Role of Qualitative and Quantitative Research in Product Management

MDP-Product management for manager

Dr Yukti Sharma

yukti.sharma@mdim.ac.in

Session Outline

- Implication of research on product management
- Types of Research
- Qualitative research
- Quantitative research

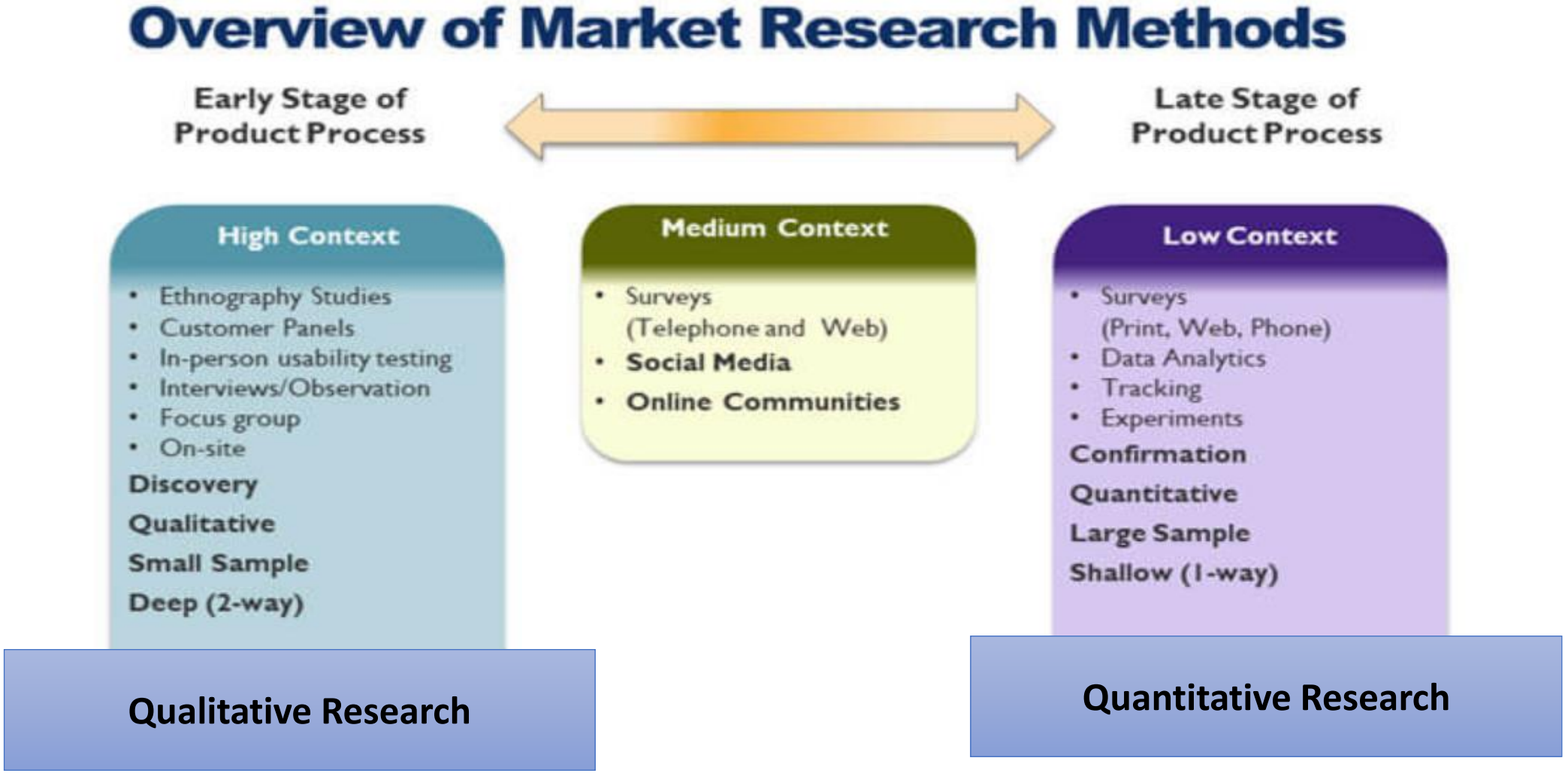
Implication of research in the life of a product manager

Where research stands in the day to day functioning?

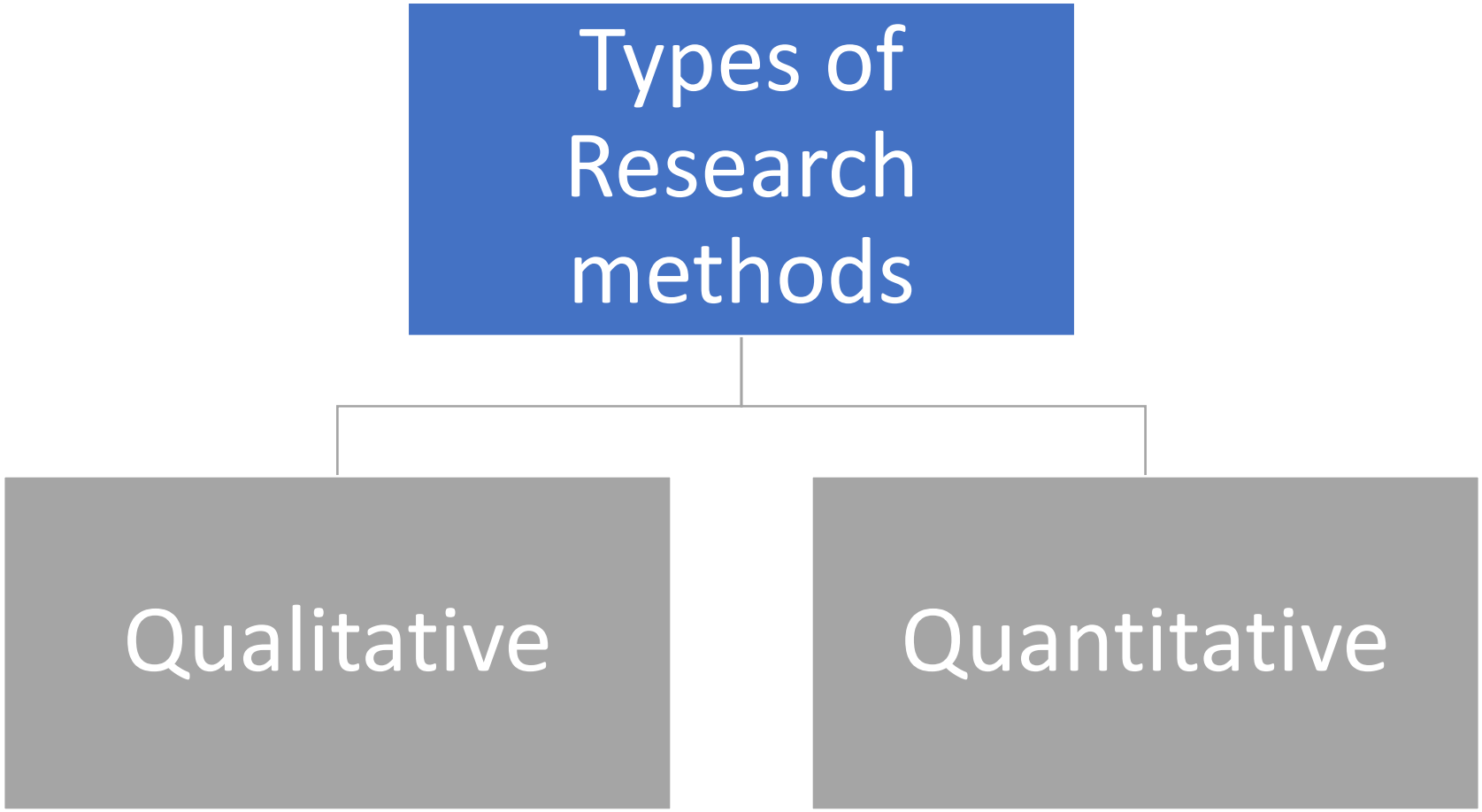
Have you employed qualitative method before?

Have you employed quantitative method or analytical method before?

