

A B C D - of Health Research

“ANY BODY CAN DO RESEARCH”



Prof. (Dr) P.R.SURESH



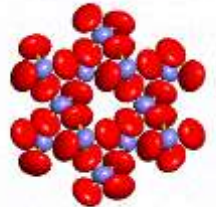
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An Instructor's Handout

Health Research Methodology

Research helps us **create new knowledge** and **develop proper tools** for the use of existing knowledge.



Not only does it enable health care providers to diagnose and treat diseases, research also **provides evidence for policies and decisions** on health and



Comment.
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Health Research Methodology

📌 What is research?



Research is the **systematic collection, analysis and interpretation of data** to **answer a certain question or solve a problem.**

📌 Characteristics of research:

**Research =
re- search**




1. It demands a clear statement of the problem.
2. It requires clear objectives and a plan (*it is not aimlessly looking for something in order to come across a solution*).
3. It builds on existing data, using both positive and negative findings.



4. **Raw data** should be systematically collected and analyzed **to answer the original research objectives.**



 Research in common parlance refers to a search for knowledge.

 Research is either discovery of new facts,
articulation of new principles, or fresh
interpretation of the known facts or principles.

 Research is a scientific and systematic search
 pertinent information on a specific topic.

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Characteristics of Good Researcher

Open mindedness,



Knowledge of specific subject,

Intellectual curiosity

Perseverance



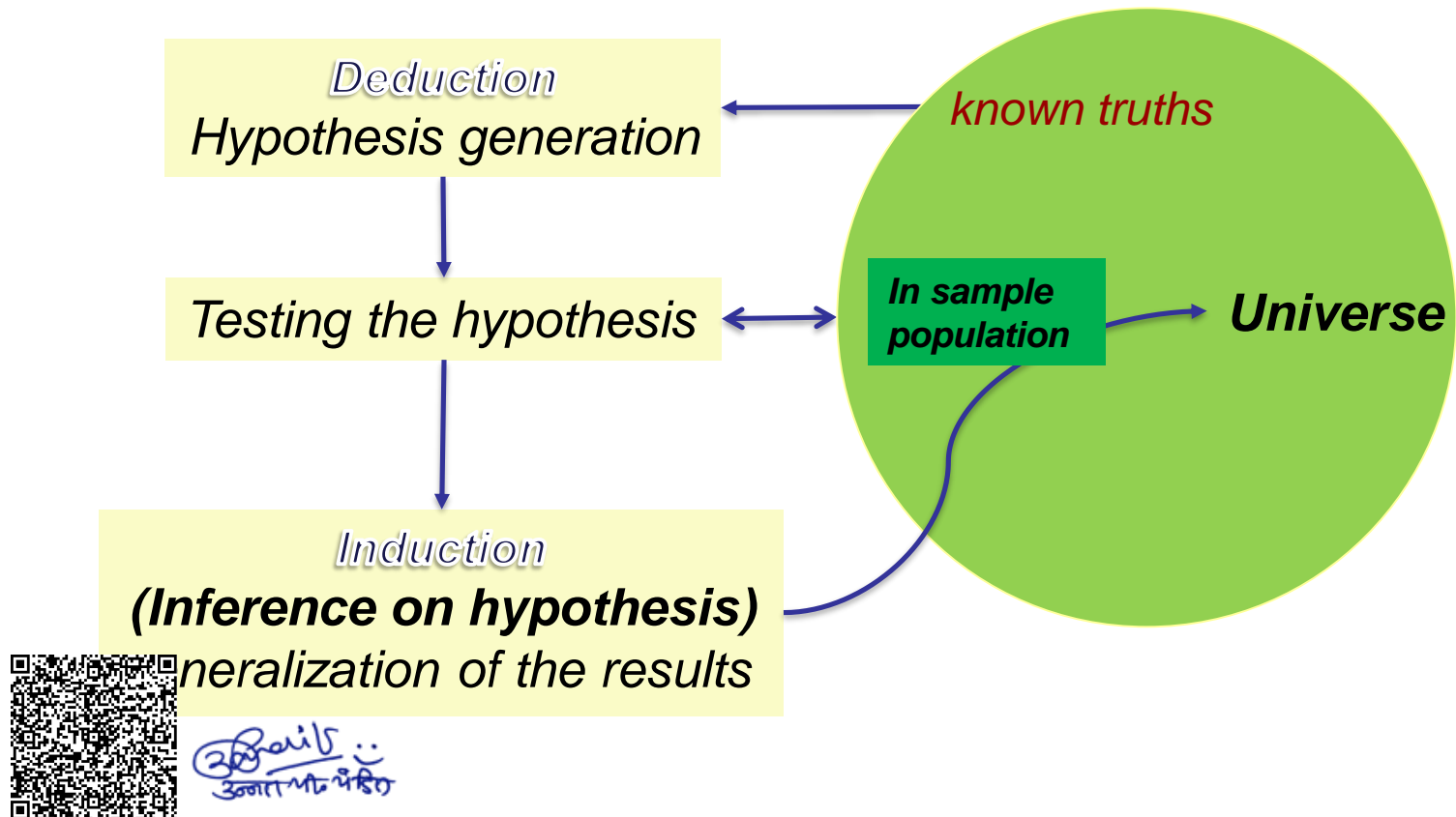
Honesty
असतो मा सद्गमय
ॐ नमो भगवते वासुदेवाय



Basics of Medical Research

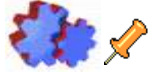
Scientific research

is an integrated approach/ of deduction and induction

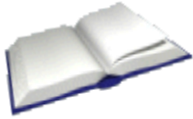


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MOTIVATION in Health Research:



Searching and Critically appraising the medical literature.



Independent Continued learning.



Writing Research Papers.



Gave me lot of kudos!



Made us a better clinician – an astute clinician



Gave us name, fame and travel opportunities



Overall personality development



Societal benefits



Promotion & Incentive.



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Santosh



Levels of Medical Research



● **FIRST LEVEL OF RESEARCH –
MASTER’S THESIS.**



● **SECOND LEVEL OF RESEARCH –
DOCTORAL DISSERTATION.**

● **THIRD LEVEL OF RESEARCH –
INSTITUTIONAL STUDY.**



● **FOURTH LEVEL OF RESEARCH –
MULTICENTRIC STUDY.**



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Challenges of Medical Research

- Unnecessary burden beyond teaching and patient care

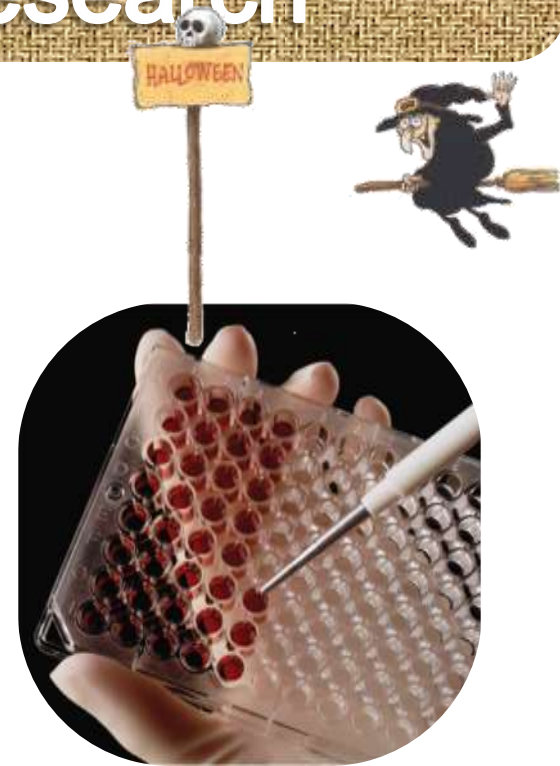
- Should be compulsory

- Not everyone can do it -
should be done by select few

- Promotion evaluation independent
of research achievements



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Steps in Medical Research



PREINVESTIGATION STEPS

- IDENTIFY THE PROBLEM
- COLLECT & EVALUATE EXISTING INFORMATION
- FORMULATE RESEARCH OBJECTIVES AND HYPOTHESES
- IDENTIFY THE STUDY SUBJECTS
- THINK OF A DESIGN
- APPROVE THE PROTOCOL
- DEVELOP THE TOOLS.



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INVESTIGATION STEPS

- PRETEST AND DO PILOT STUDY
- COLLECT THE DATA
- HANDLE THE NONRESPONSE AND ETHICAL ISSUES
- SCRUTINISE THE DATA.

..... ▶▶ ▶▶ ▶▶ ▶▶

Steps in Medical Research

POSTINVESTIGATION STEPS

- ANALYSE THE DATA
- INTERPRET THE RESULTS
- WRITE AND DISSEMINATE THE REPORT
- MONITOR THE



CTIONS.
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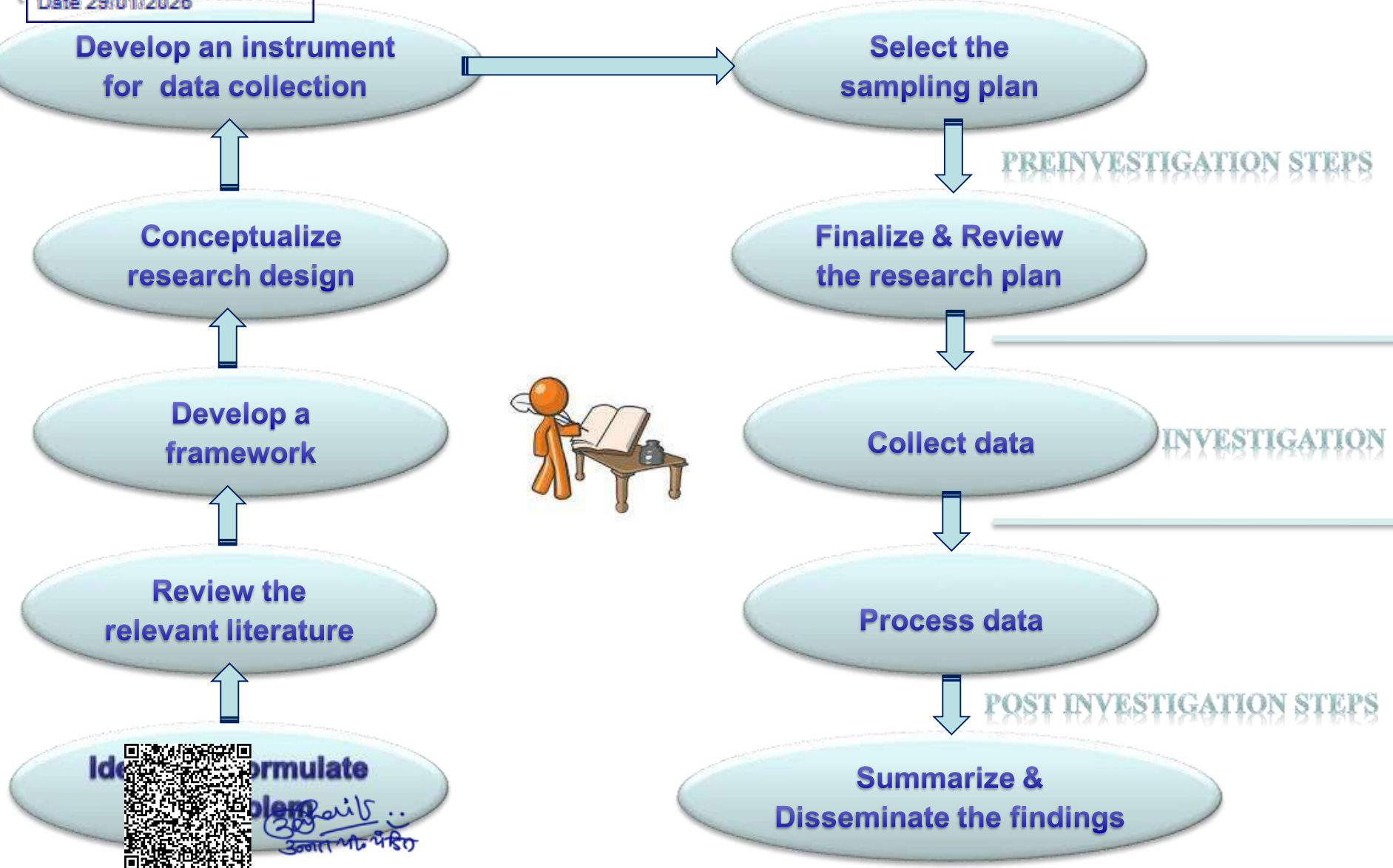
PLEASURES & FRUSTRATIONS OF MEDICAL RESEARCH

- ERRORS IN REPORTING RESEARCH
- FRUITS OF MEDICAL RESEARCH.



