

# Descriptive Statistics and Overview of Inferential Statistics



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## What is Variables?

- Variable comes from Vary + Able
- So variable is anything that its values can be varied
- Variable is a property of entities (things) that its values can be varied
- Variables are the phenomena or the topics that researchers want to investigate



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## What is measure?

- **Qualitative:**
  - focuses on collecting information that is not numerical
  - Report by symbolic meaning
  - Cannot any mathematical operation
- **Quantitative:**
  - measurement of data that can be put into numbers
  - The goal of quantitative measurement is to run statistical analysis



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# Classification of Variables

- By cause-effect
- Independent variables (IV)
  - Dependent variables (DV)
  - Extraneous variables
  - Mediator or intervening variables
  - Moderator variables



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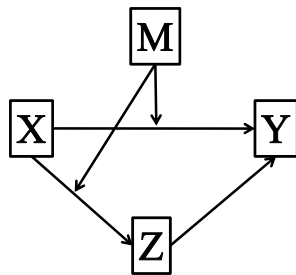
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X : IV  
Y : DV  
Z : Mediator  
M : Moderator



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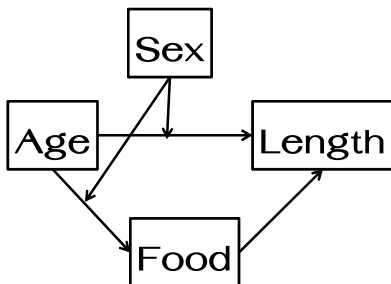
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## Classification of Variables

- By attributes
  - Qualitative variables
  - Quantitative variables
  - Different statistical methods



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## Classification of Variables

- By continuous
  - Continuous or metric variables
  - Discrete or non-metric variables



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## What is IV?

- *Independent variables; IV*
  - Antecedent
  - Consequence
  - Another call: experiment variables, manipulate variables, predictor variables *etc.*



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## What is DV?

- *Dependent variables; DV*
  - By IV
  - Or another effect (unexplained sources)



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## Scale of Variables

- **Nominal Scale**
- **Ordinal Scale**
- **Interval Scale**
- **Ratio Scale**



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## Accuracy vs. Precision; which one you prefer?



แม่นยำและเที่ยงตรง



ไม่แม่นยำแต่เที่ยงตรง



แม่นยำแต่ไม่เที่ยงตรง



既不แม่นยำและไม่เที่ยงตรง



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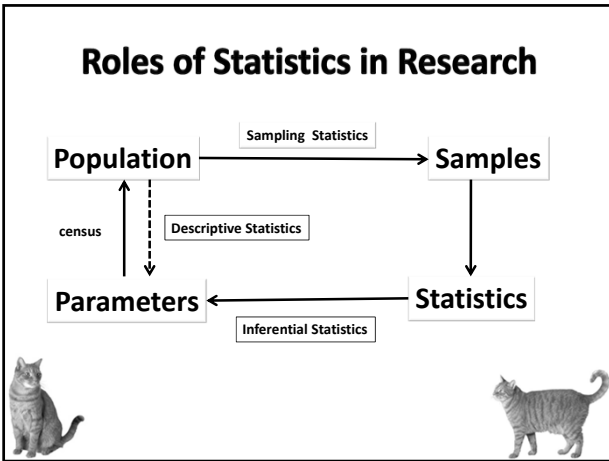
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## Q & A

- Census can calculate confidence interval or not?
- Census can forecast regression or correlation or not?

The Q&A section contains two bullet points asking about the capabilities of a census. The diagram is decorated with two cat illustrations at the bottom corners.

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## WHAT IS DESCRIPTIVE STATISTICS?

The Descriptive Statistics section asks for a definition of descriptive statistics. The diagram is decorated with two cat illustrations at the bottom corners.

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No. of variables	Scale	Statistical tools
1	Nominal scale & Ordinal scale	Frequency Percentage
1	Interval scale & Ratio scale	Mean Variance s.d. Skewness Kurtosis




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**What is Inferential Statistics?**

- Hypothesis Testing
- Estimation of parameters (causal relationship) : regression and correlation analysis
- Need appropriate sampling techniques




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**Q & A**

- Census can calculate confidence interval or not?
- Census can forecast regression or correlation or not?




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## Causal Relationship

Types of Variables		Statistical Analysis
Scale of 1 <sup>st</sup> variable	Scale of 2 <sup>nd</sup> variable	
Interval scale or Ratio scale	Interval scale or Ratio scale	Pearson Correlation (linear corr.)



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## Causal Relationship

Types of Variables		Statistical Analysis
Scale of 1 <sup>st</sup> variable	Scale of 2 <sup>nd</sup> variable	
Interval scale or Ratio scale	Interval scale or Ratio scale	Eta or Correlation ratio (non linear corr.)