Research in product management



Research methods



Qualitative research method

I. Qualitative research

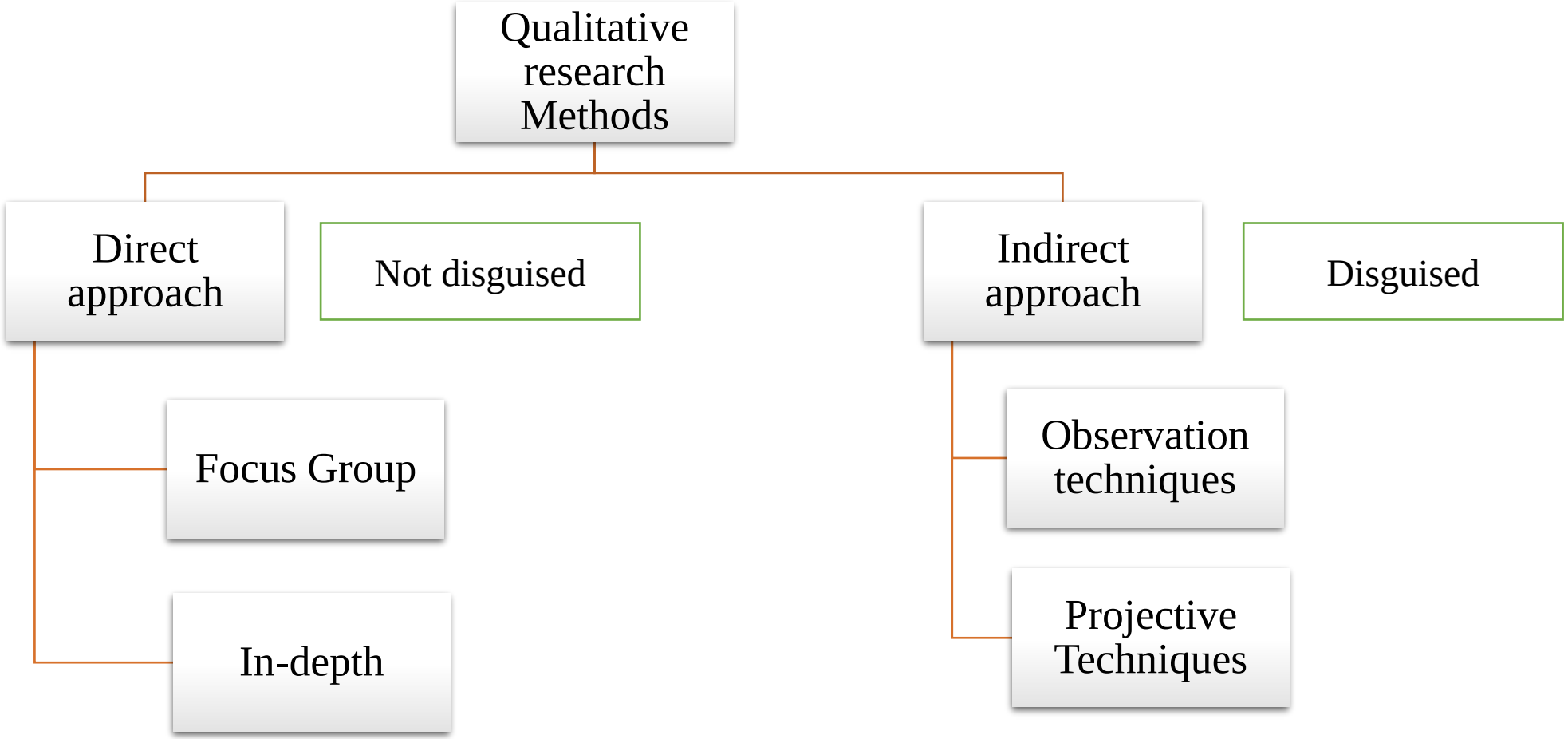
What??

- Unstructured measurement approaches that permit a range of possible responses
- Inductive reasoning
- Exploratory research
- Preliminary insights into decision problems and opportunity

When ??

- Introduce the product
- Designing the product
- Gauge consumer opinion
- Understanding consumer perception

Qualitative research Methods



Direct approach: Focus Group

Focus group

Conducted by a trained moderator

Group of 6-12 homogeneous respondents

Relaxed, informal atmosphere

Stimuli or a problem is placed

Creative discussion and reflect upon the discussion of 1-2 hours

In-depth interview

Unstructured and direct technique

Single respondent is probed by skilled interviewer

30 mints to 2 hours

Attitudinal and behavioural data

Types

- Laddering
  - Link between products and the consumer’s perception process.
- Hidden test questioning
  - Much deeply felt beliefs rather than general attitude and behavioral
- Symbolic analysis
  - Symbolic meaning consumer associate with product, deductive logics

Indirect approach: Projective techniques

- Unstructured, and indirect form of questioning
- To know underlying motivations, beliefs, attitudes or feelings regarding the issues of concern.
- Verbal or visual stimuli
- Respondents are asked to interpret the behavior of others rather than to describe their own
- **Word Association Test**
  - Given a single word
  - Asked to say whatever word/s come to their mind
- **Sentence Completion Test**
  - Pressure to give spontaneous replies
  - Incomplete sentence is given

A manager who does not plan to track their company's transactions using the Internet is……
A manager who selects a new product based on the lowest price is……..
Brand A is most preferred by…….
When I think of dividing business between brand A and Brand B, I……

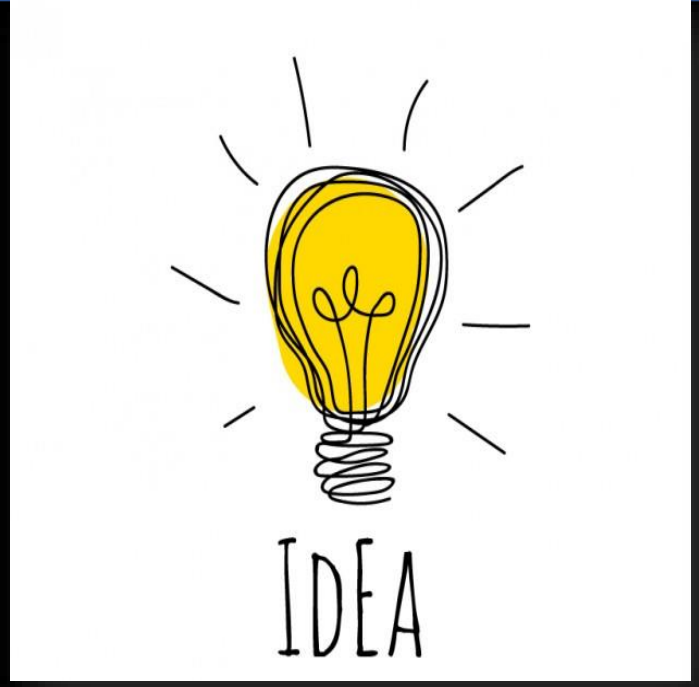
Quantitative research method

STATISTICS is a journey from data to WISDOM!

Quantitative method

- Deductive reasoning
- Empirical research method
- Numerical data and hard facts

THINK!



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PT/ER-	21NT/ER-	21MT-1/ER-	21MT-2/ER-	MDA-435/ER-	MCF10A/ER-	PT-4/ER-	H43/ER-	H4/ER-
2.80	3.92	2.15	1.99	7.97	1.86	2.05	2.12	0.98
1.82	0.36	1.06	1.40	0.75	2.53	0.23	0.92	0.80
6.65	16.77	33.19	37.49	5.05	9.73	0.10	31.79	4.46
4.10	0.59	1.56	2.21	0.41	2.60	0.52	5.68	3.17
0.64	0.88	1.06	1.34	0.94	0.51	0.17	1.36	1.01
0.99	2.83	4.76	2.64	3.41	3.87	1.20	0.63	0.92
1.74	0.63	0.86	0.77	0.43	2.30	0.01	2.49	3.84
1.24	0.18	0.37			1.03	0.26	1.08	1.06
6.12	14.94	29.88				0.20	0.20	0.20
1.12	2.51	5.0				0.31	0.88	0.93
2.65	3.29					2.07	0.50	0.04
3.21	1.61					1.56	1.56	0.69
1.45	0.71						3.95	1.22
0.53	0.24						0.61	1.14
2.26	3.14						2.98	3.21
1.23	0.64						1.54	0.94
5.10	1.93					7.26	2.71	
1.23	2.19	1				1.35	0.74	1.49
3.70	5.62	3.26				6.52	2.37	0.13
2.93	0.14	0.14				0.14	0.40	0.14
8.19	0.95	2.33	3.02		3.13	0.08	6.78	5.88
7.06	1.97	1.47	5.68	1.81	12.78	4.48	25.32	7.46
0.29	0.44	0.01	0.59	0.93	0.59	0.37	1.32	0.75
2.55	0.96	2.86	0.08	2.45	0.54	4.56	0.71	1.85
0.28	0.08	0.10	0.06	0.09	0.60	0.12	0.70	1.43
1.20	2.13	3.98	1.69	1.39	0.72	0.19	0.42	0.52
0.16	0.01	0.73	0.01	2.56	6.95	0.23	10.41	4.93
1.06	4.35	5.86	2.60	1.07	0.85	1.16	0.91	0.47
0.51	0.06	0.06	0.06	0.06	18.34	0.06	20.93	4.07
0.85	0.45	0.01	0.72	0.62	0.57	0.89	0.42	0.26
2.21	0.87	0.48	0.58	0.27	14.98	0.34	2.23	1.96
5.66	2.92	1.15	2.54	0.77	14.25	3.79	0.84	0.28
8.90	0.93	0.80	1.41	1.02	7.12	2.42	8.82	1.37
0.71	3.02	0.76	0.88	0.95	0.84	0.05	0.61	0.05

DATA

What is the most important?