Health Research Methodology

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STEPS OF RESEARCH PROCESS IN FLOW CHART

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Select & Field test an already constructed instrument

Choose b/n Quantitative & Qualitative research design

Identify & Develop conceptual definitions

Analysis & Synthesis the findings from the studies

formulate research questions
search literature
formulate hypothesis

Develop an instrument for data collection

Conceptualize research design

Develop a framework

Review the relevant literature

Identify & formulate the problem

Select the sampling plan

Finalize & Review the research plan

Collect data

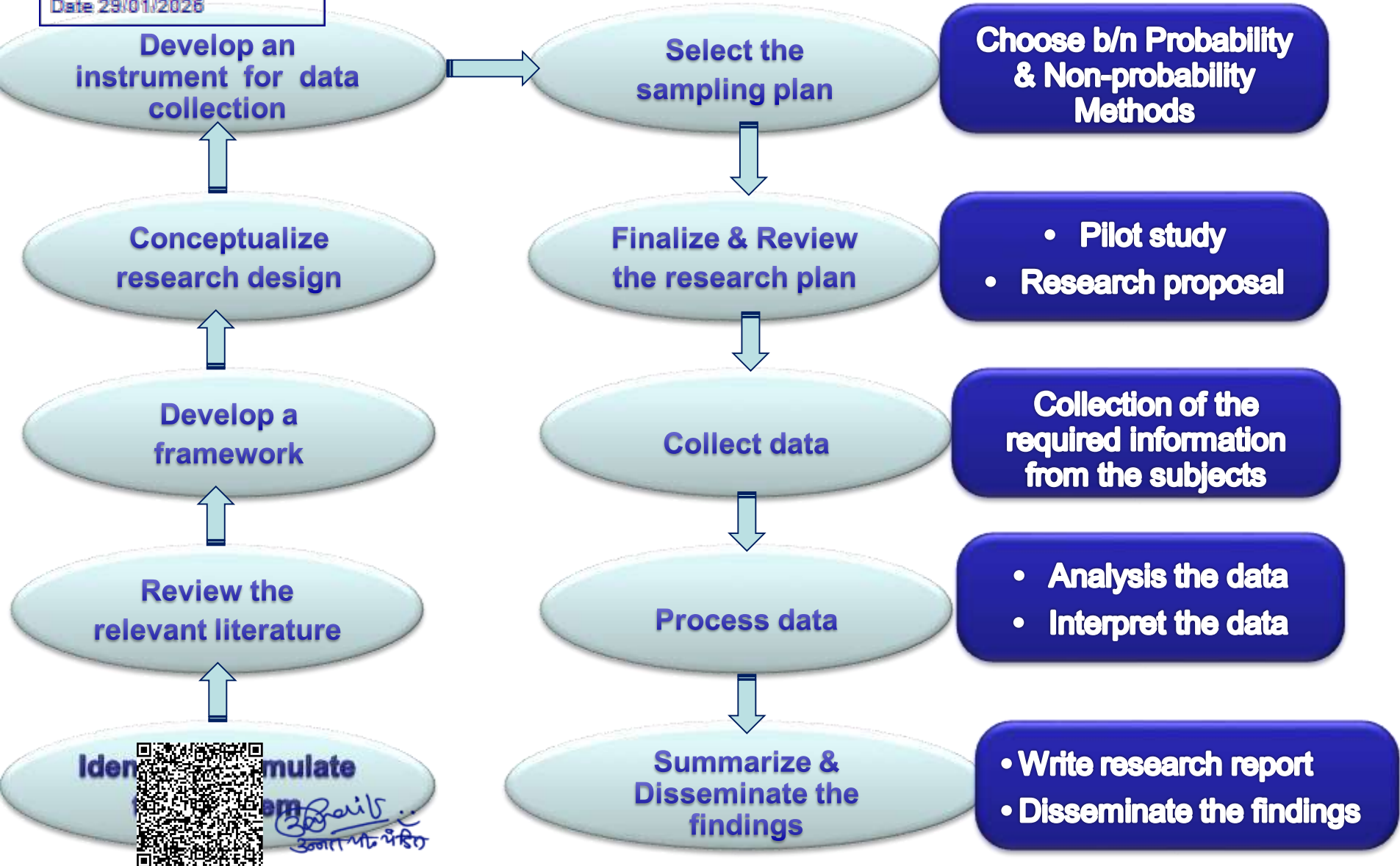
Process data

Summarize & Disseminate the findings

STEPS OF RESEARCH PROCESS IN FLOW CHART

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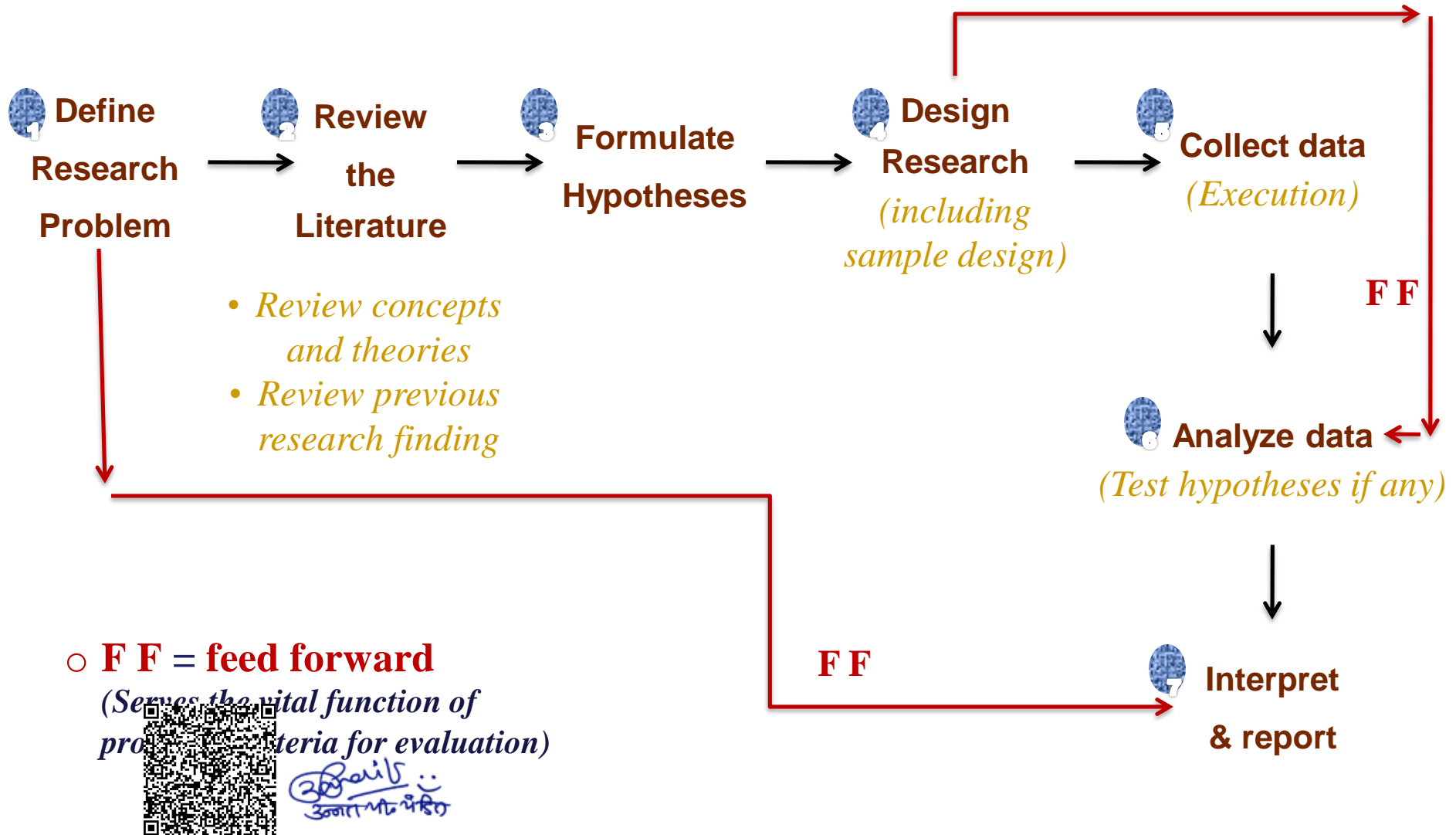
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STEPS OF RESEARCH PROCESS IN FLOW CHART

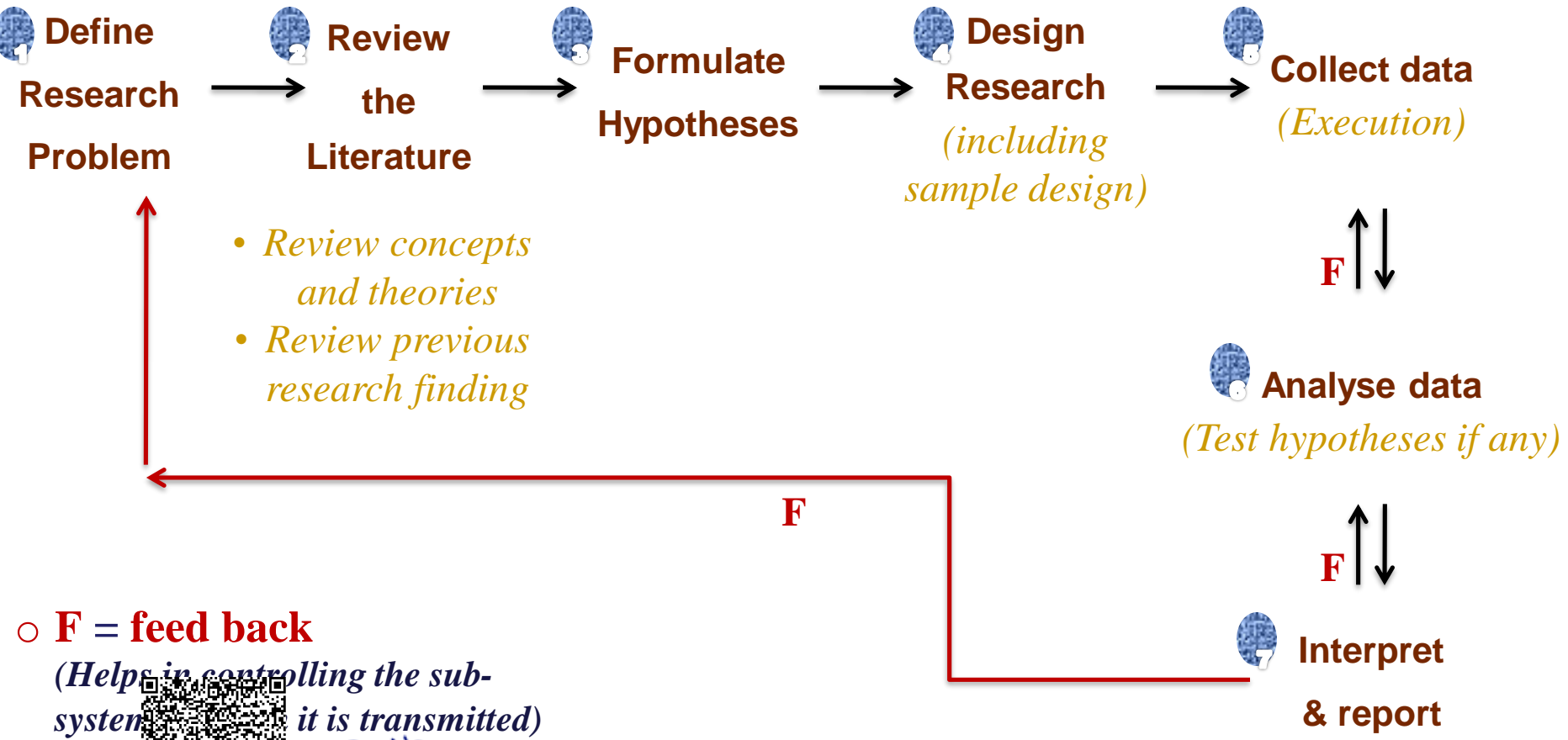
Health Research Methodology

FF = feed forward



Health Research Methodology

F = feed back



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Characteristics of a Good Research Question

The book mentions 5 important characteristics of a good research question. It should be -

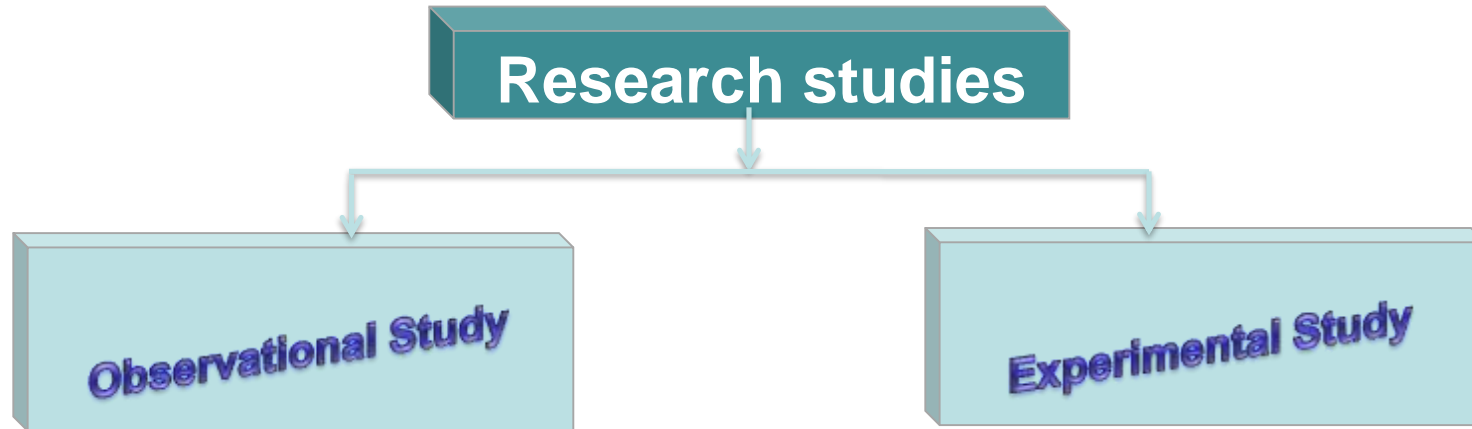
1. **Feasible:** will it be feasible to complete the project in terms of Scope, Time, Expense, Number of subjects, Technical expertise, Equipment.
2. **Interesting**
3. **Novel**
4. **Ethical**
5. **Relevant**



