **Insert column and raw**
9. **Auto-sum functions**
10. **Table, Picture and chart**
11. **Formulas**
12. **What if Analysis (Scenario Manager, Goal seek)**
13. **copy graph, chart etc. to MS-Word file**
14. **Print**

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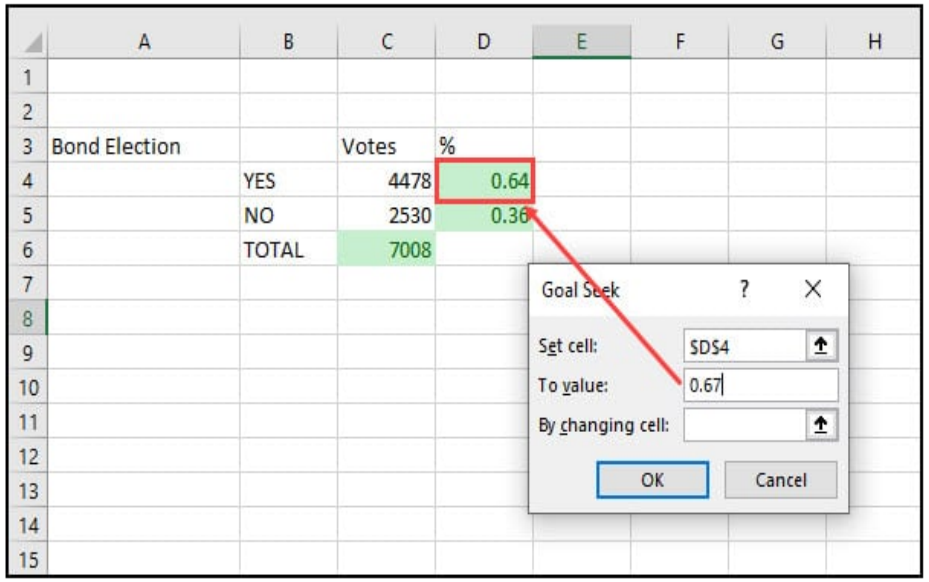
What if Analysis (Goal seek)

What is Goal Seek?

Goal Seek is a built-in Excel tool that allows you to see how one data item in a formula impacts another. You might look at these as "cause and effect" scenarios. It's useful to answer "what if" type questions because you can adjust one cell entry to see the result. The tool is often used in finance, sales, and forecasting scenarios.

2. Click the cell you want to change. This is called the "**Set cell**". In my example, this will be D4.
3. From the **Data** tab, select the **What if Analysis...** button
4. Select **Goal seek...** from the drop down menu
5. In the **Goal Seek** dialog, enter the new "what if" amount in the **To value:** text box.



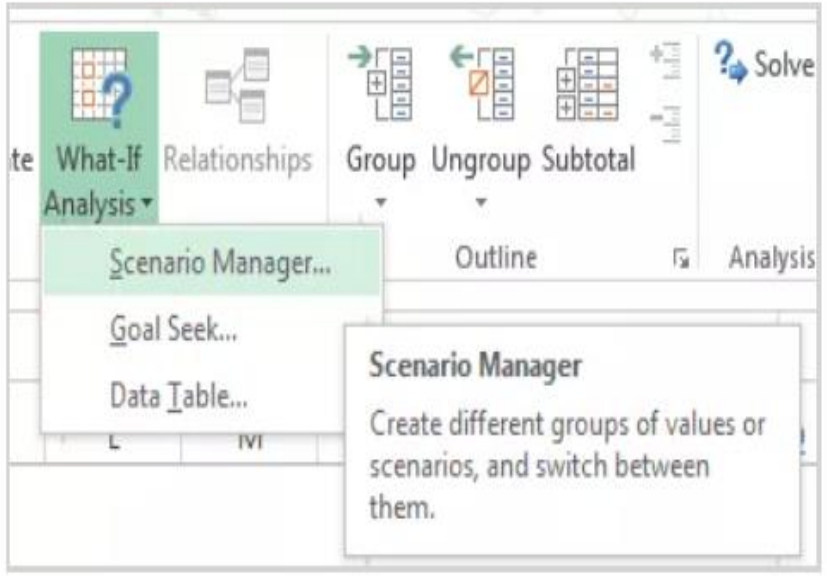
What if Analysis (Scenario Manager)