The most important thing is …

IDEA gives *research issues* and research problems!!!

Idea: Case scenario

- *Supposedly, you are a product manager at ABC Ltd, which manufactures "Everyday Noodles". You were comparing your monthly sales data of past three-years, with other well-known noodles brands "Daily noodles" and "Tangy noodles". You need to determine which of these noodle brands is* ***performing well****?*

The Problem is…

- *How to address and test our research issue?*

For this, the most important input is…

Data analytics snapshot

- **Descriptive Analytics**: (What has happened?) (Data aggregation, EDA Summary)
- **Diagnostic Analytics:** (Why it has happened)?(Hypothesis testing)
- **Predictive Analytics** : (What might happen?) (Regression, Structural equation, ARIMA, GARCH)
- **Prescriptive Analytics** : (What should we do?) (Optimization, Recommendation)

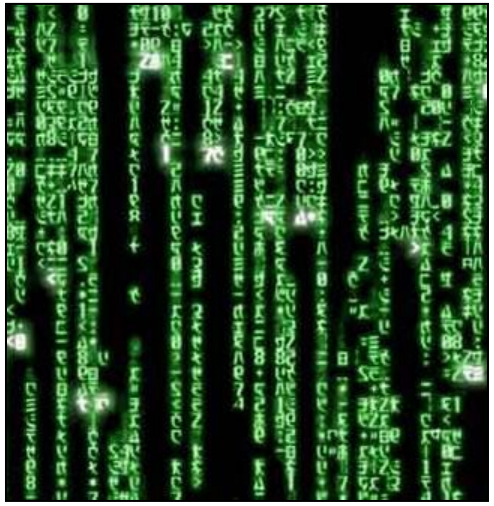
1. Descriptive analytics

Exploratory Data Analysis

- ***Exploratory data analysis*** *(EDA) is an approach to analyzing* ***data*** *sets to summarize their main characteristics, often with visual methods*

Data

- Data **are** raw facts and figures that on their own have no meaning
- These can be any alphanumeric characters i.e. text, numbers, symbols



Note the bit pattern above?
What does this mean?

Data Examples

Customer purchase

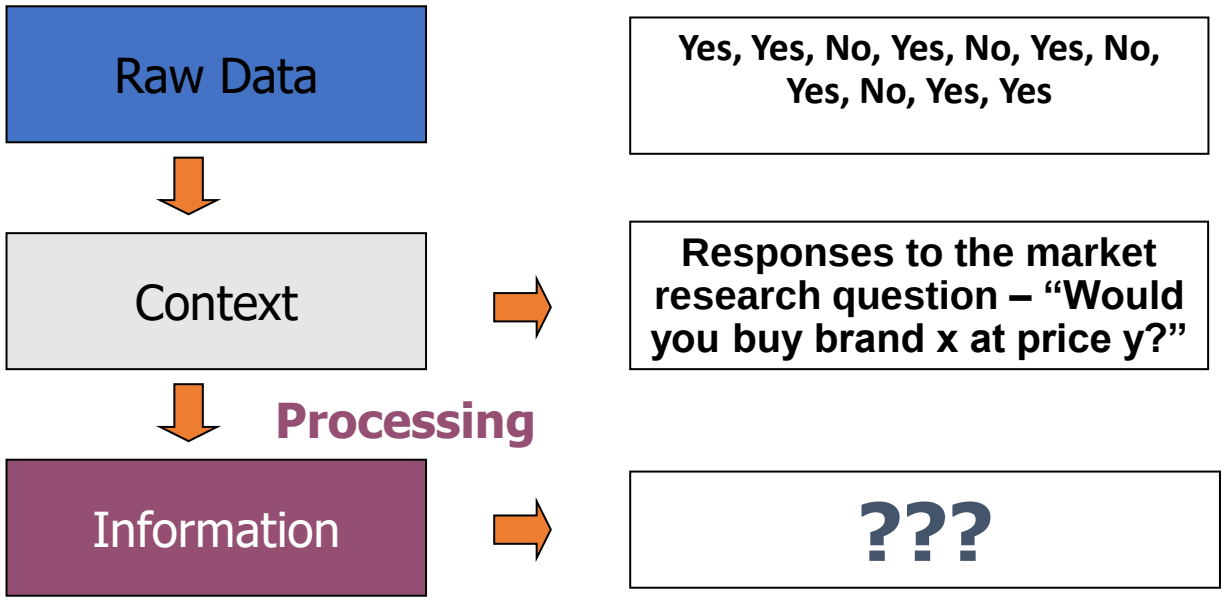
Willingness to pay

- Yes, Yes, No, Yes, No, Yes, No, Yes
- 42, 63, 96, 74, 56, 86

- None of the above data sets have any meaning until they are given a **CONTEXT** and **PROCESSED** into a useable form

Data Into Information

- To achieve its aims the organisation will need to **process** data into information.

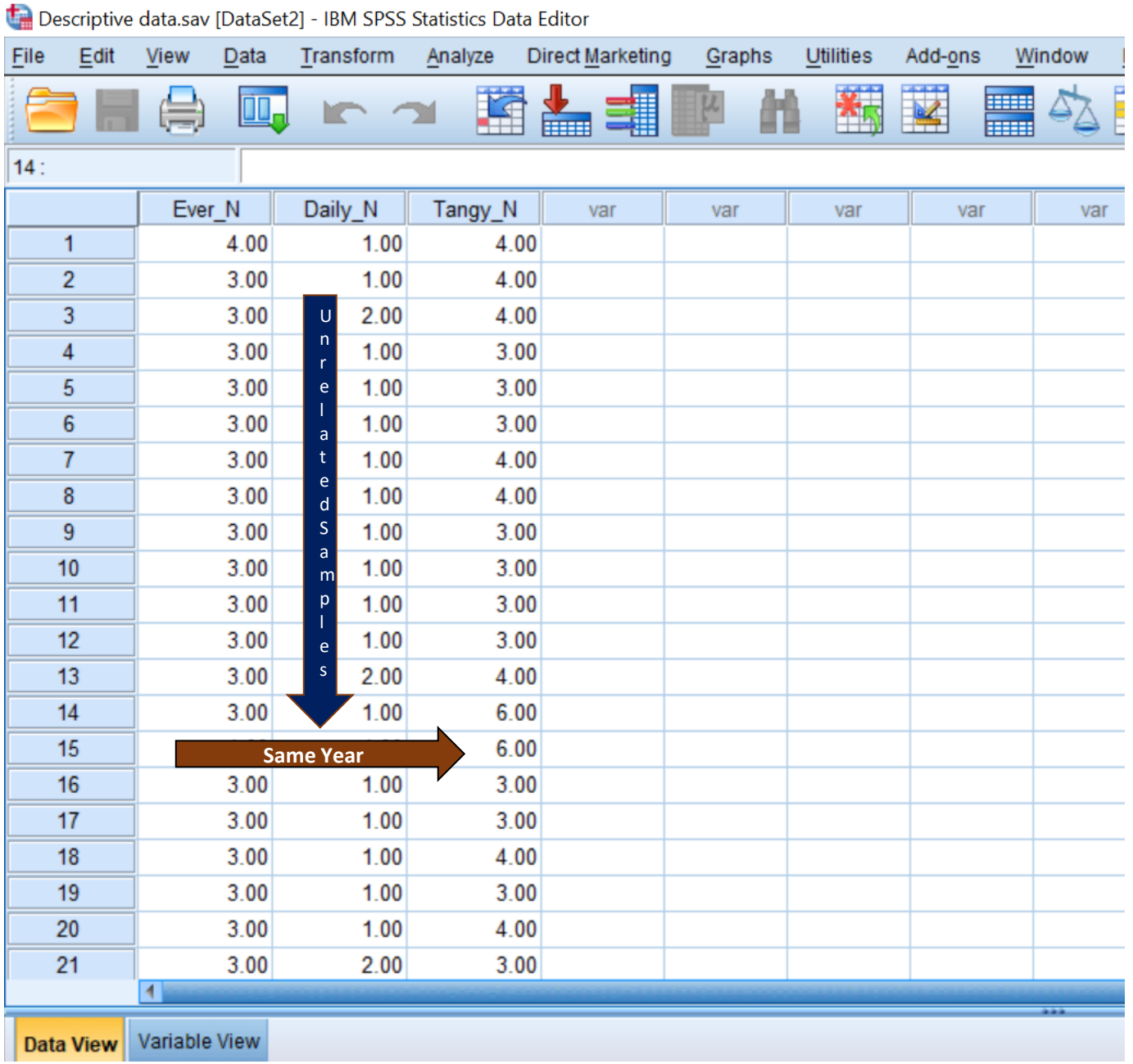


Software

- IBM’s SPSS version 22 software to analysis

Data in SPSS

Monthly sales data of past 3 years (in lakhs)



What do you mean by information

- Mean
- Median
- Mode
- Standard deviation
- Variance: Variability in data
- Coefficient of variation (C.V)= mean/ std. deviation
- Etc….