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Types of Research Studies



Observational

- ✎ Identify subjects, then
- ✎ Observe and record characteristics



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Experimental

- ✎ Identify subjects,
- ✎ Place in common context,
- ✎ Intervene, then
- ✎ Observe effects of intervention

Types of Research Studies

Observation Vs Experiment

- Observations are readily obtained, but subject to bias, *that is systematic errors*
- Some observational designs are less subject to bias than others
- Experiments are hard to do well
- Experiments can answer narrow questions definitively
- Generalizability of results from experiments may be at issue, *eg new drug testing that excludes women subjects*



Types of Research Studies

Research studies

Observational Study
(the study does not involve any intervention/ exposure)

Experimental Study
(the study involve any intervention/ exposure)

Analytical Study
(Comparison group also studied)

Descriptive Study
(No Comparison group)

Randomized Study

Non-Randomized Study

Cohort Study

Case control Study

Cross sectional Study

Controlled Study
(control group in the study)

Uncontrolled Study
(no control group)

Cohort Study



Roman word = an army group of 500 soldiers

- **Forward looking / Prospective study**
- **Study that moves logically from exposure to outcome**
- **A group of subjects (the cohort) is followed over time.**
- **“For example, an investigator examines a group of Smokers vs. Non-smokers over a period of time & observe the development of lung cancer.”**



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Case control Study


- **Backward looking / Retrospective study**
- Study that starts with the **outcome** & looks backwards at the **exposure**. 
- A group of subjects (the cohort) is **followed over time**.
- “For example, an investigator examines an association b/n Peptic ulcer (out come) & use of NSAIDs (exposure) will starts from the identification of the patients with Peptic ulcer .”
- p  h Peptic ulcer as “**Cases**” & those without as “**Controls**”.

Cross sectional Study

- Measurement of exposure of interest and outcome of interest is carried out at the same time (*e.g. Obesity and Hypertension*).
- There is no in-built directionality as both exposure and outcome are present in the study subject for quite some time
- Deals with the situation existing at a given time (*during a given period*) in a group or population.



Randomized Controlled Study

- A study design that **randomly assigns participants** into an experimental group or a control group.
- As the study is conducted, the only expected difference between the control and experimental groups in a randomized controlled trial (RCT) is the **outcome variable being studied**.
- Good randomization will **“wash out” any population bias**
- **Easier to blind/mask** than observational studies
- **R**  **can be analyzed** with well known statistical tools.

Randomized Double Blind Controlled Study

- **Double-blind Study** - an experimental procedure in which neither the subjects of the experiment nor the persons administering the experiment know the critical aspects of the experiment.
- A Double-blind Procedure is used to guard against both experimenter bias and placebo effects.



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Review-Types of Research Studies

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Research studies

Observational Study

(the study does not involve any intervention/ exposure)

Analytical Study

Descriptive Study

Cohort Study

Case control Study

Cross sectional Study

Experimental Study

(the study involve any intervention/ exposure)

Randomized Study

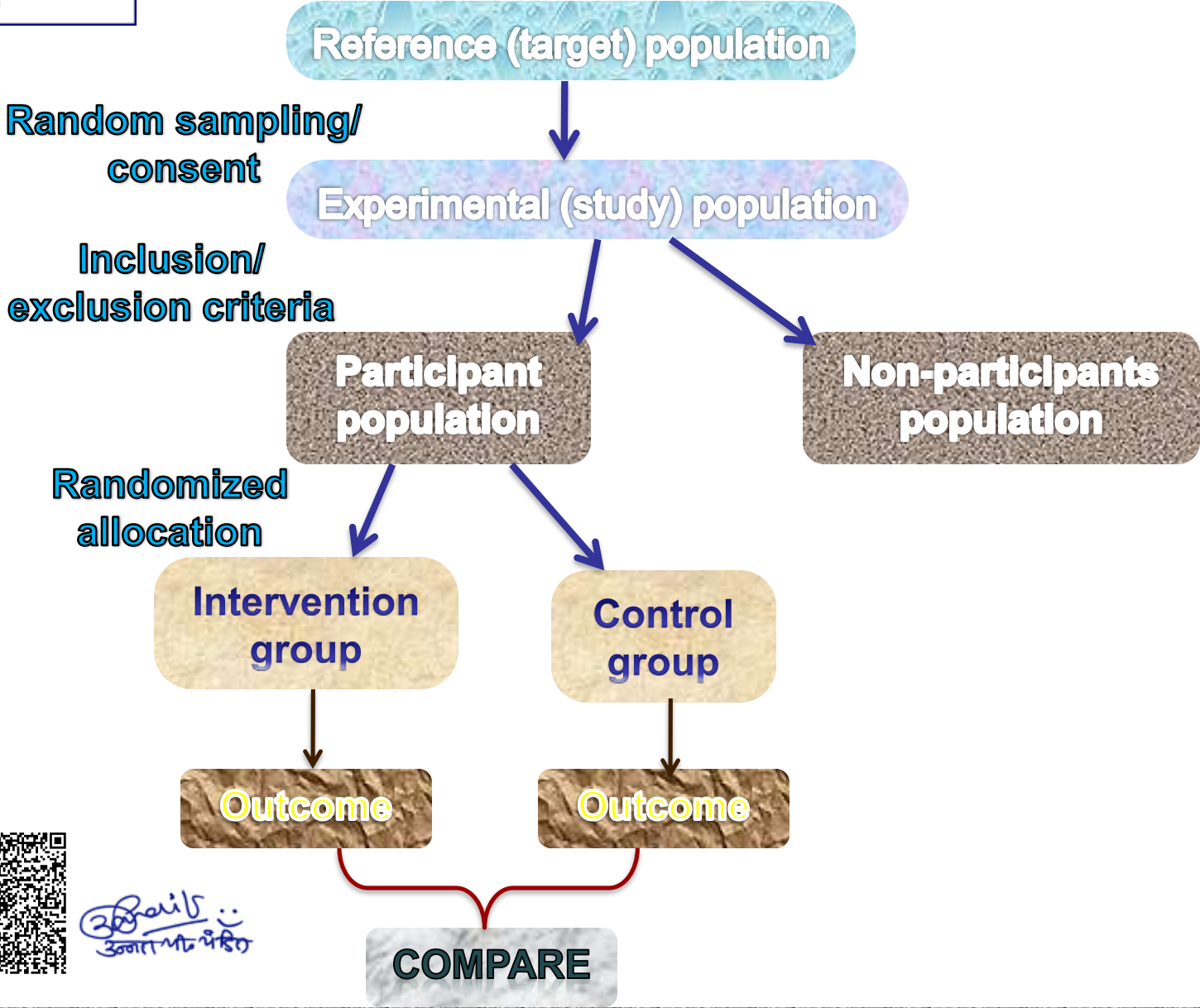
Non-Randomized Study

Controlled Study

Uncontrolled Study

FLOW CHART OF AN EXPERIMENT STUDY

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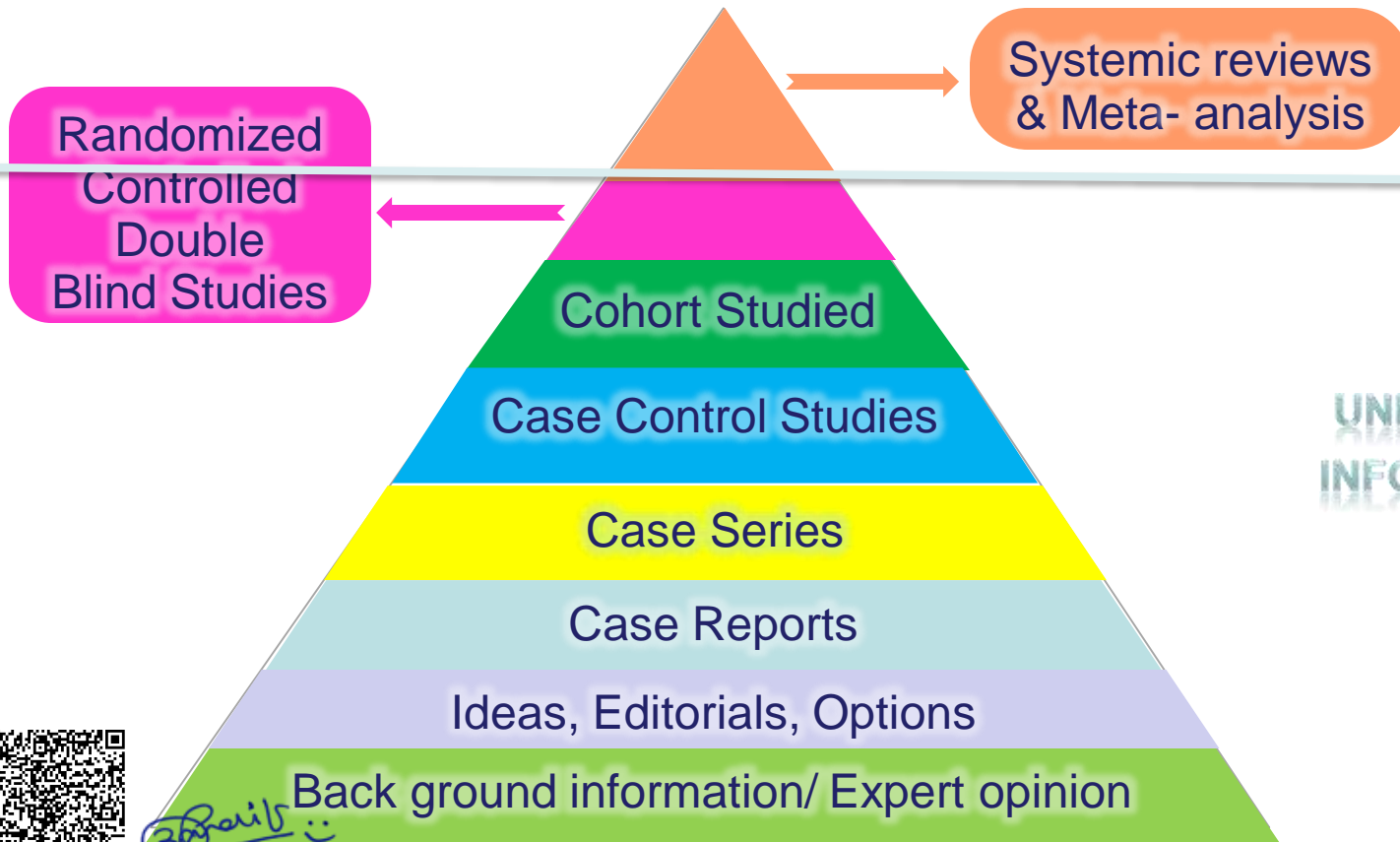
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COMPARE



THE HIERARCHY OF EVIDENCE

FILTERED
INFORMATION



UNFILTERED
INFORMATION



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अज्ञानमोक्ष संस्थान

Systematic review

- A document often written by a panel that provides a comprehensive review of all relevant studies on a particular clinical or health-related topic/question.
- The systematic review is created after reviewing and combining all the information from both published and unpublished studies (*focusing on clinical trials of similar treatments*) and then summarizing the findings.



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Meta-analysis



- A "**meta-analysis**" is a statistical approach to combine the data derived from a systematic-review.
- Therefore, every meta-analysis should be based on an underlying systematic review, but not every systematic review leads to a meta-analysis.



$$+ \frac{\mu_1 - \mu_2}{\sigma}$$

COMMON TERMS/ APPLICATIONS IN Health Research Methodology




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आर्य समाज





Subjects

- ▶ The **peoples who take part in a research** are called subjects, these participants must be defined carefully & clearly.
- ▶ A very important point: we do't want our results to apply only small sample or group people you used in the experiment, so we sh'd able to **Generalize** our results.
- ▶ The sample selected for the study must be sufficiently large & representative (*Eg: 15-20pts/ group*).
- ▶ The subjects shall be selected **Randomly** to make sure generalization.
- ▶  **Ethical** handling with subjects.

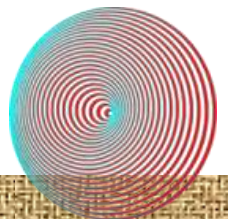


Hypothesis

- Hypothesis is a conjectural statement of relationship between two or more variable (*Kerlinger, Fried N, Foundations of Behavioural Research , 3rd edition, New York: Holt, Rinehart and Winston, 1986*).
- A hypothesis is written in such a way that it can be proven or disproven by valid and reliable data – in order to obtain these data that we perform our study (*Grinnell, Richard, Jr. Social Work Research and Evaluation, 3rd edition, Itasca, Illinois, F.E. Peacock Publishers, 988*).
- Experimental Hypothesis thus predict a relation b/n 2 or more things known as **Variables**.