Scenario manager

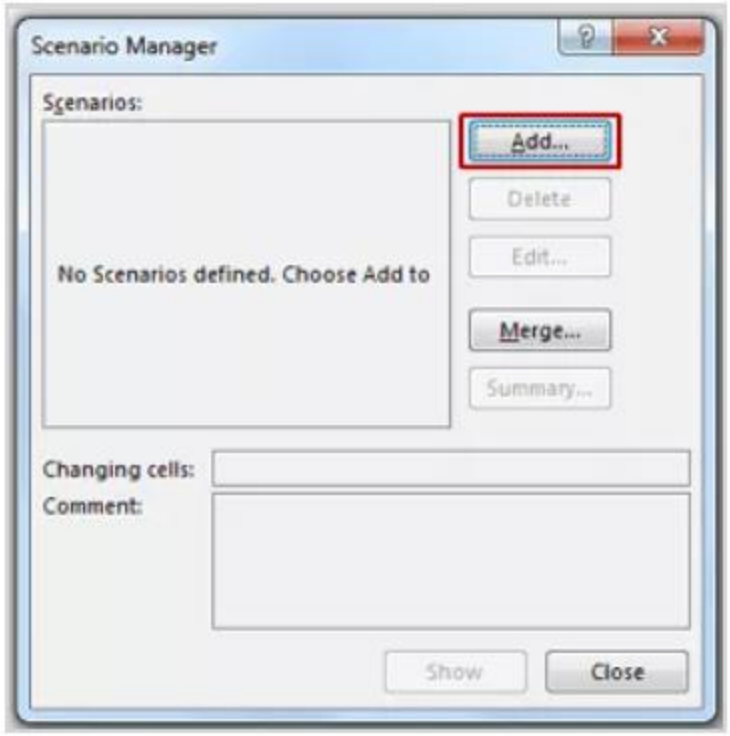
Scenario analysis is a common top-down analytical approach where numerous inputs are modified at a time, consistent with a common theme, and corresponding outputs are then analyzed, e.g. “best case”, “most likely case”, “worst case”.

Setting up Scenario Manager in Excel

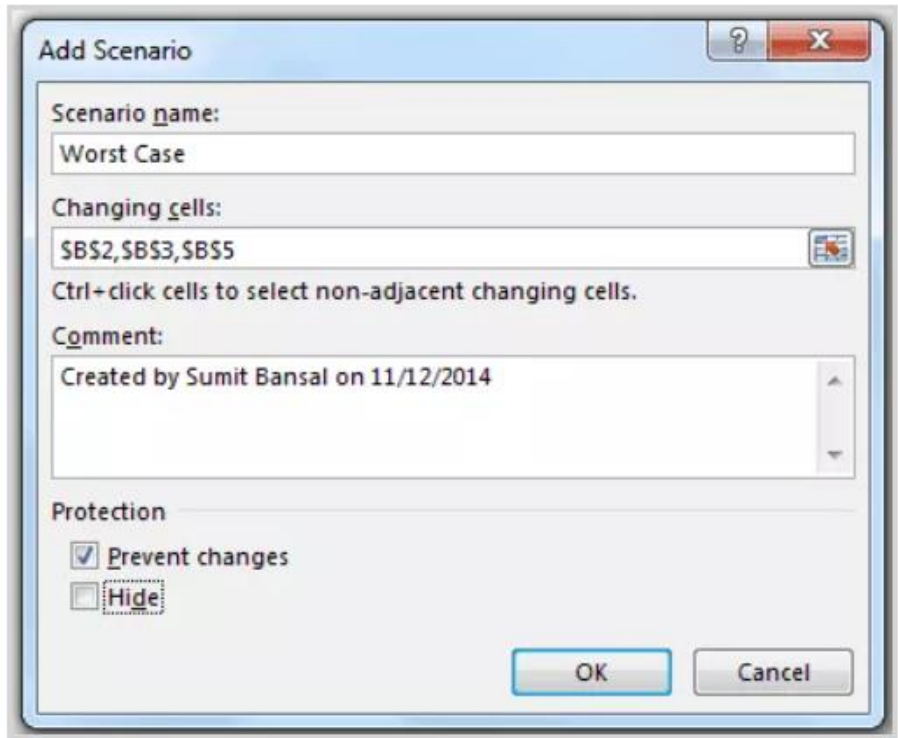
- Go to Data Tab -> Data Tools -> What-If Analysis -> Scenario Manager.