Descriptive Results

Statistics

		Everyday noodles	Daily noodles	Tangy Noodles
N	Valid	36	36	36
	Missing	0	0	0
Mean		3.1389	1.1389	3.6667
Std. Error of Mean		.09044	.05846	.14907
Median		3.0000	1.0000	3.0000
Mode		3.00	1.00	3.00
Std. Deviation		.54263	.35074	.89443
Variance		.294	.123	.800
Skewness		1.251	2.180	1.494
Kurtosis		3.814	2.913	1.812
Std. Error of Kurtosis		.768	.768	.768
Range		3.00	1.00	3.00

2. Diagnostic Analytics

Diagnostic tools

- Why did this happen?
- Claim or hypothesis
- This includes using processes such as data discovery, data mining, and drill down and drill through.

General flow of diagnostic analytics

Let’s say there is a sudden drop in sales of Everyday noodles. Now you need to determine why your product is not performing well in comparison to other noodles’ brands

How will you respond as a product manager?

Value perception as a key!!

- Let’s say the major reason of falling sales you found to be **value perception** of your Brand “Everyday noodle”. With falling sales you made a claim that “Everyday noodle” brand has lower value perception as compared to other product brand “Daily noodles”. You conducted a survey and to capture the value perception your brand and competitor’s brand.

Now, we move towards …

HYPOTHESIS-TESTING

Steps in Hypotheses testing

Establish a null and alternative hypothesis

Collecting data to prove or disapprove the claim

Determine the appropriate statistical test

Calculate test statistics/ observed value

Level of significance

Establish decision rule and calculate the critical value

Reach a statistical conclusion

Hypotheses Testing

- **"Hypotheses are *tentative explanations of a principle operating in nature.*"**

- *Null Hypothesis:* H_0
- *Alternative Hypothesis:*H_a
- For example:

Null hypothesis: H_0*: μ= Value perception of brand A is same as the value perception of Brand B*

Alternative hypothesis H_a*: Value perception of brand A is lower than value perception of Brand B*

- The null and alternative hypotheses are mutually exclusive (no overlap) and collectively exhaustive
- Summarily a good hypothesis:

(i) objectively tested,
(ii) mutually exclusive, and
(iii) exhaustive.

Collecting data to test the claim

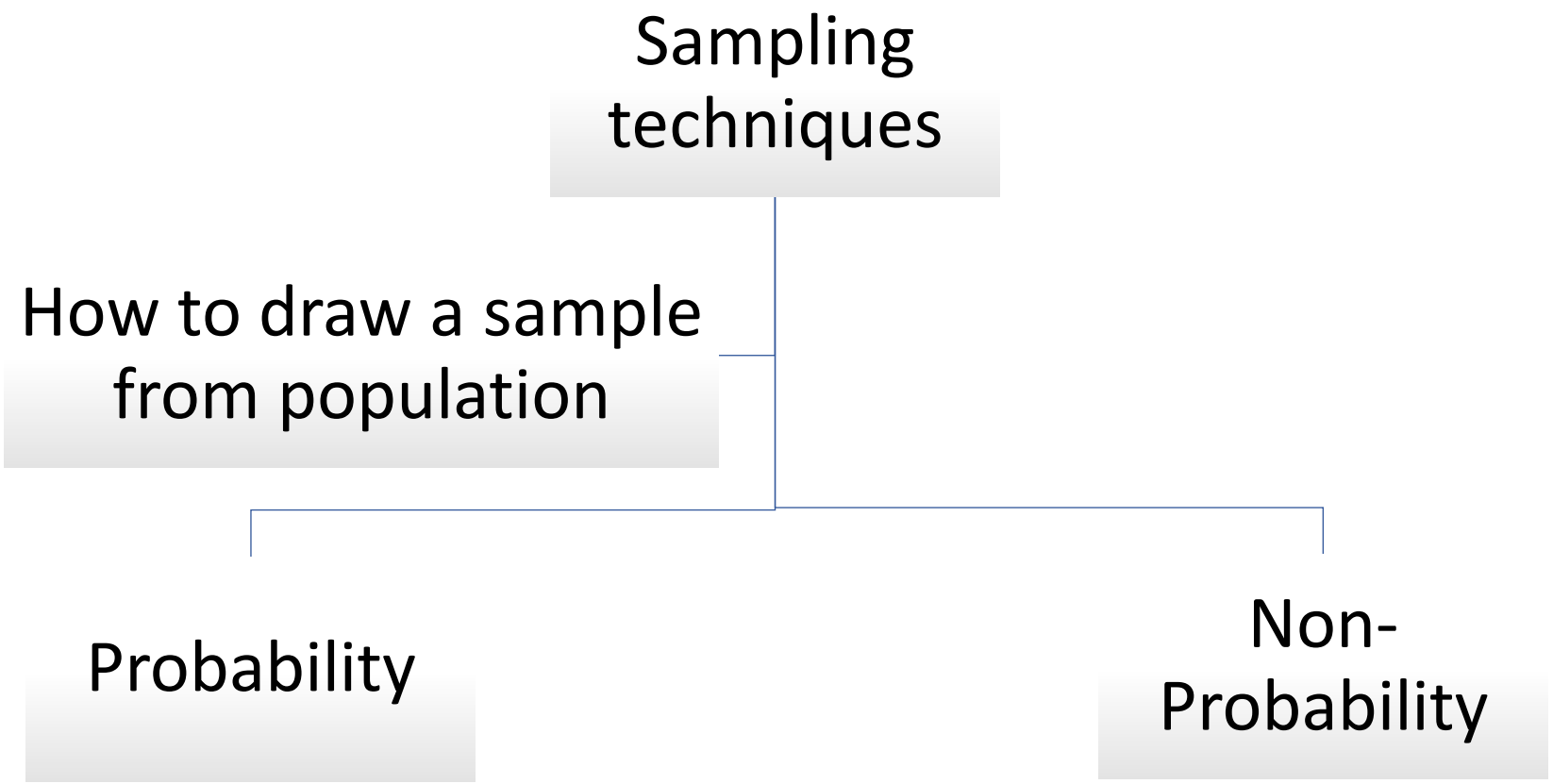
Census Method and Random Sampling

- A census is an attempt to gather information about every member of some group, called the population
- Sampling – collecting data from a portion of the population-reduces both time and money

Can you tell me the most important thing to ensure the sample is a true representative of the population??

- The sample provides needs to be drawn randomly.
- Difficulty in obtaining true random samples

Drawing samples



Survey approach

1. Ensure that questions are without bias.
2. Make the questions as simple as possible..
3. Make the questions specific.
4. Avoid jargon or shorthand. Avoid trade jargon, acronyms, and initials not in everyday use
5. Steer clear of sophisticated or uncommon words. Use only words in common speech