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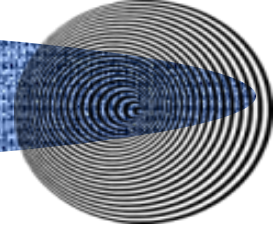
Hypothesis

Things to remember during formulating
Hypothesis:



-  I. It sh'd be testable,
-  II. It sh'd be realistic in it's aims/
something do-able.
-    The variables sh'd be properly defined.

Hypothesis




- **Experimental Hypothesis (H_1):** starting point of any research is Research/ Working/ Alternative hypothesis.
- A suitable project is designed & carried out to test the H_1 .
- **Null Hypothesis (H_0):** it says there is no relationship & that any results get from the research project are due to chance & not to any real.
- The H_0 is simply to predict *no relationship* b/n the 2 variables.
- **Note:** H_0 predicts no relationship; it doesn't predict the **opposite** of the H_1 .



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Hypothesis

Activity- assume the research questions

1. Children with leg #s progress faster on traction than adolescents with leg #s.
2. It is predicted that female and male participants will differ in the frequency with which they nominate smell as their favorite sense.
3. Men are more likely to suffer chest infections following Cardiothoracic surgery than are women.
4. Independent Diagnostic labs achieve better results for culture & sensitivity than Hospital attached ones.
5. There is a difference in the professional competence b/n
ts who trained in hospital based colleges & those who
trained in University based colleges.

Null-Hypothesis

Activity- assume the H_0 for the previous H_1

1. There is no difference b/n age of pts & progress rate on traction following leg #.
2. Both female and male participants are similar in the frequency with which they nominate smell as their favorite sense.
3. There is no relationship with sex of patient & incidence of chest infections following Cardiothoracic surgery.
4. Both Independent Diagnostic labs & Hospital attached ones have same results for Culture & Sensitivity
5. There is no significant difference in the professional competence b/n students who trained in hospital based colleges & those who trained in University based colleges.



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उत्कृष्ट शिक्षण

Quantitative Vs Qualitative Research



QUANTITATIVE

- are Measurable,
- Information are numerical in nature
- *Eg: B.P, Temp', distance walked,*



B.S level...
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QUALITATIVE

- Subjective data,
- *Eg: Views, feelings, beliefs, colour ...*
- A holistic approach »
Risk of Bias is high.

Prospective Vs Retrospective



**Forward looking /
Prospective study**

**Backward looking /
Retrospective study**

■ one in which the data to be studied are yet to be generated, the events having not yet occurred.

■ one based on examination of existing data, on events that have already occurred.

■ **E.g.: Cohort Study**



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■ **E.g.: Case control Study**

Prospective Vs Retrospective

Study: Effect of Marijuana on Cocaine use

RETROSPECTIVE

Sample of 1000
cocaine addicts

“Before using cocaine, did you smoke
marijuana on a frequent basis?”

Yes = 97%

No = 3%

Study concludes:

“Marijuana leads to cocaine use.”

PROSPECTIVE

Sample of 1000
college students

• “Have you ever smoked marijuana on a
frequent basis?”

Yes = 38%

No = 62%

• If yes, “Have you ever used cocaine?”

Yes = 18%

No = 82%

Study concludes:

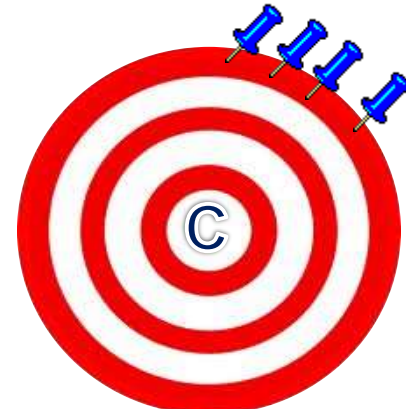
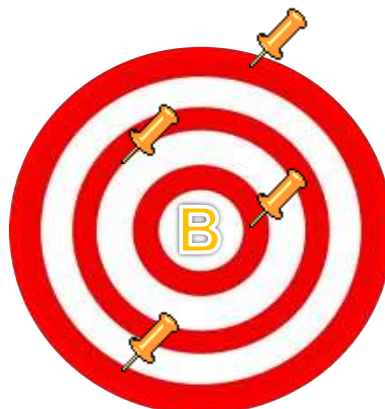
“Marijuana does not lead to cocaine use.”



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Validity Vs Reliability

- ❗ Good Researchers uses **Procedures, Methods and Techniques** that have been tested for their validity and reliability.
- ❗ *Validity* means that correct procedures have been applied to find answers to a question.
- ❗ *Reliability* refers to the quality of a measurement procedure that provides repeatability and accuracy.



None

Reliable



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WORK OVER

Validity Vs Reliability

WHICH ONE IS VALID/ RELIABLE

✍ Student A is scoring 30% for three internal exams.
Reliable

✍ Student B is scoring 23% for I, 84% for II & 50% for III internal exams.
None

✍ Student C is scoring 60% for I, 91% for II & 50% for III internal exams.
Valid



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Independent Vs Dependent Variable

- ✦ Hypothesis predicts a relationship b/n 2 variables.
- ✦ This relationship actually exists is to alter one of these variables to see what difference it makes the other. This alterations is known as **Manipulation of Variables**.
- ✦ This is the basis of experimental design.
- ✦ The Variable which is manipulated is called the **Independent Variable (IV)** & the variable as a result of the manipulation is known the **Dependant Variable (DV)**.

✦ T can be thought of as the cause & the DV as the effect

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Independent Vs Dependent Variable

Activity- assume the Variables out of these H_0

1. There is no difference b/n age of pts & progress rate on traction following leg #.
2. Both female and male participants are similar in the frequency with which they nominate smell as their favorite sense.
3. There is no relationship with sex of patient & incidence of chest infections following Cardiothoracic surgery.
4. Both Independent Diagnostic labs & Hospital attached ones have same results for Culture & Sensitivity
5. There is no significant difference in the professional competence b/n students who trained in hospital based colleges & those who trained in University based colleges.




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Independent Vs Dependent Variable

WORK OUT

- ✦ Activity- assume the IV & DV for the previous H1.
- ✦ *Tip to make the task easier – just ask which variable depends on which.*

IV

1. Age of patients
2. Sex of patients
3. Sex of patients
4. Types of Lab set
5.  of Institute

DV

1. Recovery rate
2. Frequency of smell sense
3. Incidence of Chest infection
4. Quality of Culture & sensitivity
5. Professional skill of students

Research Designs

Data from research must be presented in a way that can be understood by others. The 2 ways of doing this are:

- **Descriptive statistics**, which summarize the main features of the results from a survey by describing the average scores, etc.
- **Inferential statistics** which are used to test hypothesis & which involves selecting a small sample of people for the study & from the results of this, allowing the researcher to make inference about the population from which the sample was drawn.

In other words the descriptive sample allows the researcher to make the statements only about the results obtained, but do't permit any assumptions to be made beyond the data collection, where as inferential allow the researcher to make assumptions beyond the set of data in front of her/ him



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Experimental Vs Correlational

- ◆ **Experimental designs** involve manipulating the IV & measuring the effect of this on the DV. The IV can be thought of as cause & the DV as effect.
- ◆ **Correlational designs** also have 2 variables in the hypothesis, but neither is manipulated. Therefore there is no IV & DV. As a result it can't be ascertained which variable is having an effect on the other. All that can be established is whether or not **scores** on the 2 variables are linked in some way.



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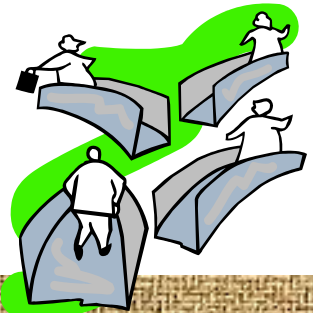
Sampling

- While carrying out a piece of research it is impossible to involve every person who might be of interest to you, both for practical and financial reason.
- A sample is a subset of the population.
- To ensure that the sample is pretty well representative



population from which they are drawn.

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Types of Sampling

★ **Probability sample** – a method of sampling that uses of random selection so that all units/ cases in the population have an equal probability of being chosen.

★ **Non-probability sample** – does not involve random selection and methods are not based on the rationale

of probability theory.



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Types of Sampling

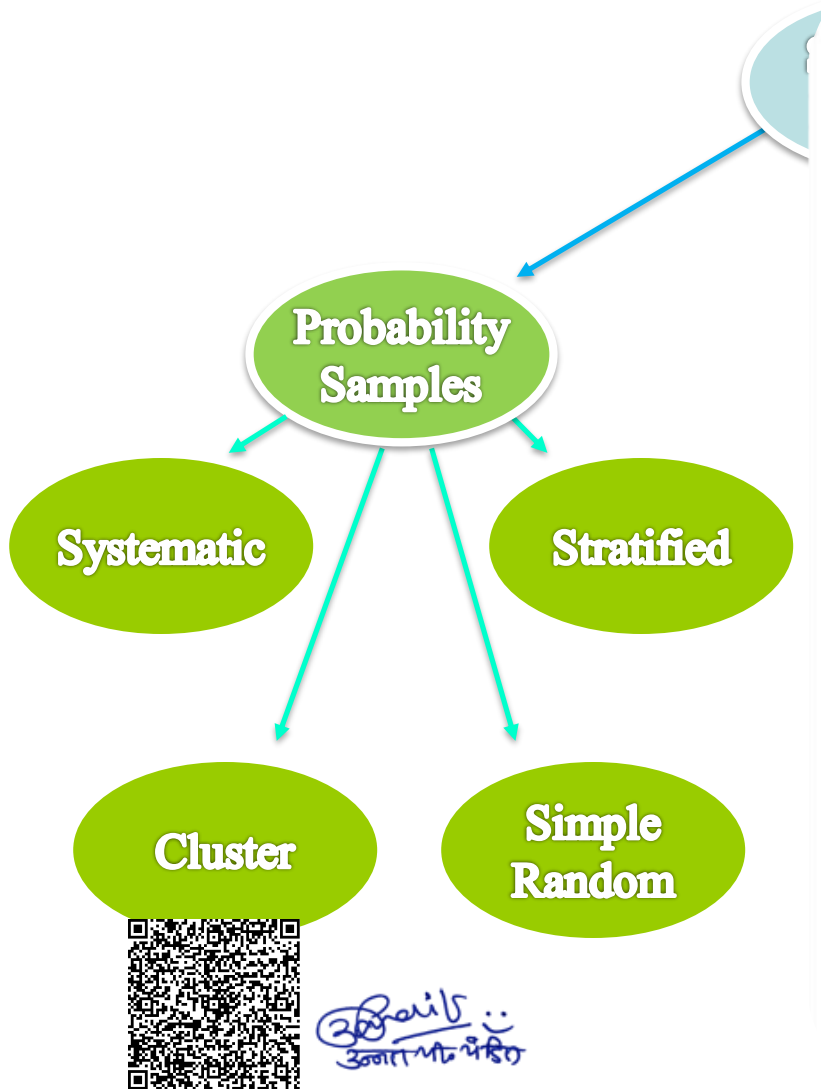
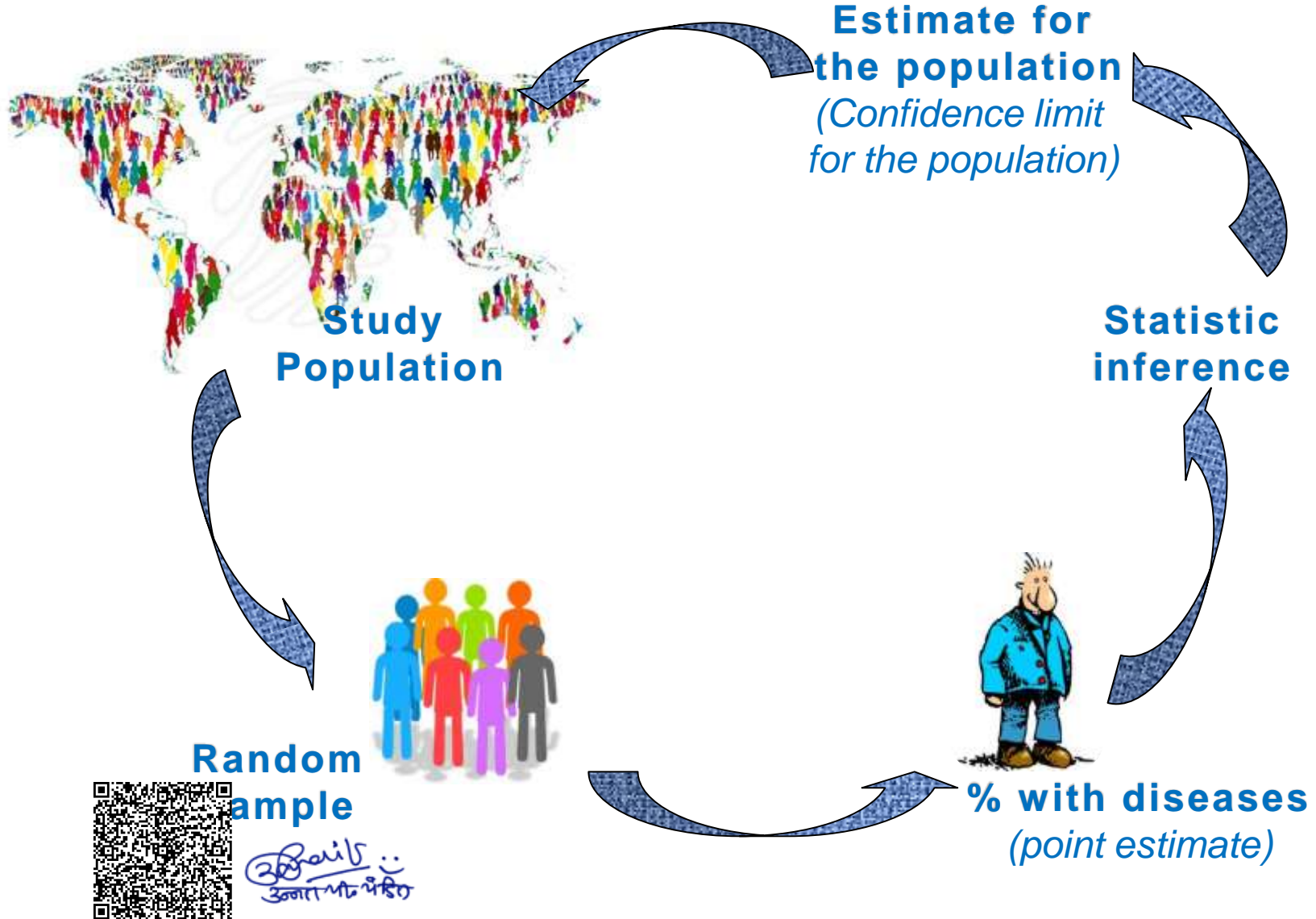


Table of random numbers 1 to 100 with no numbers repeated in each block of 25.