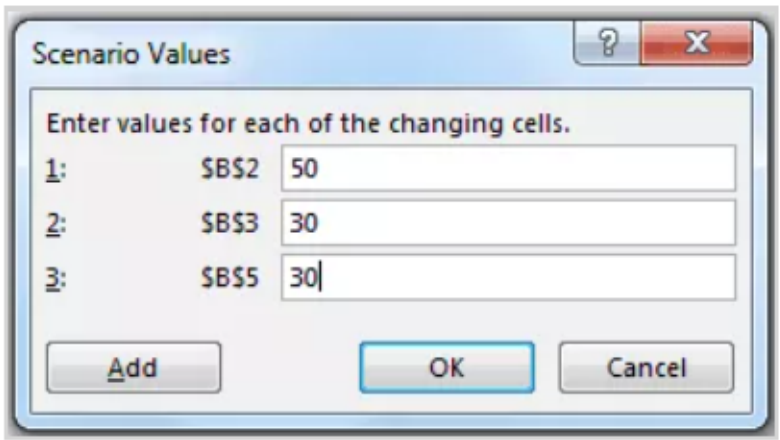
In the Scenario Manager dialogue box, click on Add.



- In the Add Scenario dialogue box, fill in the following details:
  - Scenario name: Worst Case
  - Changing cells: $B$2,$B$3,$B$5 (you can also select it by pressing the CONTROL button and using mouse left-click).
  - Comment: Any comment you wish you add. You can also leave this blank.



- Click OK. This opens the Scenario Values dialogue box.
- In the Scenario Values dialogue box, fill in the following values (since this is the worst case scenario, enter the values accordingly). *If you create names for each cell, that name is visible instead of the cell address*:
  - $B$2: 50
  - $B$3: 30
  - $B$4: 30



- Click OK (Click on Add if you want to add another scenario).

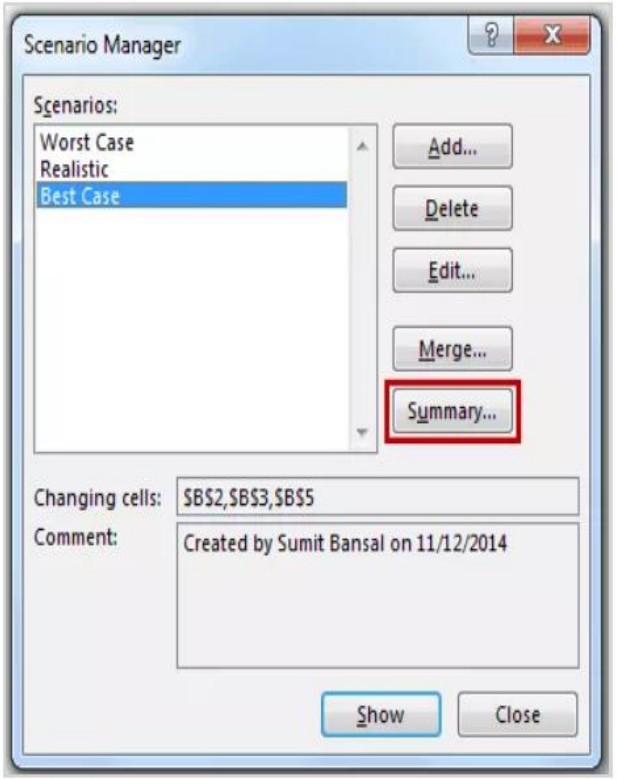
This creates the Worst Case scenario for this data set. You can similarly follow these steps and create multiple scenarios (for example, Worst Case, Realistic, Best Case).