Survey instrument

D1 Gender □ Male □ Female

D2 Age(years) □ 20-24 □ 25-30 □ 31-35 □ 36-40 □ 41-45 □ 46-50 □ 51-55 □ 55+

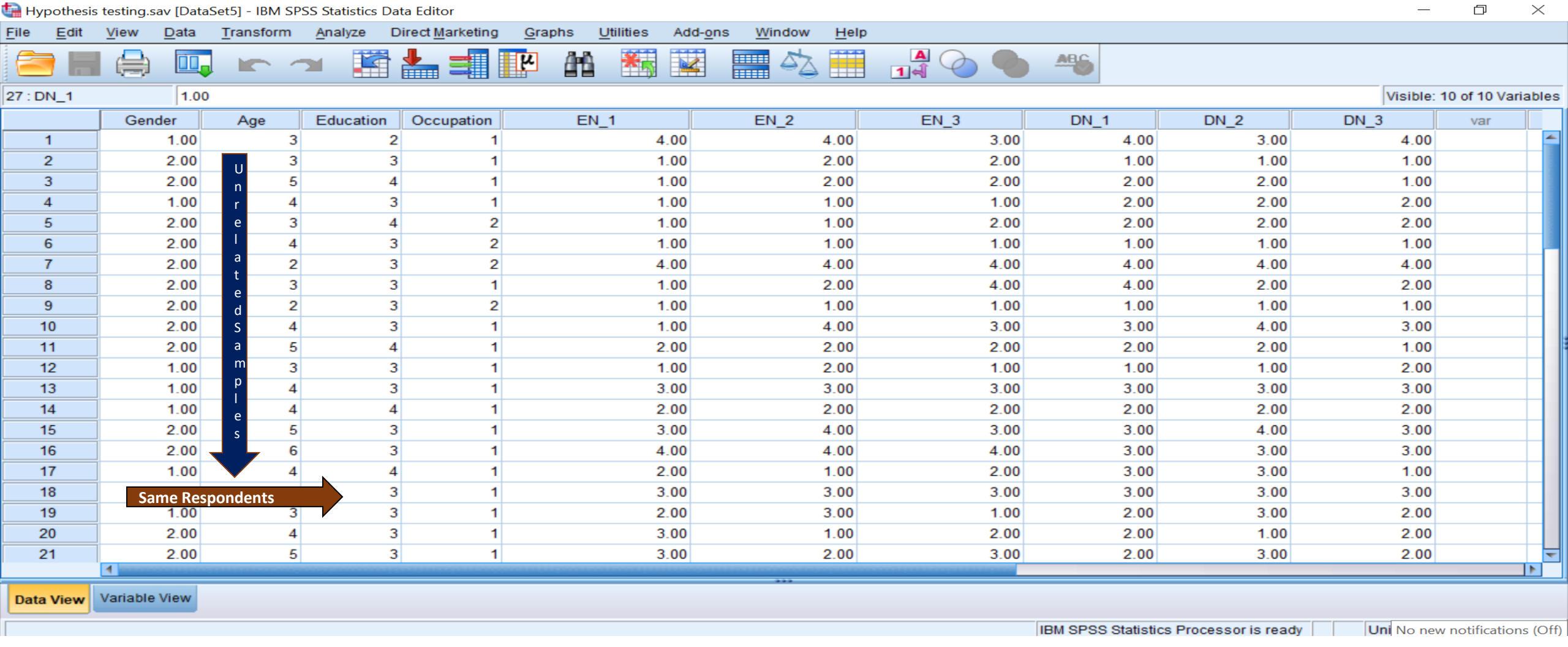
D3 Your Educational Qualification □ Less than Graduate □ Graduate □ Post Graduate □ Others(Please specify)_____

D4 Your Occupation □ Working □ Student □ Homemaker □ Others_____

Mark the following statement on the agreement scale regarding your value perception about Everyday noodles and Daily noodles

Statements	Everyday noodles							Daily noodles						
	Strongly Disagree						Strongly Agree	Strongly Disagree						Strongly Agree
This product offers good value for the money	1	2	3	4	5	6	7	1	2	3	4	5	6	7
The prices of in this store would be fair.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
This product is economical.	1	2	3	4	5	6	7	1	2	3	4	5	6	7

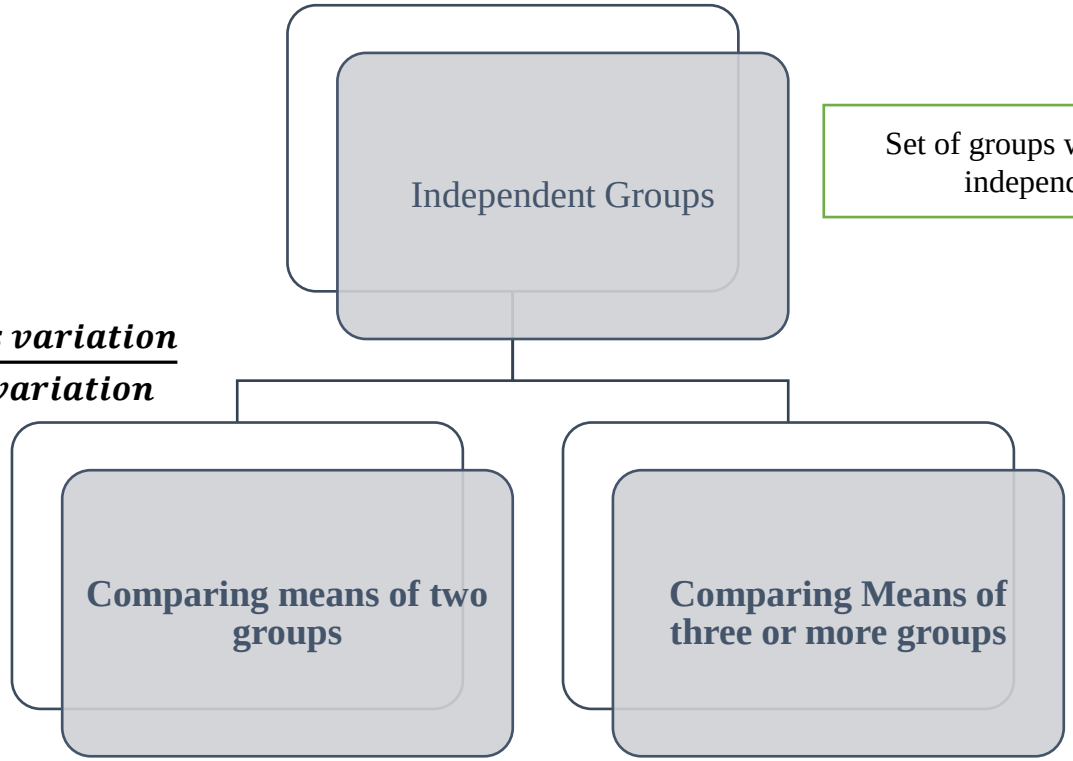
Survey data



	Gender	Age	Education	Occupation	EN_1	EN_2	EN_3	DN_1	DN_2	DN_3	var
1	1.00	3	2	1	4.00	4.00	3.00	4.00	3.00	4.00	
2	2.00	3	3	1	1.00	2.00	2.00	1.00	1.00	1.00	
3	2.00	5	4	1	1.00	2.00	2.00	2.00	2.00	1.00	
4	1.00	4	3	1	1.00	1.00	1.00	2.00	2.00	2.00	
5	2.00	3	4	2	1.00	1.00	2.00	2.00	2.00	2.00	
6	2.00	4	3	2	1.00	1.00	1.00	1.00	1.00	1.00	
7	2.00	2	3	2	4.00	4.00	4.00	4.00	4.00	4.00	
8	2.00	3	3	1	1.00	2.00	4.00	4.00	2.00	2.00	
9	2.00	2	3	2	1.00	1.00	1.00	1.00	1.00	1.00	
10	2.00	4	3	1	1.00	4.00	3.00	3.00	4.00	3.00	
11	2.00	5	4	1	2.00	2.00	2.00	2.00	2.00	1.00	
12	1.00	3	3	1	1.00	2.00	1.00	1.00	1.00	2.00	
13	1.00	4	3	1	3.00	3.00	3.00	3.00	3.00	3.00	
14	1.00	4	4	1	2.00	2.00	2.00	2.00	2.00	2.00	
15	2.00	5	3	1	3.00	4.00	3.00	3.00	4.00	3.00	
16	2.00	6	3	1	4.00	4.00	4.00	3.00	3.00	3.00	
17	1.00	4	4	1	2.00	1.00	2.00	3.00	3.00	1.00	
18			3	1	3.00	3.00	3.00	3.00	3.00	3.00	
19	1.00	3	3	1	2.00	3.00	1.00	2.00	3.00	2.00	
20	2.00	4	3	1	3.00	1.00	2.00	2.00	1.00	2.00	
21	2.00	5	3	1	3.00	2.00	3.00	2.00	3.00	2.00	

Statistical analysis of “Groups”

Test statistic= $\frac{\textbf{\textit{Between groups variation}}}{\textbf{\textit{Within group variation}}}$



Set of groups where change in one group is independent of change in other

Comparing means of two groups

- Given the following data of two brands: Brand A and Brand B

	Brand A	Brand B
Average Sales	5 ($\overline{X_1}$)	6 ($\overline{X_2}$)
Sample Size	40	40
Variance	.245	.278

Between Groups Difference: $\overline{X_2}$ - $\overline{X_1}$ = 5 – 6 = -1

Independent samples t-test

Within Group Variation: $Var\ (A+B) = Var\ (A) + Var\ (B)$

Test statistic: t-statistic $= \frac{Between\ groups\ variation}{Within\ group\ variation} = \frac{\overline{X_2} - \overline{X_1}}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$