75 64 26 45 10	79 18 58 61 09	67 05 60 19 91	14 62 02 35 98	88 51 53 56 96
24 05 89 42 27	98 62 31 19 95	24 25 58 50 49	19 30 31 58 59	49 47 85 48 30
63 18 80 72 41	26 11 91 96 81	55 92 44 23 93	97 89 53 40 80	29 46 34 39 63
38 81 93 68 22	84 92 59 82 80	26 94 73 71 45	63 84 68 44 94	93 64 13 94 31
25 59 54 43 02	16 41 97 40 65	70 29 77 74 27	69 81 70 01 95	82 99 77 80 21
12 26 15 88 98	21 28 92 06 08	33 72 05 13 06	85 65 33 90 20	92 33 27 59 49
36 59 95 67 96	25 72 30 41 81	71 92 18 65 17	64 58 56 89 28	69 18 36 06 71
91 72 33 68 11	22 20 15 01 65	34 60 47 16 09	44 45 46 97 83	44 51 98 67 29
86 04 47 43 69	12 85 04 93 74	80 08 57 25 79	72 96 07 57 40	82 62 68 60 73
01 05 65 97 77	96 64 98 62 49	07 19 63 46 66	77 98 80 54 60	97 32 83 74 80
26 95 96 93 87	17 59 90 35 94	73 68 03 27 29	49 64 66 14 65	57 24 45 76 39
45 27 71 62 05	71 18 32 42 91	25 66 46 49 71	67 11 25 23 12	41 47 99 66 01
74 07 90 20 25	05 52 65 84 92	87 57 95 37 83	85 45 22 56 26	10 28 04 88 49
77 99 91 43 02	96 06 07 36 68	17 48 06 09 84	31 86 91 87 96	63 87 32 33 70
75 53 35 46 41	21 95 85 61 46	94 18 78 39 47	19 60 48 15 59	68 79 42 09 67
45 65 84 36 28	48 33 62 62 71	74 48 75 92 34	32 94 26 70 88	35 50 19 97 52
81 74 60 90 46	13 51 24 54 55	45 54 32 90 99	44 68 86 71 58	27 51 81 13 77
95 11 96 85 83	93 53 74 52 97	79 53 21 41 44	45 81 02 38 07	38 07 80 89 56
29 40 82 33 86	67 95 43 41 89	05 52 17 31 13	82 61 78 57 40	84 39 57 63 78
79 14 32 21 09	32 27 02 70 20	61 47 24 42 76	77 27 99 36 15	36 98 08 40 53
51 46 23 17 11	93 35 70 37 86	26 23 64 88 17	17 78 95 93 83	65 23 90 78 55
98 75 60 99 89	91 18 20 27 74	31 82 01 32 97	97 43 21 87 82	33 28 10 56 98
15 97 42 56 79	08 58 79 40 31	37 19 20 58 42	41 86 66 54 45	08 76 89 86 32
06 16 35 93 26	36 97 26 17 71	74 95 89 08 50	50 62 48 46 26	24 95 93 01 64
54 43 55 21 74	47 59 75 03 57	63 38 02 51 77	77 76 65 06 92	72 29 35 06 85
66 31 33 83 19	15 01 38 69 66	77 83 87 16 45	04 07 72 32 08	53 91 03 48 49
06 07 88 09 61	19 29 39 18 16	76 48 53 81 12	61 39 87 60 33	84 75 78 22 55
57 01 84 02 27	11 14 47 20 44	22 34 90 86 79	89 68 71 46 77	08 76 89 86 32
47 08 89 24 85	87 13 18 68 94	07 70 86 03 36	75 92 73 05 56	62 37 77 34 42
17 05 93 51 30	62 49 61 45 31	91 55 23 11 89	53 15 34 76 78	33 41 99 79 43
15 19 85 03 11	81 76 26 77 13	73 75 64 47 85	08 61 70 03 25	90 92 94 98 97
91 64 24 16 46	23 44 70 47 17	10 70 43 35 56	67 73 71 90 57	37 34 54 95 35
70 09 43 21 61	24 74 07 96 33	08 42 19 74 12	09 27 77 23 17	93 43 14 38 15
62 94 51 92 60	49 25 15 85 34	86 09 11 03 96	47 54 02 32 76	75 13 76 32 03
53 13 59 22 82	87 37 94 62 65	18 40 14 38 71	41 55 14 50 28	62 74 08 31 58
93 59 48 96 88	04 83 14 84 53	45 70 37 18 05	79 14 45 55 46	28 55 36 35 77
58 14 07 89 30	51 76 30 05 32	13 01 23 63 33	24 73 13 21 16	46 78 20 67 32
47 40 60 22 29	52 16 70 44 19	46 41 93 73 78	68 88 42 02 28	66 17 83 37 38
28 02 81 52 50	56 08 63 06 22	35 50 32 75 22	66 69 65 97 35	87 65 33 29 10
69 24 61 41 42	24 73 45 55 46	47 21 95 09 62	86 67 29 74 54	95 14 74 72 79


Use of statistics in Research



Use of statistics in Research

- For Logical & Universal approval on the results obtained.

DON'T PANIC!

- Most important rule: **Do't be Panic!**
- No need to remember all the formulas.
- Statistic are just a tool for data analysis – be comfortable in employing softwares (*Microsoft*
 *SPSS, Primer, etc*), calculators...

DON'T PANIC!

Use of statistics in Research

- For enjoying car driving/ watching TV, we no need to know the Mechanical/ electronic aspects.



- Statistical approaches

Descriptive Statistics
eg: data from a survey

Inferential Statistics
Usually from experiments
Uses Hypothesis



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Statistical test for an Experimental design

Same subject /
matched subject design

Different subject
design

2 conditions

3 or more
conditions

2 different
groups

3 or more
different groups

*Non-
Parametric
test*

Mc Nemar test
Wilcoxon test

Friedman test/
Page 's trend test

Chi -squared test /
Mann-Whitney U
test

Extended
chi-squared test
/Kruskal-wallis test/
Jackheere trend test

Related / test

One way Anova
for related
design Scheffe
test (if required)

Unrelated t test

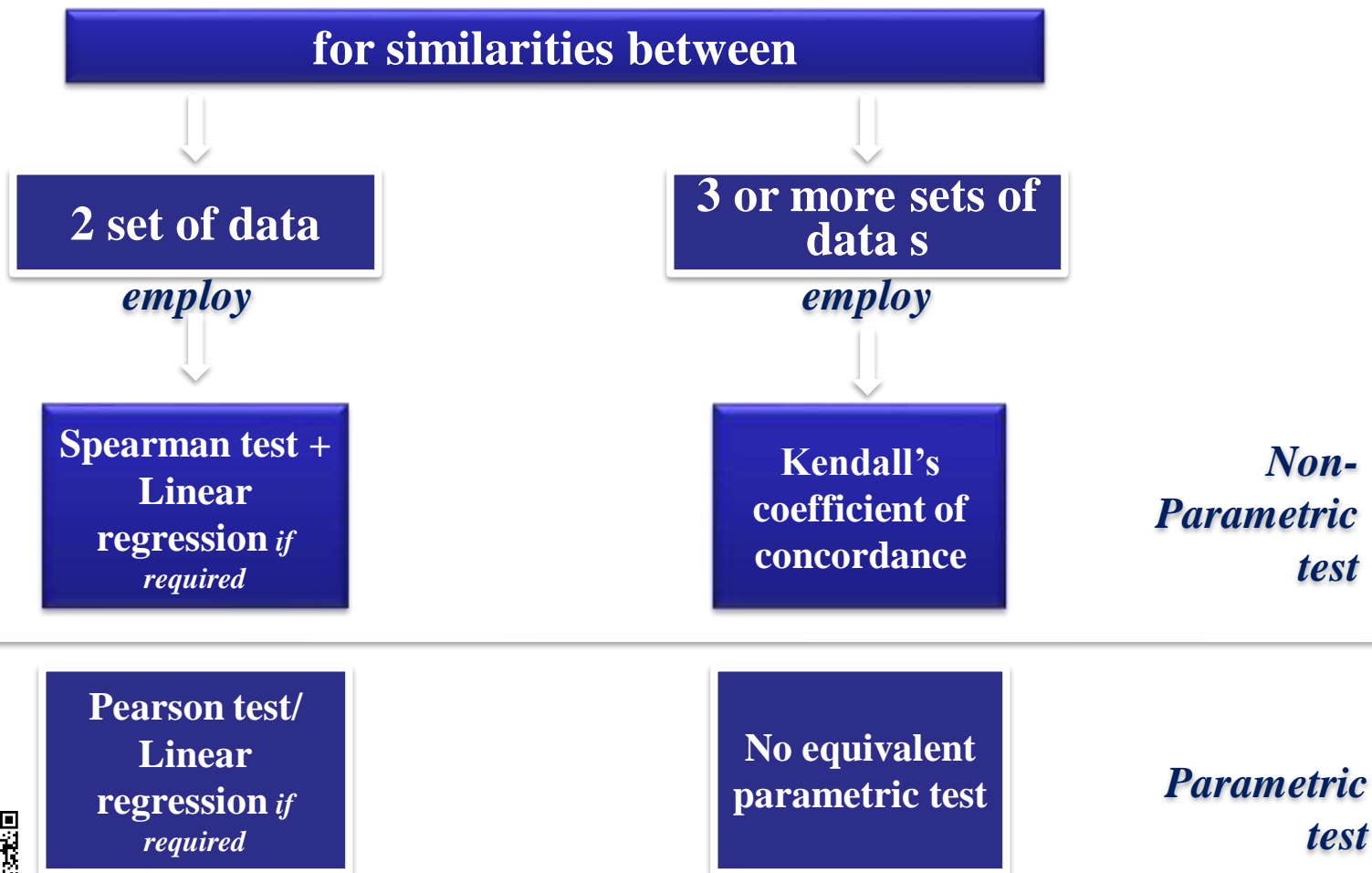
One way Anova
for unrelated
design
Scheffe test
(if required)