Once you have created all the scenarios, you can view the result from each of the scenarios by simply double clicking on any of the scenario. As you double click, the values would change based on that scenario.

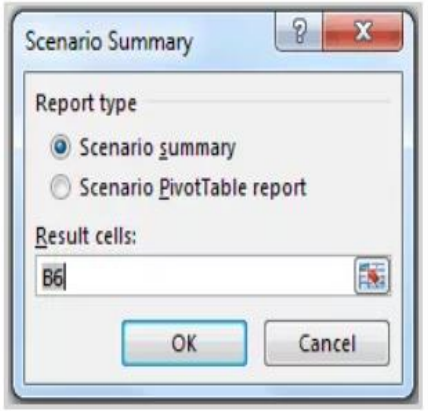
Additionally, you can also ***create a summary of all the scenarios.***

Create a Summary of all the Scenarios

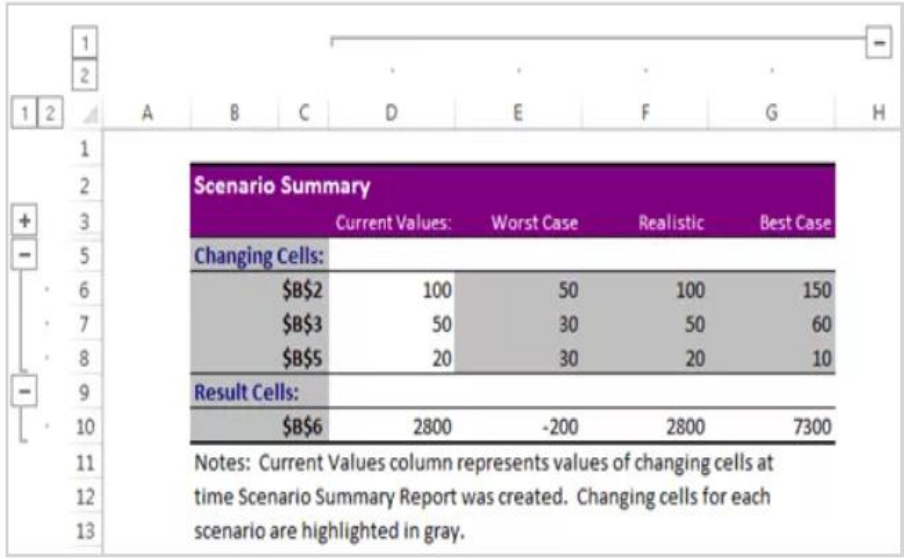
- Click on the Summary button in the Scenario Manager dialogue box.



- In the Scenario Summary dialogue box, select Scenario Summary or Pivot Table (these are the 2 ways to show summary). Also specify the Result cells (the cell where you have the output of this calculation; B6 in this example)



- Click OK. Instantly a new tab is created with the summary of all the three scenarios.



Scenario Summary	Current Values:	Worst Case	Realistic	Best Case
Changing Cells:				
$B$2	100	50	100	150
$B$3	50	30	50	60
$B$5	20	30	20	10
Result Cells:				
$B$6	2800	-200	2800	7300

Notes: Current Values column represents values of changing cells at time Scenario Summary Report was created. Changing cells for each scenario are highlighted in gray.

Use Microsoft Power point in Research

Power point package is used for present the research documents in the appropriate format with formatted text, images for granting to text, represent photos and images respected to documents or task of the research. We can also add animation and SmartArt in the power point slide for batter presentation of the research documents as desire.

Most Features of power point for research documents presentation

1. Adding Smart Art
2. Inserting Shapes
3. Inserting an Image
4. Slide Transitions
5. Adding Animations
6. Exporting as Image, Shapes, Custom Animation, Shortcuts to save time, Color palates, Transition, New Morph Transition, Selection panel, Themes etc.

MS-Access Database (Back-end tool)

MS-access package is used ford data and documents storages as non-volatile basis. Here data are arranged in row and column format as matrix form. Each data has separate cell for storage,

Data are stored using the record, and system provide one row to store one record, here thousand of record are stored and maintained using MS-access tool.