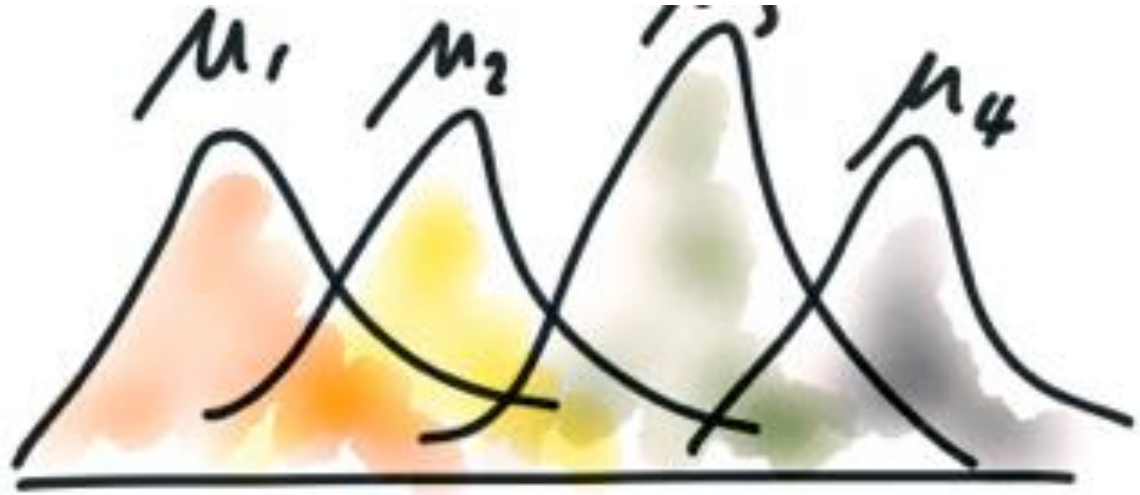
SPSS output

Pivot Table Independent Samples Test

File Edit View Insert Pivot Format Help

Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Equal variances assumed	.006	.940	.000	78	1.000	.00000000	.22360680	-.44516694	.44516694
Equal variances not assumed			.000	78.000	1.000	.00000000	.22360680	-.44516694	.44516694



ANOVA

$\mu_1 = \mu_2 = \mu_3 = \mu_4$?

Comparing means of three groups

Given the following data for three brands: Brand A, Brand B, and Brand C

	Brand A	Brand B	Brand C
Average sales	5 ($\overline{X_1}$)	6 ($\overline{X_2}$)	4 ($\overline{X_3}$)
Sample Size	40	40	40
Variance	.245	.278	.110

Between Groups variation = $(\overline{X_2} - \overline{X_1})^2 + (\overline{X_3} - \overline{X_2})^2 + (\overline{X_1} - \overline{X_3})^2$

It is a tool which help us in answering …

Is Y = *f* (x)?

Where

Y = Dependent Variable measured at a scale level; → Value perception

X = Independent Variable which is CATEGORICAL Variable → Brands

ANALYSIS OF VARIANCE …

- More than one samples.

- ANOVA proceeds with a Null Hypothesis of *no differences among the means of populations.* That is-

Null Hypothesis H_0: $\mu_1 = \mu_2 \quad \mu_3$

And,

Alternative Hypothesis H_1: At least two means are different.

One way ANOVA

- Within group variation = $\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2} + \frac{S_3^2}{n_3}$

F-statistic = $\frac{Between\ group\ variation}{Within\ group\ variation} = \frac{MSC}{MSE}$

SPSS Output

ANOVA

Value perception

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	254.400	2	127	57.31	.010
Within Groups	259.600	117	2.213		
Total	514.000	119			

ANOVA and *t*-Test...

- ANOVA tests for equality of means for multiple groups and uses *F*-Statistics which is the ratio of two variances *while t-Test is used for testing equality of means of two groups.*

- Please note that for two group cases, $F = t^2$.

- ANOVA can be used for testing equality of means even for two groups.

Types of Error in hypothesis testing

Error in hypothesis testing -Type I and Type II

- In the hypothesis testing, we prove or disprove our claim based on the **known** null hypothesis or established accepted reality.
- In the real world, we can never be sure whether the null value is: true or false.

In such a case, we can come across two types of errors:

- **Type 1 error**: When we reject the null hypothesis, when in reality it is true
- **Type II error**: When we do not reject the null hypothesis, when is reality it was false.

Type 1 and Type II

Row 1: If we reject the null hypothesis, then it could be possible:

When in reality it is false → correct decision.

When is reality it was true → Type 1 error

For instance: wheat flour- package

Row 2: If we do not reject the null hypothesis:

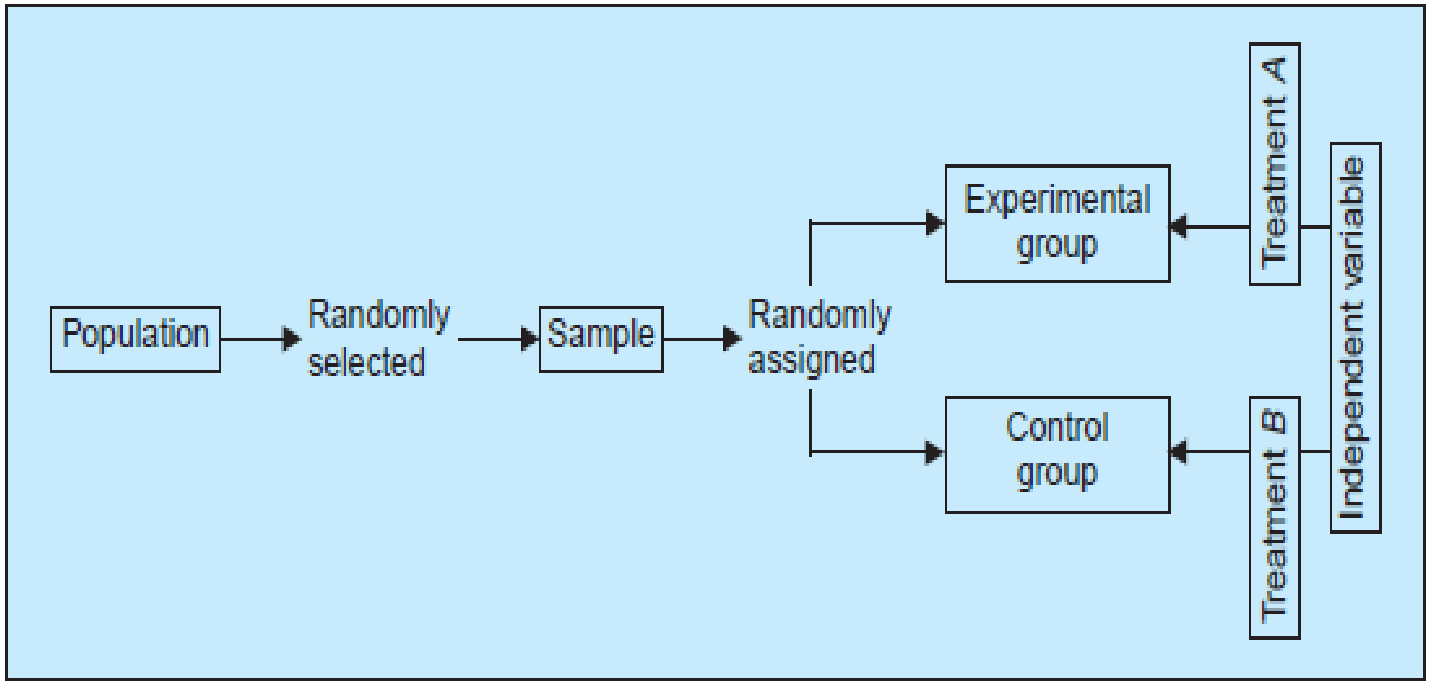
When is reality it was true → Correct decision

When in reality it is false → Type II error

Unknown Reality

Conclusion from hypothesis testing	**H0 is true**	**H0 is False**
Reject the H0	**Type I error**	Correct decision
Do not reject H0	Correct decision	**Type II error**

Surveys to Experiments



“Groups” in Experiments

- Basic to understanding Experiments
- Basic experiment design involves ***two groups*****-** Treatment/ Experiments and Control group.
    - ***Other Examples????***
- *Note: Do not worry if you could not understand heavy terms, like randomly distributed, and manipulations*

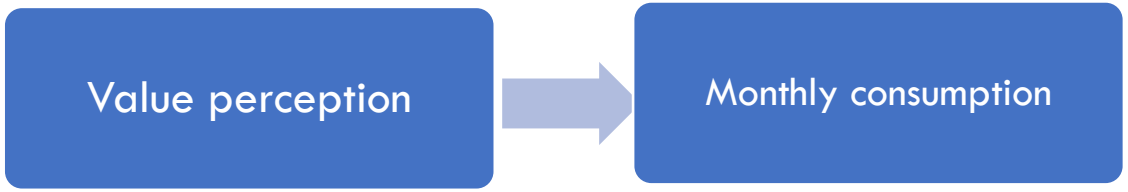
Research problem 1

Relationship of interest

Designing a survey

What is the value perception of customer towards Brand A ?