Paramet



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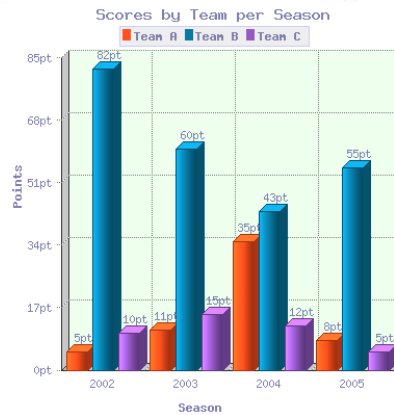
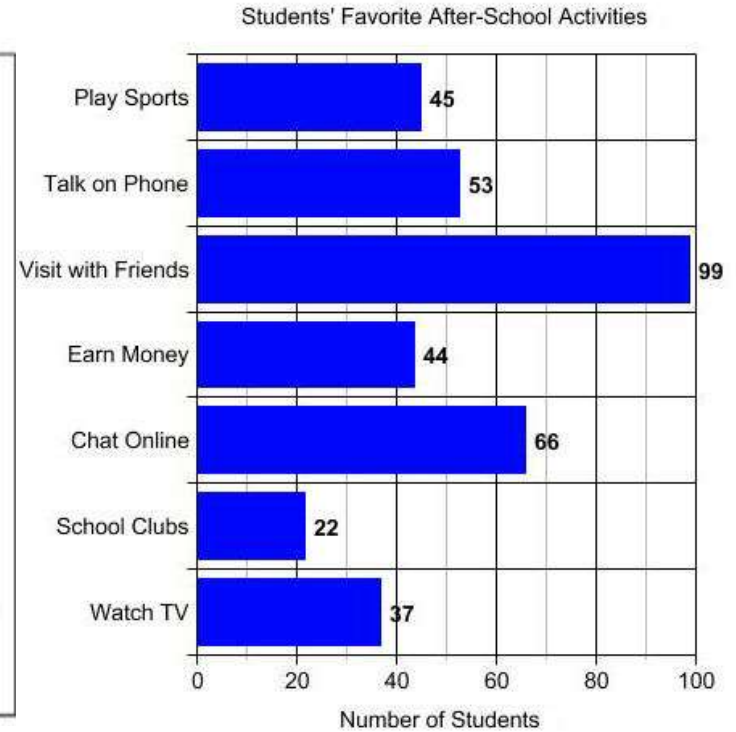
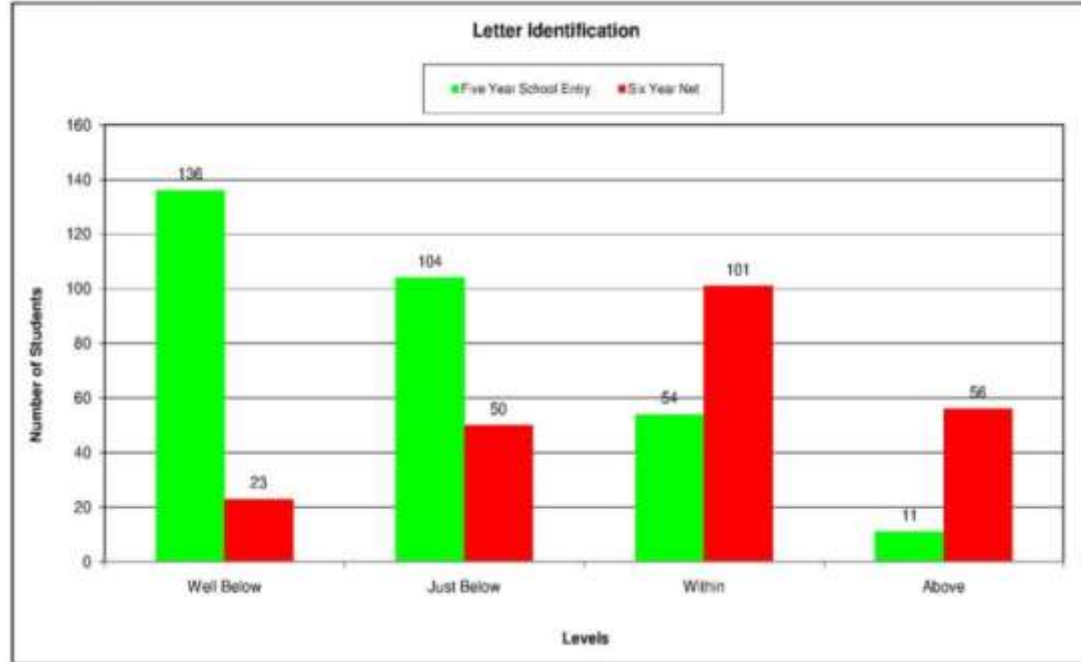
Statistical test for a Correlation design



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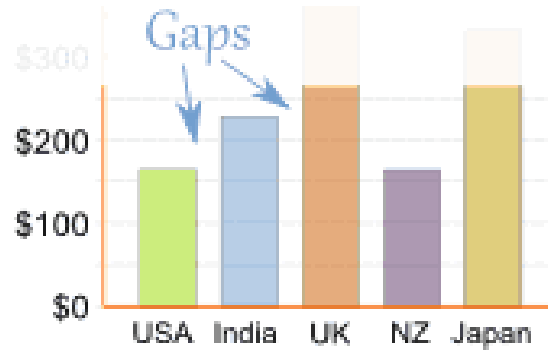
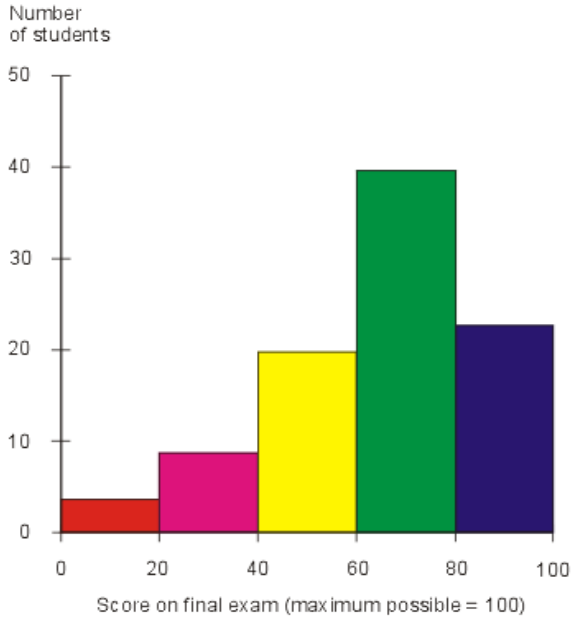
Statistical Graphs - Bar Graph

Bar Graph Template



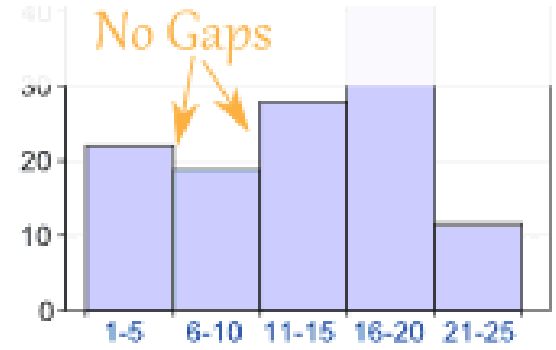
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Statistical Graphs - Histogram Graph



← Categories →

Bar Graph

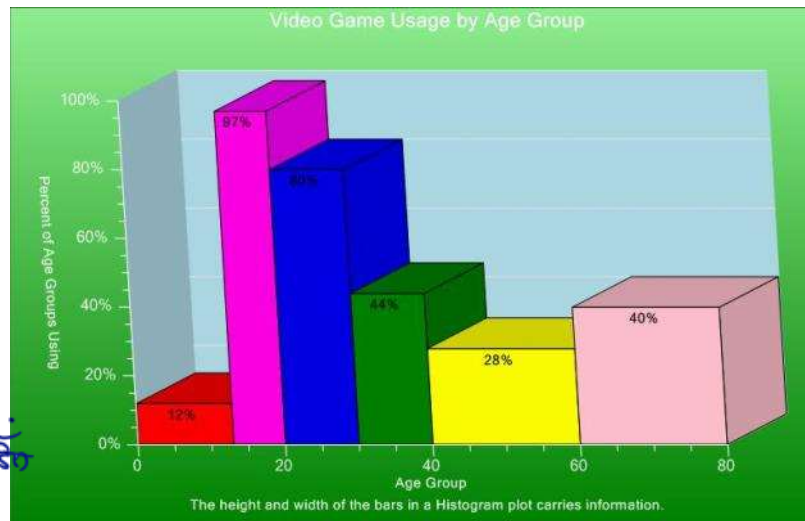


← Number Ranges →

Histogram



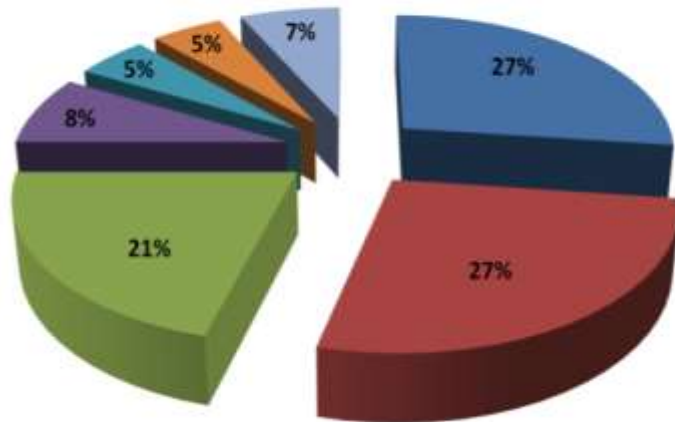
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Statistical Graphs - Pie chart

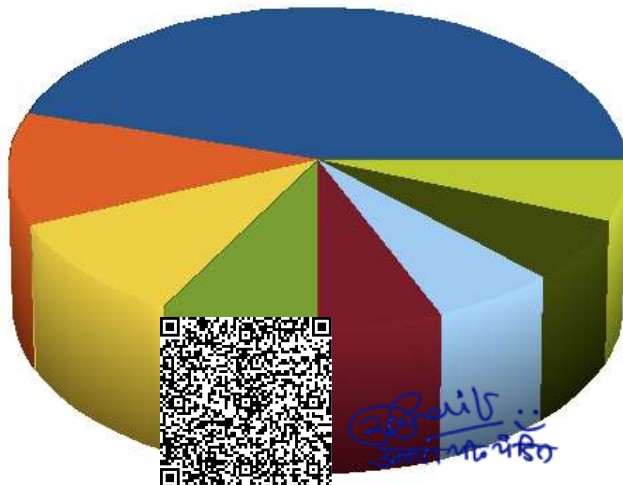
Religions of Lebanon

- Sunni Islam
- Shi'a Islam
- Maronite Christian
- Greek Orthodox
- Druze
- Greek Catholic
- Other Christian



% of Traffic

- Google
- Yahoo
- MSN



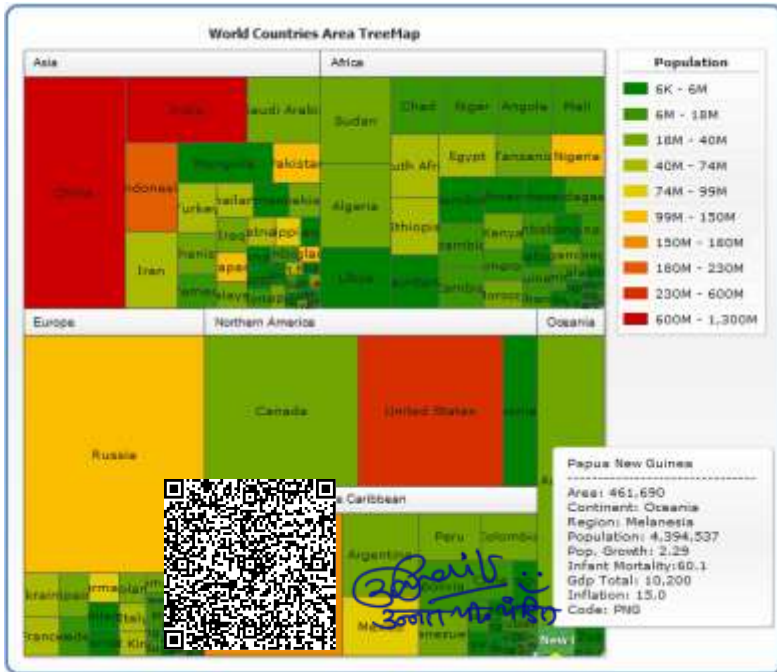
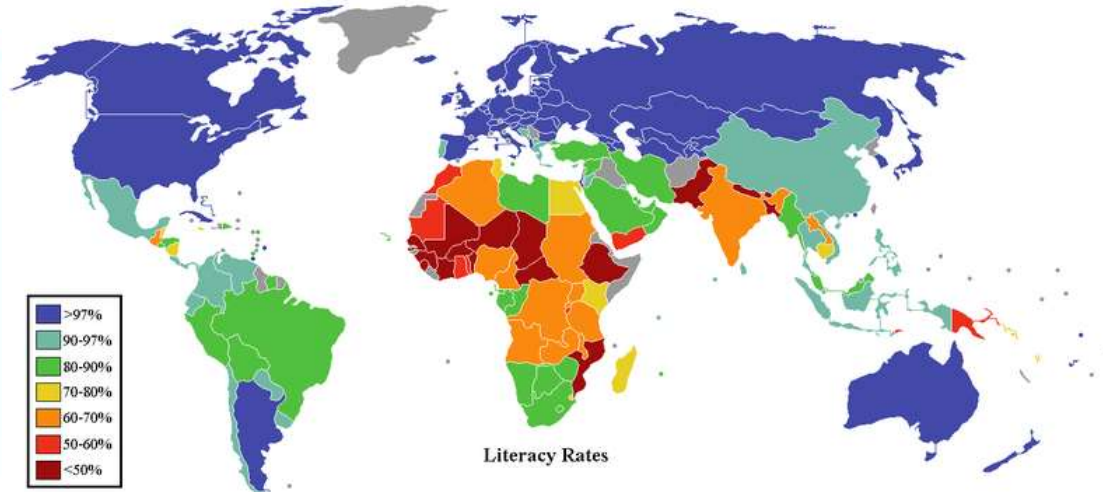
- MySpace
- Facebook
- Orkut
- hi5
- Xanga
- Live Spaces
- Classmates.com
- Bebo