Here collection of records are called class, each class has number of related record, and class is called **table** in MS-access and each other databases as mentioned above.

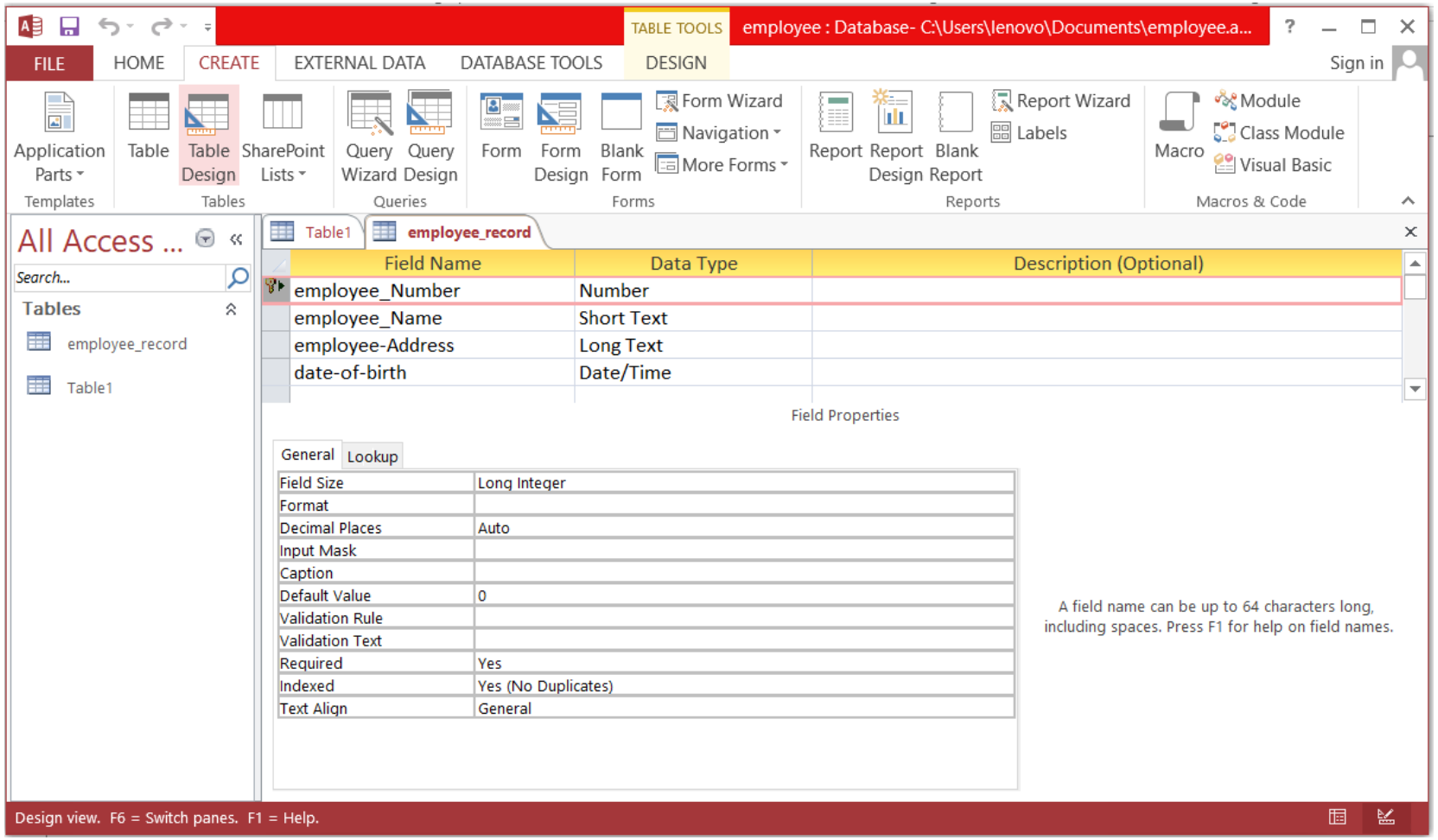
So, we have to create a database file for each class for record storage, here record is the collection of data, and class is the collection of record, which is called file/table in MS-access.