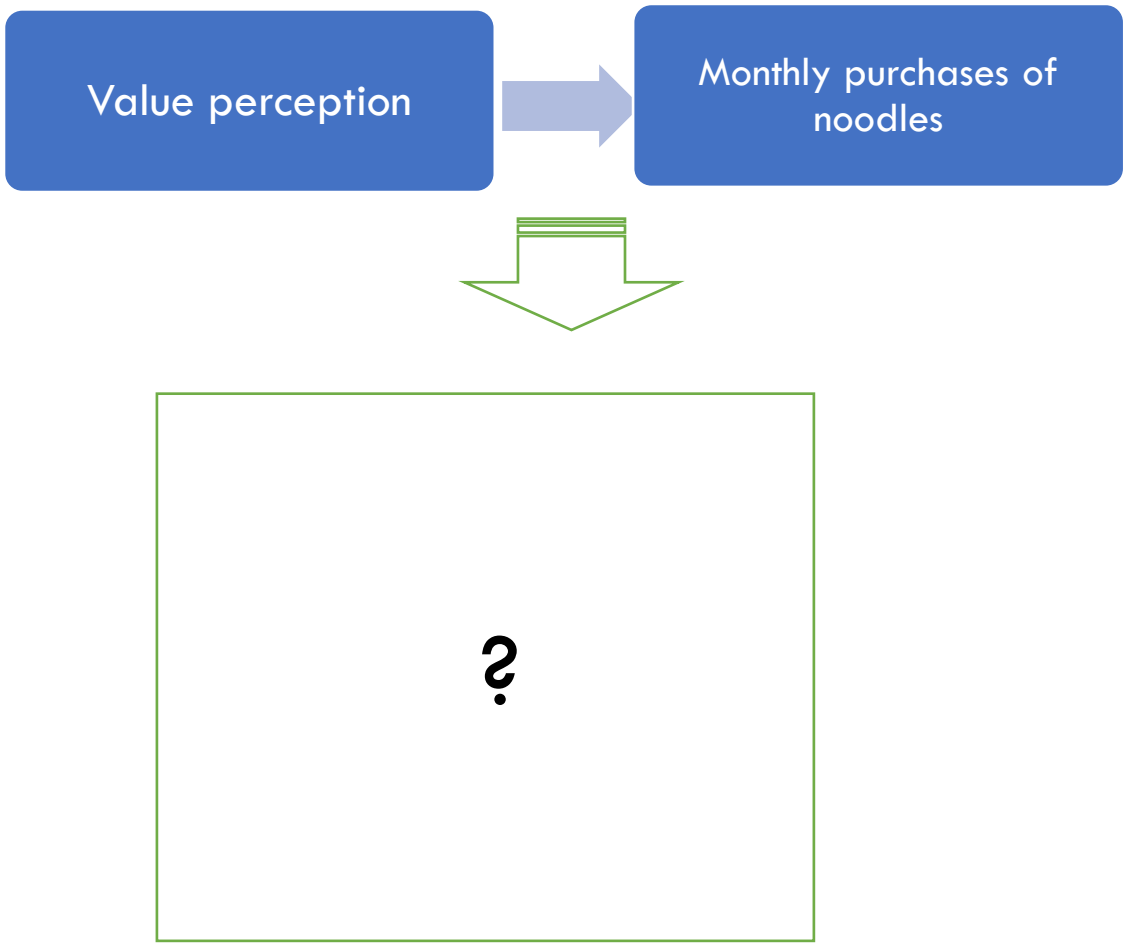
What is your monthly consumption of Brand A ?



Association

- Coefficient of correlation (r)= + 0.78; significant at 0.05 level of significance.
- Association between Value perception and consumption
- ***“Can we conclude that there exists a causality between both???”***
- Association is necessary but not sufficient condition to establish causality.
- To establish causality we need two more ingredients- Isolation and Time precedence

Isolation



1. Identify all such spurious/ extraneous variables
2. Capture all these
3. Control for these variables
4. **Isolate** the effect value perception

Time Precedence Or Temporal Priority

"Invariable assumption of time precedence" in surveys

Temporal priority of the independent variable

Cause precedes the effects

Admit to hospital today for illness to arise tomorrow

May be "Monthly purchase led to Value perception"

Causality

Association

- Correlation between IV and DV
- Move in harmony
- e.g. Cigarette smoking and Lungs-Cancer

Time Precedence

- Variation in the independent variable came before variation in the dependent variables

Isolation

- Control for Spurious/ extraneous/ confounding
- Spurious, when effect due to changes in a third variable
- e.g., Price of Pen and Demand of Petrol

Experiment Method

"Provides the most powerful design for testing causal hypotheses"

Experiments

- “*Series of purposeful changes are made in IV to identify the reasons for change in output/response/ dependent variable*”
  - Two comparison groups -experimental group and control group, *to establish association*.
  - Variation in the independent variable before assessment of change in the dependent variable, *to establish time order.*
  - Random assignment to the two (or more) comparison groups, *to establish isolation*.

4. Predictive analytics

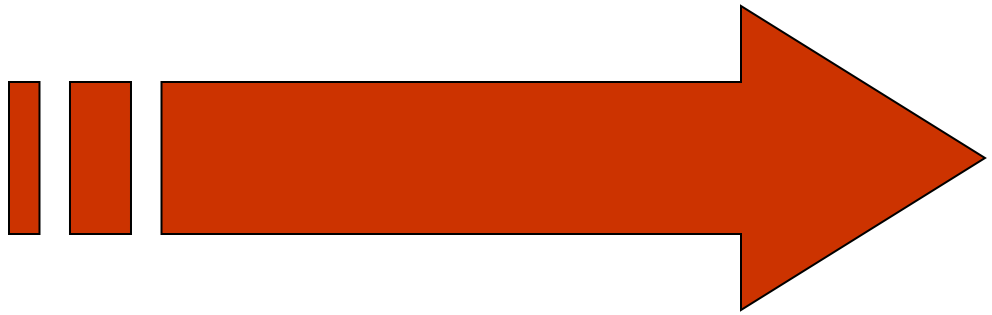
Predictive Analytics

- Regression and SEM
- Sales
  - Customer Acquisition Cost (CAC)
  - Customer Conversion Rate (CCR)
  - Repurchase Rate (RR)
  - Daily Active Users (DAU)
  - Customer Satisfaction (CSAT)
  - Customer Lifetime Value (CLV)

So, let’s us start with

REGRESSION MODEL …

But, first the CLASSICAL REGRESSION MODEL…



REGRESSION MODEL

- The General form of the Classical Linear Regression Model:

$$Y_i = \alpha + \beta X_i + \varepsilon_i \; ; \; i = 1, \ldots, n$$

- Where-
  - The above equation is called Simple Linear Regression Model
  - Also, known as Two-Variable Linear Regression Model
  - α is called the Intercept Parameter.
  - β is called the Slope Parameter in the relation between variables Y *and* X.
  - ε_i is called Error Term or Disturbance Term or Noise Term.

REGRESSION MODEL

- Every Classical Linear Regression Model is Stochastic in nature due to the error term, as the behavior of error term is random in nature.

- Error Term takes care of ‘other things being constant’ or ‘ceteris paribus’.