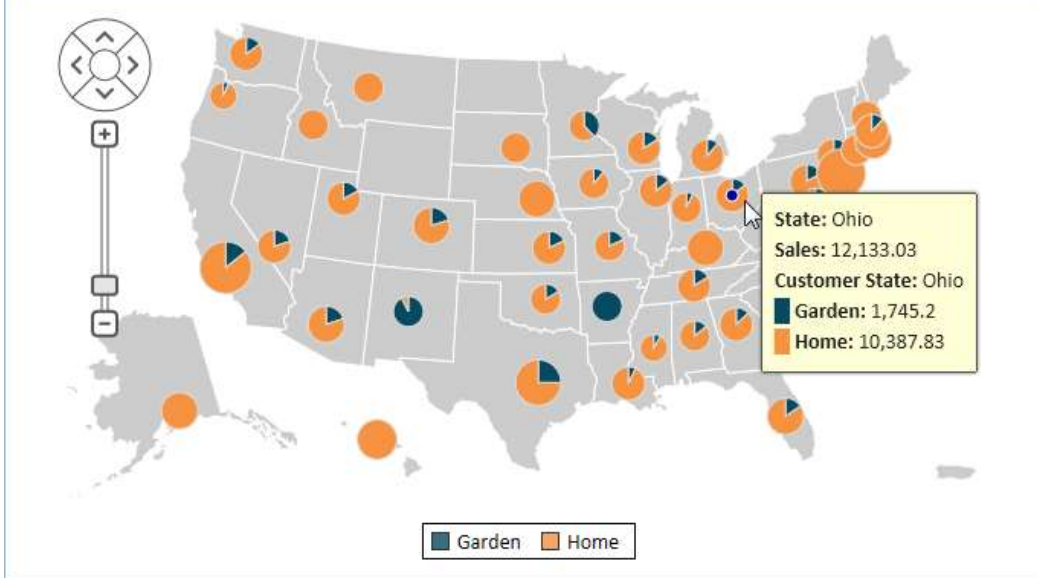
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30/01/2026

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 Date 29/10/2026

Statistical Graphs - Map chart

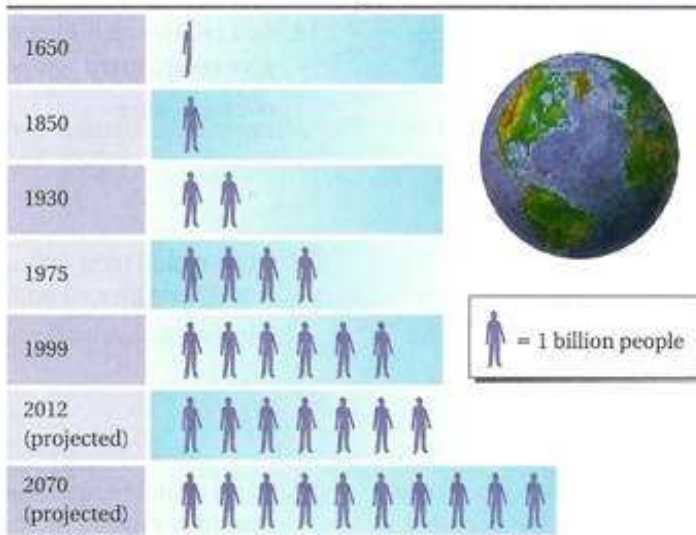


Legend: bottom right Map: world us-50 us-48 Mouse-drag: select-zoom pan
 Longitude: -81.820952 Latitude: 40.035267



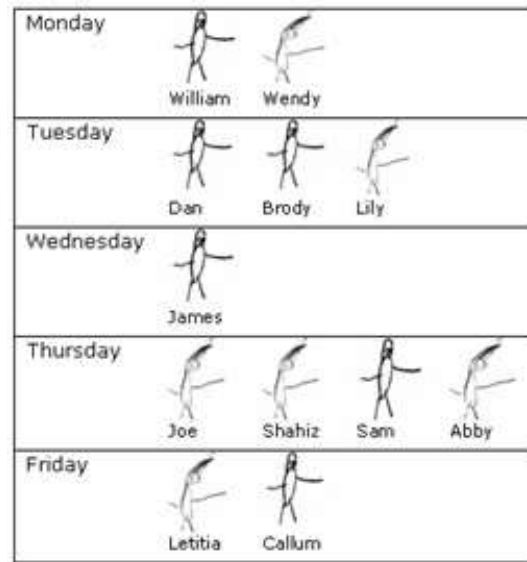
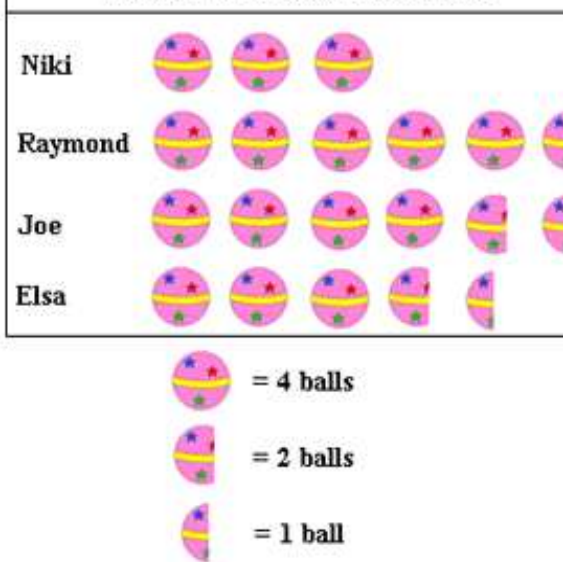
Statistical Graphs - Pictograph

World Population



Source: U.S. Census Bureau, International Data Base

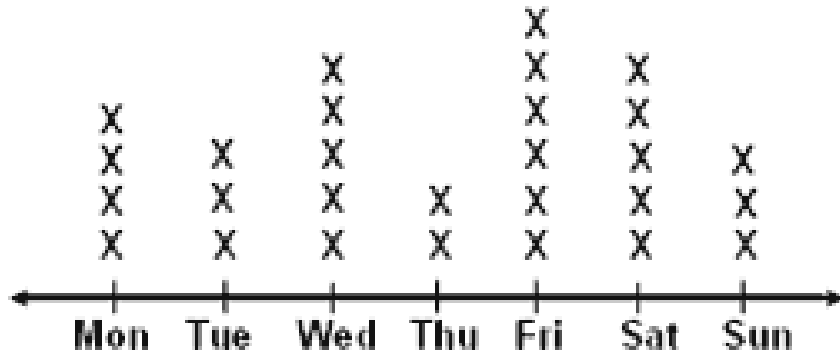
Number of balls with each child



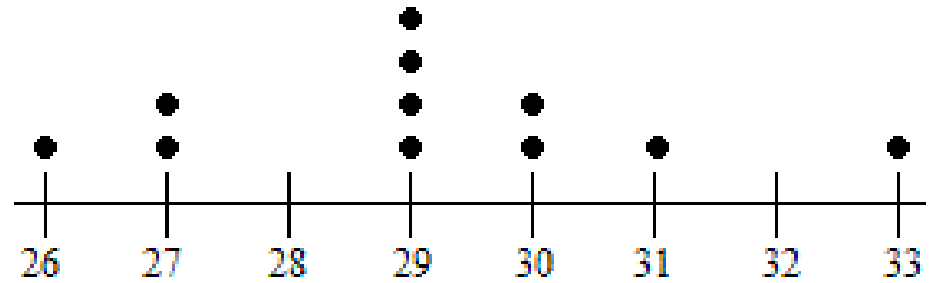
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Statistical Graphs - Line plot

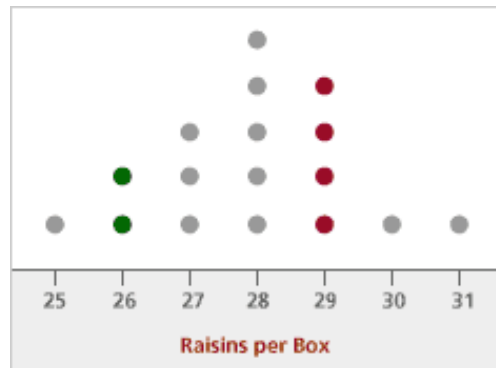
Number of Cars Sold



Line Plot: Number of Students per Classroom

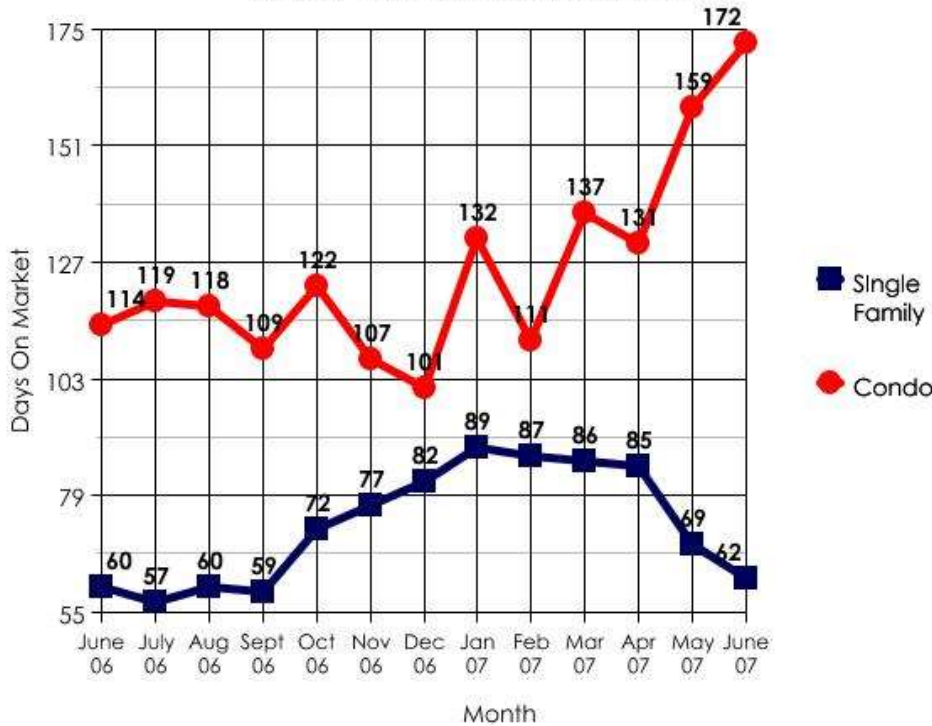


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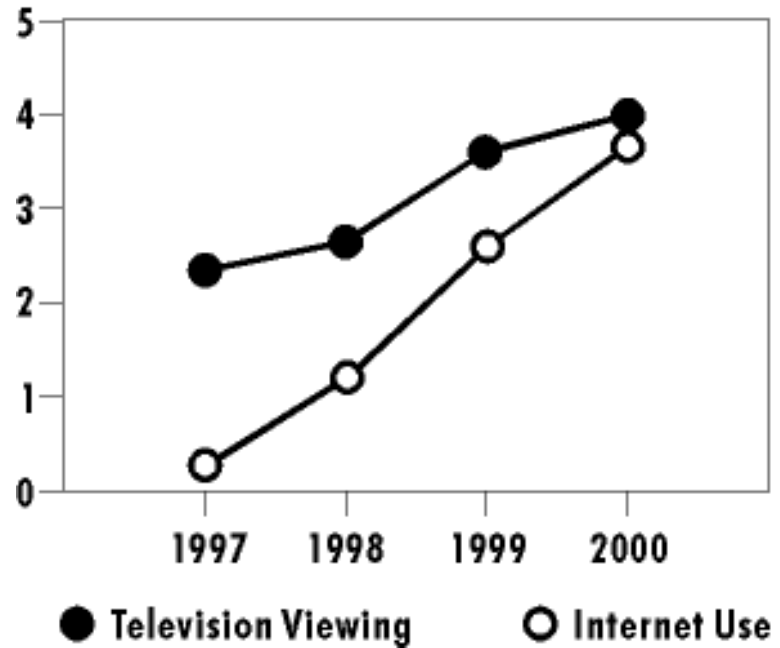