To creating a data table for data storage, first we have to create database and give the appropriate name to database and can create number of tables/files as your requirements

For example the following is the example to create the **database structure** of each table

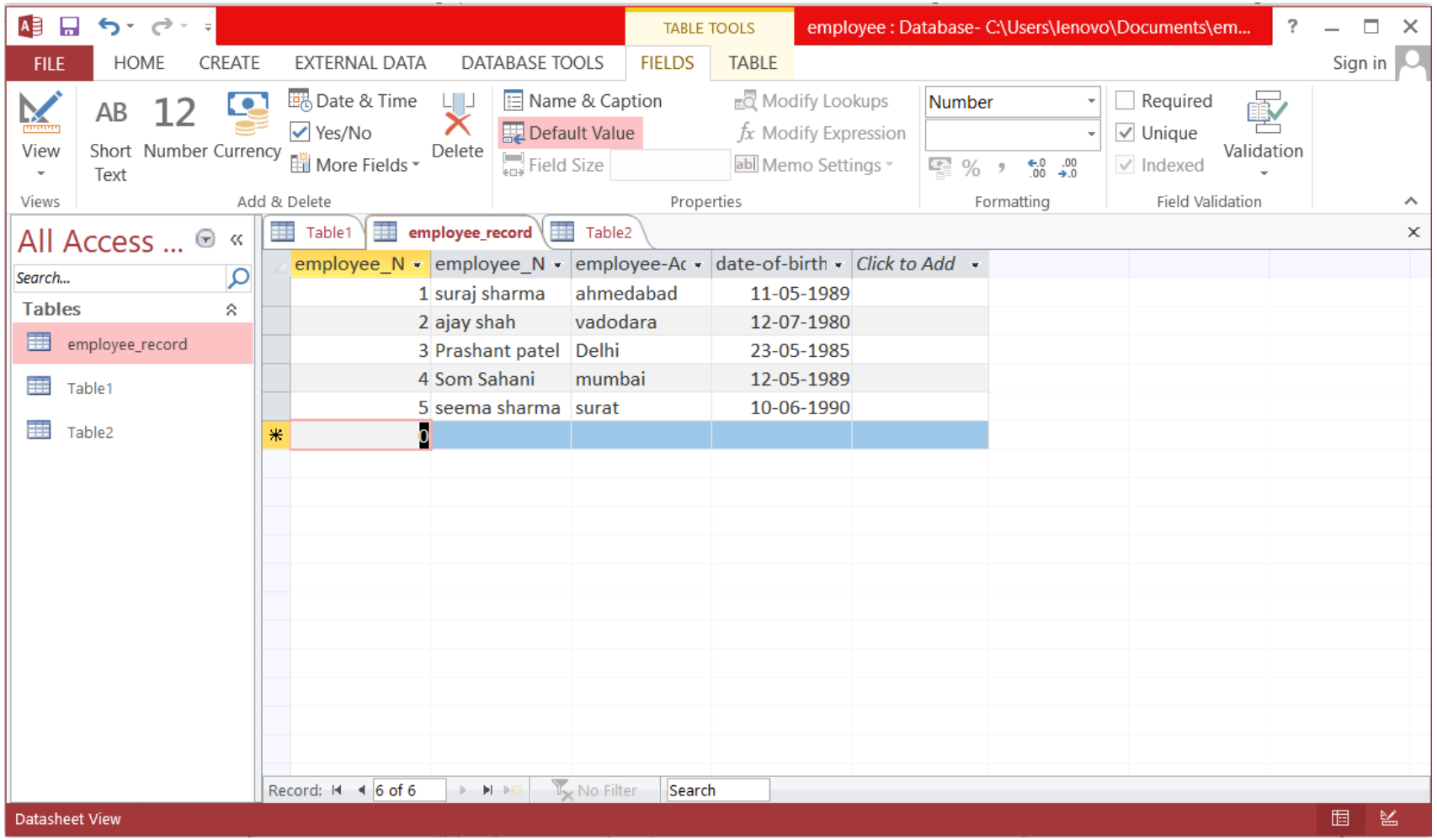
Database structure

Here, this is the structure of the table, and database name is employee, and table name is employee_record. We can create number of tables in one database



Add records in table

After creating a table structure, we can add the record of the each employees of the company. Here we have to create five record of the employees.