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## Causal Relationship

Types of Variables		Statistical Analysis
Scale of 1 <sup>st</sup> variable	Scale of 2 <sup>nd</sup> variable	
Ordinal scale	Ordinal scale	Spearman Rank Correlation



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## Causal Relationship

Types of Variables		Statistical Analysis
Scale of 1 <sup>st</sup> variable	Scale of 2 <sup>nd</sup> variable	
Ordinal scale (more than 2 orders)	Ordinal scale (more than 2 orders)	Polychoric Correlation




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## Causal Relationship

Types of Variables		Statistical Analysis
Scale of 1 <sup>st</sup> variable	Scale of 2 <sup>nd</sup> variable	
Nominal scale (2 groups)	Nominal scale (2 groups)	Phi Correlation
Nominal scale (more than 2 groups)	Nominal scale (more than 2 groups)	Cramer's V




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## Meaning of Correlation Coefficients

Correlation coefficients	Level of coefficients
0.81 – 1.00	Highly correlated
0.51 – 0.80	Moderately correlated
0.21 – 0.50	Low correlated
0.00 – 0.20	Very low correlated




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**Statistical Techniques for Causal Analysis  
with IV & DV**

Scale of IV	Scale of DV	Statistical Techniques
nominal/ordinal	nominal	crosstabulation, X-tab
nominal/ordinal	interval/ratio	ANOVA
interval/ratio	interval/ratio	simple regression
interval/ratio	nominal/ordinal (dummy variable; 0,1)	logistic regression, discriminant analysis

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**STATISTICAL FOR TESTING  
HYPOTHESIS**

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**Confidence Interval**

- **Types of Statistical Estimation**
  - Point Estimation
  - Interval Estimation
- **Confidence Interval :**
  - Interval estimation
  - More flexible than point estimation

$$\bar{X} \pm Z \times \frac{S}{\sqrt{n}}$$

∴ Confidence Interval = Statistics ± Sampling Error  
(Margin Error)

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### One population t-test

- Compare between population mean and constant

### Two population t-test

- Compare between two population means
- Three cases to concern




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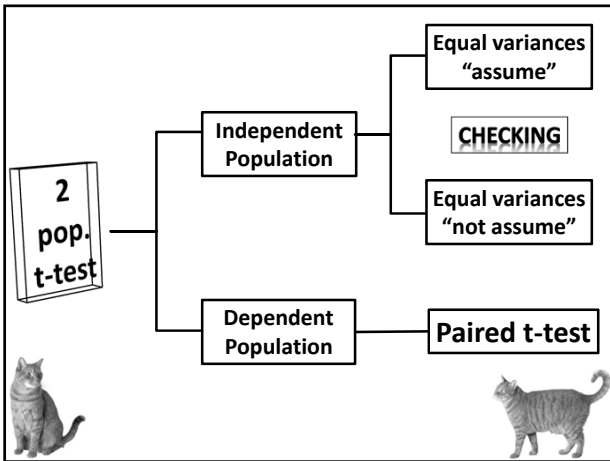
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### t-test

Variable	No.	Scale of Variable
IV	1	Non-metric Variable (2 groups of categorical data)
DV	1	Metric Variable (quantitative)

if more than 2 groups of non-metric???




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# ONE-WAY ANOVA

Variable	No.	Scale of Variable
IV	1 or $\geq 1$ , each of them have $\geq 2$ data	Non-metric (nominal, ordinal)
DV	1	Metric (quantitative)




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# Multi-WAY ANOVA

- Main effect and interaction effect
- Also computed  $R^2$
- Factorial Experiment




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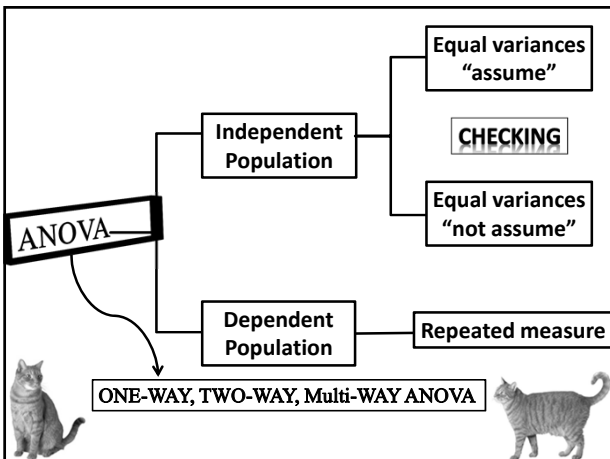
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