Statistical Graphs - Line graph

Monthly Days On Market For Dane County

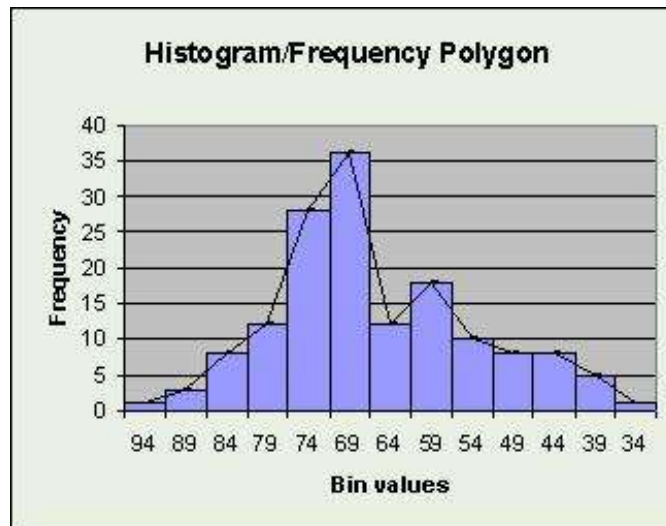
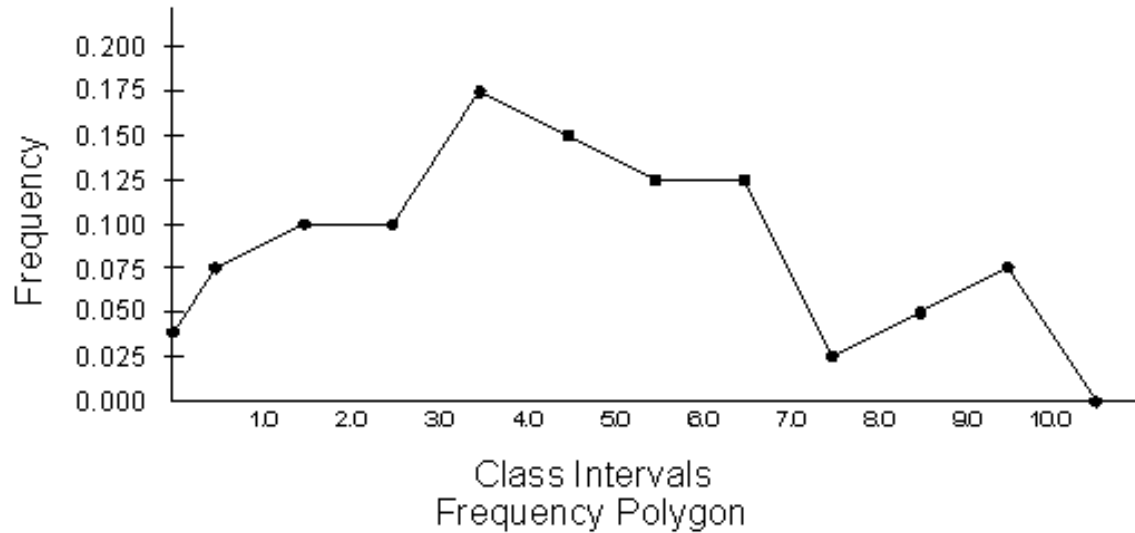
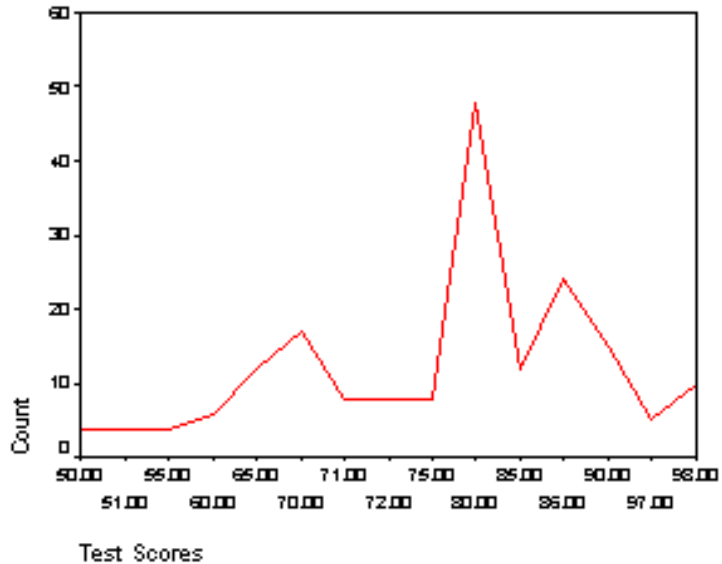


Adventure County Average Daily Hours
 9- to 14-Year-Olds Spent With Media



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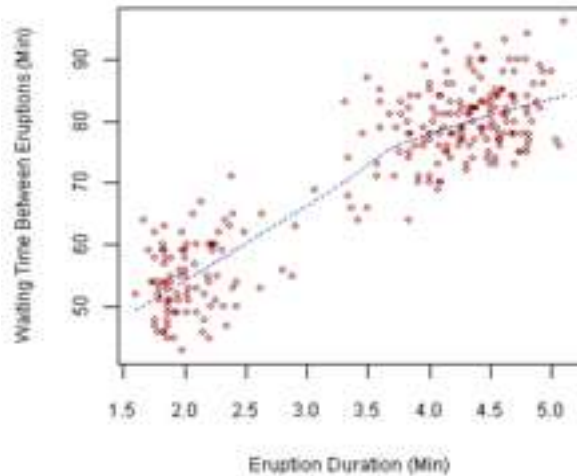
Statistical Graphs - Frequency Polygon



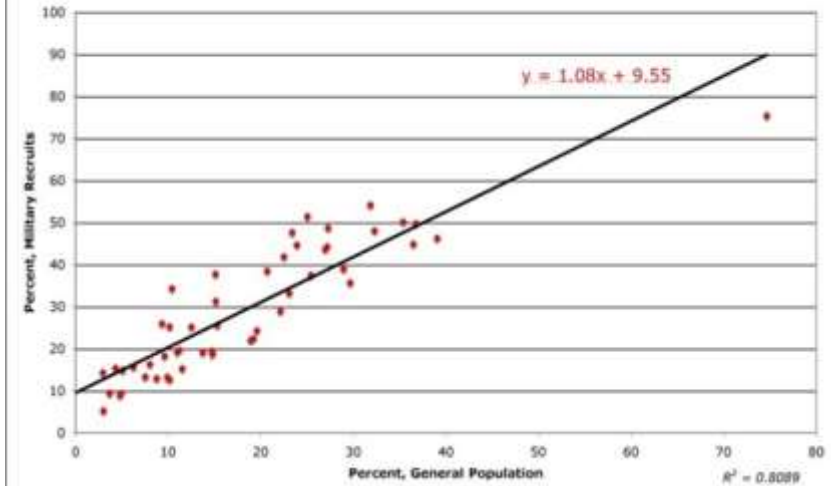
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Statistical Graphs - Scatter plot

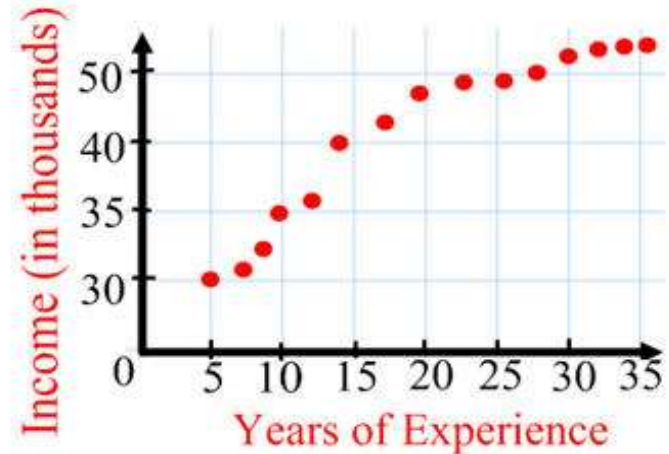
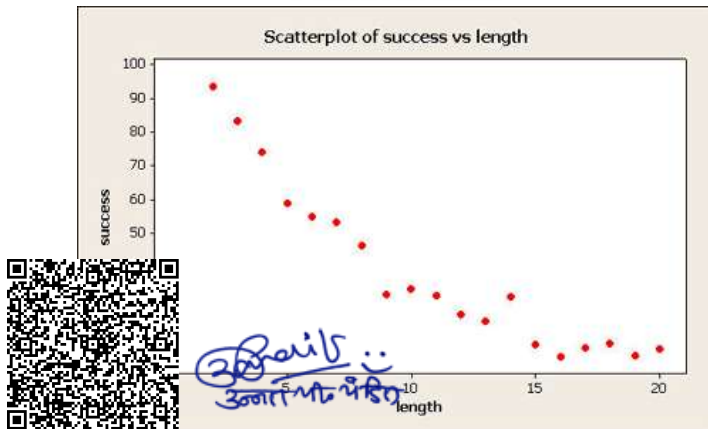
Old Faithful Eruptions



Comparison of Military Recruits and General Population, Percent People of Color, by State



Scatterplot of success vs length



Statistical Graphs - Stem & Leaf Plot

15, 16, 21, 23, 23, 26, 26, 30, 32, 41

Stem	Leaf
1	5 6
2	1 3 3 6 6
3	0 2
4	1

how to place "32"

Stems	Leaves
0	2 6
1	0 3
2	4 5 8
3	4 4 9
4	
5	5 9
6	1 5 7

Means 25

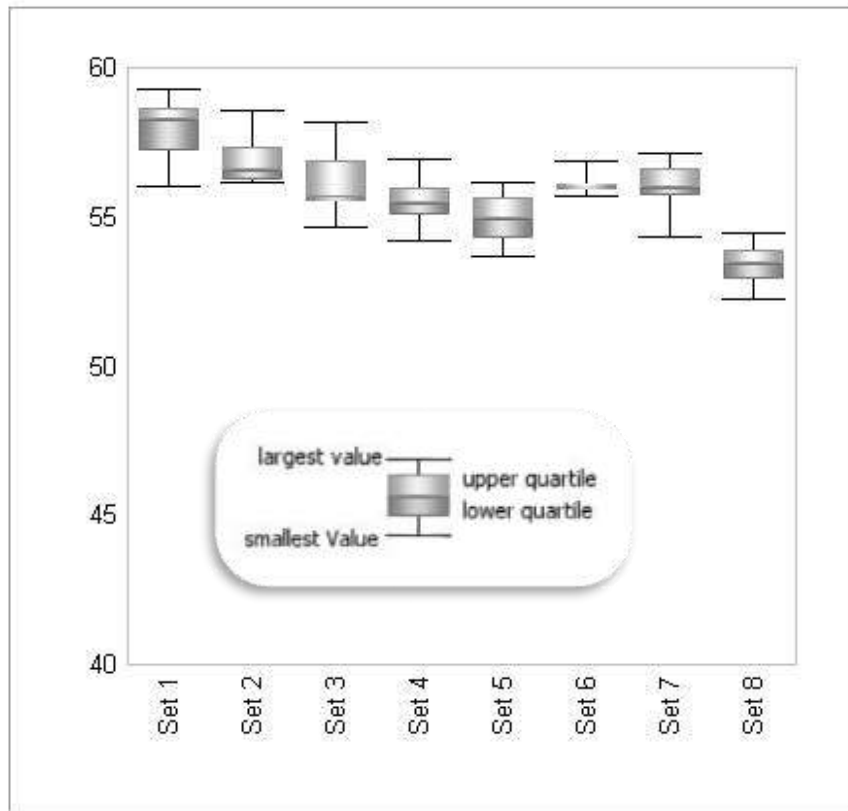
Means 55

Stem	Leaf
2	2 6 7
3	1 3 5
4	2 4 6
5	7 8 9
6	1 3 4 5 7

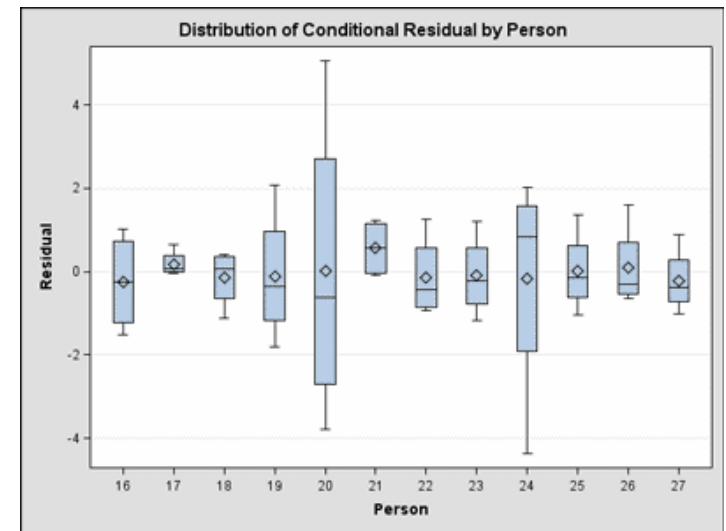
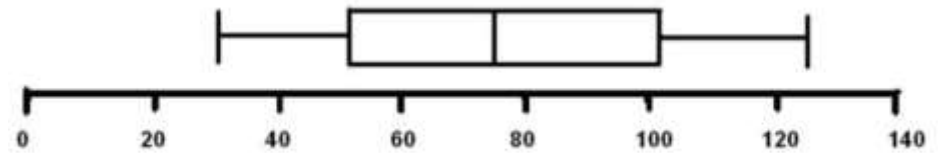


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Statistical Graphs - Box plot



Annual snow depth at Mathsville Ski Resort



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Bias in Research



- Bias is the term used to describe differences between *the study findings* and *truth*.

- Last defines bias as

“Any effect at any stage of investigation or inference tending to produce results that depart systematically from the true values (*to be distinguished from random*



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Bias in Research

Minimizing measurement bias



1. Use valid, reliable tools to measure all study subjects
2. Train staff and monitor their use of research tools
3. Regular quality checks of research tools
4. Blinding of study subjects and assessors
5. Consider sub-study to determine validity & reliability



assessments.



Criteria of Good Research

1. **Good research is systematic:** It means that research is structured with specified steps to be taken in a specified sequence in accordance with the well defined set of rules. Systematic characteristic of the research does not rule out creative thinking but it certainly does reject the use of guessing and intuition in arriving at conclusions.
2. **Good research is logical:** This implies that research is guided by the rules of logical reasoning and the logical process of induction and deduction are of great value in carrying out research. Induction is the process of reasoning from a part to the whole whereas deduction is the process of reasoning from some premise to a conclusion which follows from that premise. In fact, logical reasoning makes research more meaningful in the context of decision making.



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THANKS FOR YOUR TIME

Health Research Methodology



PR.SURESH



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आपके लिए

... may I have your questions ...