Networking Hardware tools for data communication

Hub (HW device for LAN and peer data communication between clients by hub)

Repeater (HW device, regenerate data signals and forward to onward)

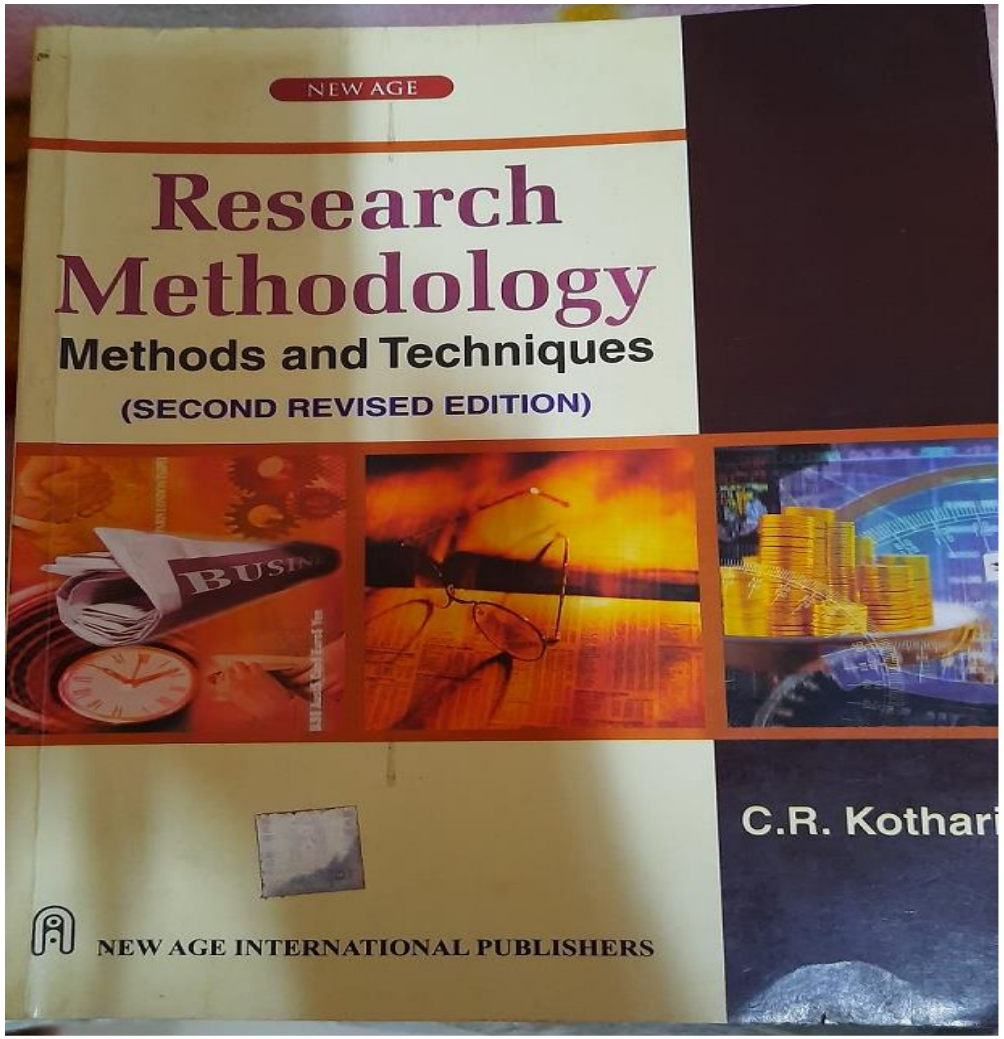
Bridge (HW & SW device connect two separate network)

Router (HW and SW start device for data transmission using TCP)

Getaway (Manage different types of data from one network to another network e:q Chinese to Swiss)

HOME

Reference Book



Return

Thanks

from

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