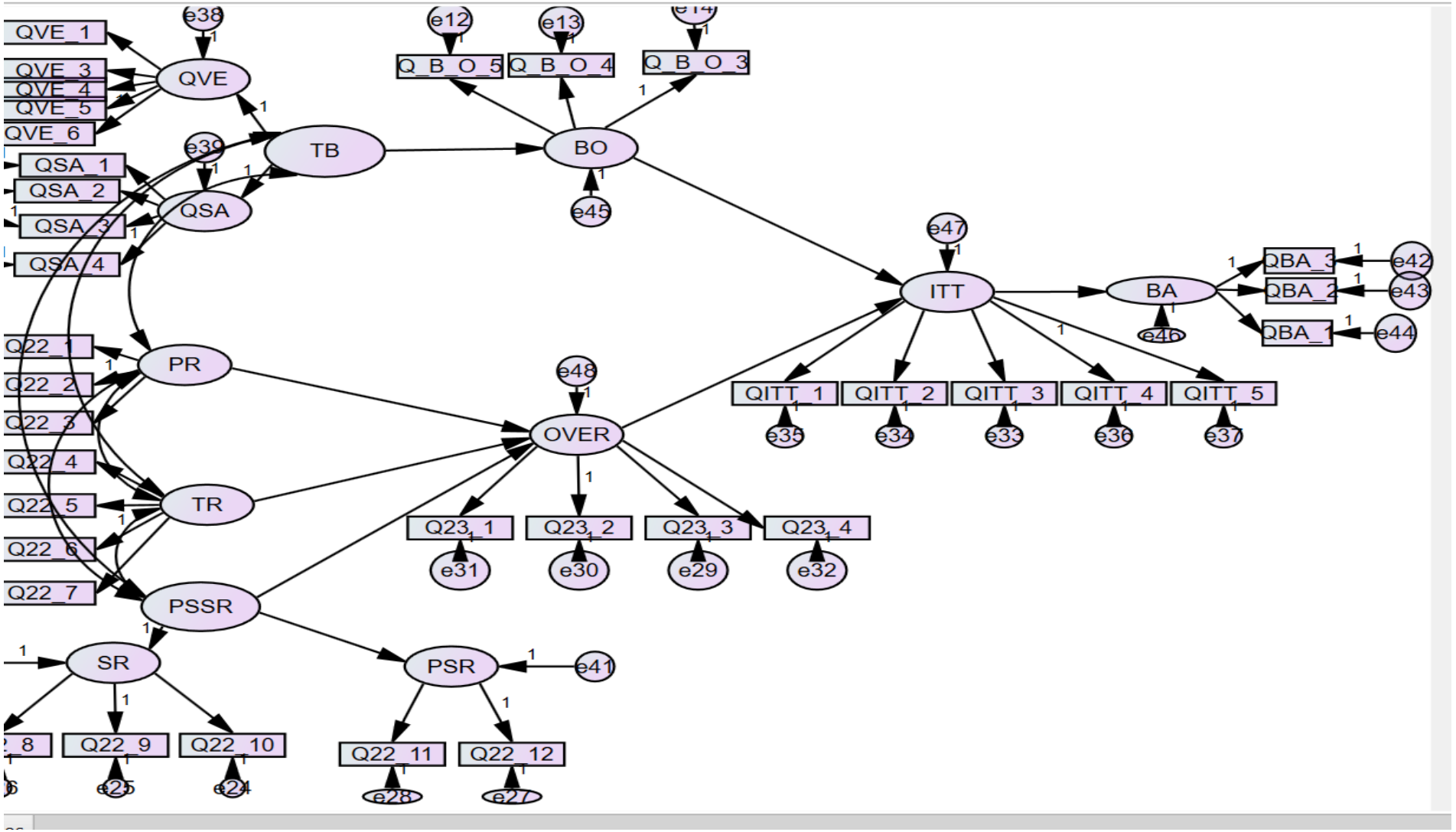
REGRESSION MODEL – Assumptions

- BASIC ASSUMPTIONS:
  - Zero Mean of the Disturbance: $E[\varepsilon_i] = 0$ for all i;
  - Homoscedasticity: $Var[\varepsilon_i] = \sigma^2$, a constant for all i;
  - Nonautocorrelation: $Cov[\varepsilon_i , \varepsilon_j] = 0$ if $i \neq j$
  - Uncorrelatedness of regressor and disturbance: $Cov[X_i , \varepsilon_j] = 0$ if all i and j;
  - Normality: $\varepsilon_i \sim N[0, \sigma^2]$; and
  - Non-Stochastic Regressor: the value of X_i is a known constant in the probability distribution of Y_i.

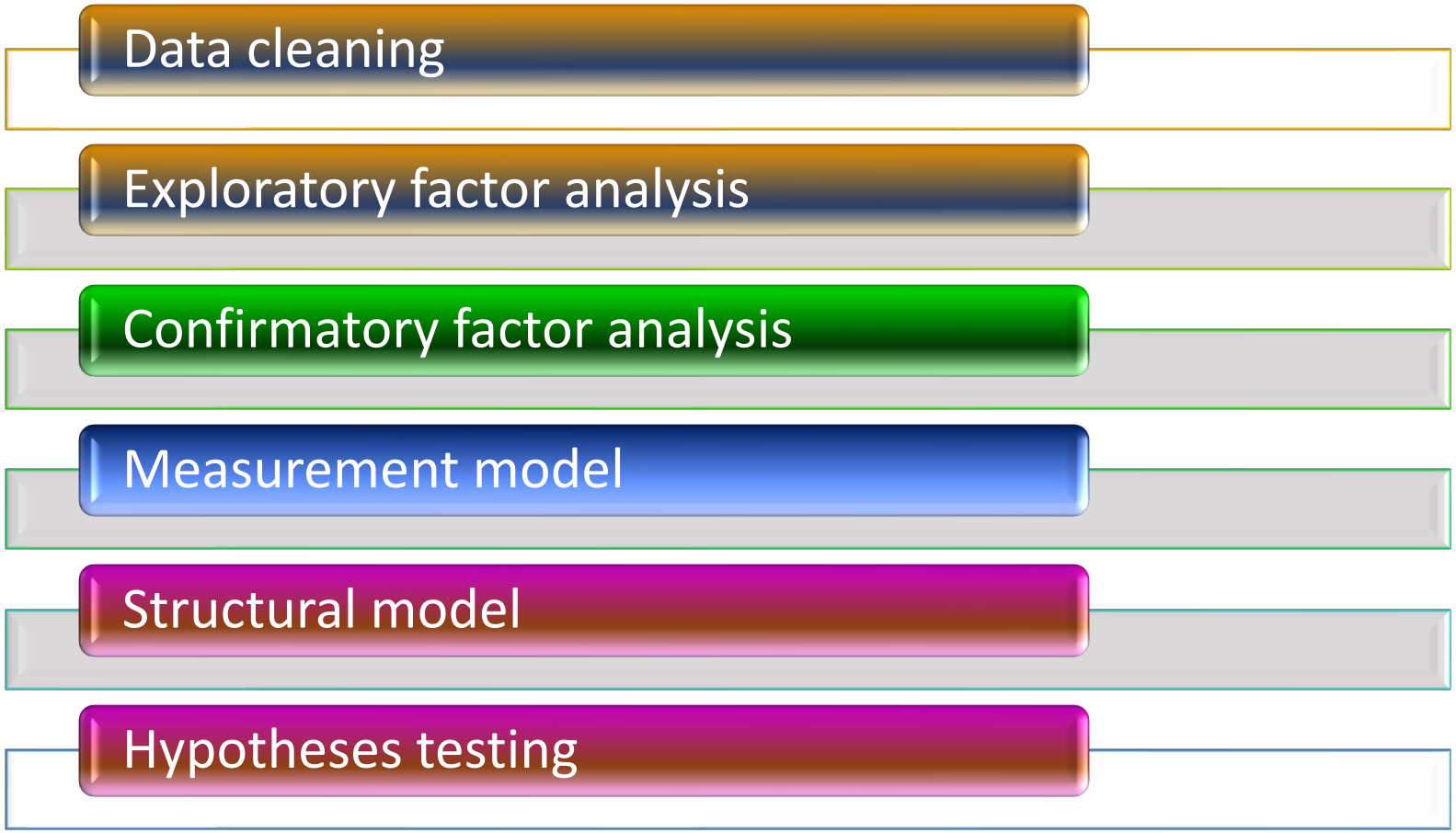
Properties of OLS estimates

- GAUSS - MARKOV THEOREM : This theorem says that given the assumptions of the classical regression model, the OLS estimators, in the class of unbiased linear estimators, have minimum variance; that is, they are BLUE.
  - Best - - - - - Minimum Variance
  - Linear - - - - - Linear Functions of variables
  - Unbiased - - - - - their expectations are equal to population parameters.
  - Estimators - - - - - Estimates from the sample information.

Structural equation modeling



Basic flow for conducting SEM analysis



4. Prescriptive Analytics

- Advise on possible outcomes
- Optimization
- Scenario analysis
- Simulation

Concluding points

BASIS FOR COMPARISON	QUALITATIVE RESEARCH	QUANTITATIVE RESEARCH
Meaning	Qualitative research is a method of inquiry that develops understanding on human and social sciences, to find the way people think and feel.	Quantitative research is a research method that is used to generate numerical data and hard facts, by employing statistical, logical and mathematical technique.
Nature	Holistic	Particularistic
Approach	Subjective	Objective
Research type	Exploratory	Conclusive
Reasoning	Inductive	Deductive
Sampling	Purposive	Random
Data	Verbal	Measurable
Inquiry	Process-oriented	Result-oriented
Hypothesis	Generated	Tested


ARE THERE ANY QUESTIONS? FEEL FREE TO ASK ANY-THING AT ALL.