

Addis College

M.Sc : Construction Technology & Management

Course: Research Methods and Statistical Application

Lecture 8: Inferential and Descriptive statistics

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Descriptive & Inferential statistics

- Descriptive and inferential statistics are two broad categories in the [field of statistics](#).
- Both descriptive and inferential statistics help make sense out of row after row of data.
- Use descriptive statistics to summarize and graph the data for a group that you choose. This process allows you to understand that specific set of observations.

- Descriptive statistics describe a [sample](#). That's pretty straightforward. You simply take a group that you're interested in, record data about the group members, and then use summary statistics and graphs to present the group properties. With descriptive statistics, there is no uncertainty because you are describing only the people or items that you actually measure. You're not trying to infer properties about a larger [population](#).
- The process involves taking a potentially large number of data points in the sample and reducing them down to a few meaningful summary values and graphs. This procedure allows us to gain more insights and visualize the data than simply pouring through row upon row of raw numbers!

Inferential Statistics

- Inferential statistics use a random sample of data taken from a population to describe and make inferences about the population.
- Inferential statistics are valuable when examination of each member of an entire population is not convenient or possible.

For example:

- To measure the diameter of each nail that is manufactured in a mill is impractical. You can measure the diameters of a representative random sample of nails. You can use the information from the sample to make generalizations about the diameters of all of the nails.

- In inferential statistics we use the following methods:
 - Z – scores
 - Hypothesis testing
 - T statistics
 - Correlations and Regression
 - Chi – square statistics
 - Analysis of variance (ANOVA)

Goal of Inferential Statistics

- Quantitative research in psychology and social science aims to test theories about the nature of the world in general (or some part of it) based on samples of “subjects” taken from the world (or some part of it).
- When we perform research on the effect of TV violence on children’s aggression, our intent is to create theories that apply to all children who watch TV, or perhaps to all children in cultures similar to our own who watch TV.

Goal of Inferential Statistics Cont'd

- We of course cannot study all children, but we can perform research on samples of children that, hopefully, will generalize back to the populations from which the samples were taken.
- Recall that external validity is the ability of a sample to generalize to the population (and to other operationalizations that are assumed to represent that same constructs).
- Inferential statistics is the mathematics and logic of how this generalization from sample to population can be made.

The fundamental question is:

- *Can we infer the population's characteristics from the sample's characteristics?*

Goal of Inferential Statistics Cont'd

- Descriptive statistics remains local to the sample, describing its central tendency and variability, while **inferential statistics** focuses on making statements about the population.

Basic principles of inferential statistics

- At a certain basic level, all inferential statistics procedures are the same: they seek to determine if the observed (sample) characteristics are sufficiently deviant from the null hypothesis to justify rejecting it. How deviant?
- The ingredients for making this calculation are the same for all statistical procedures:
 1. the size of the observed difference(s)
 2. the variability in the sample
 3. the sample size.

Basic principles of inferential statistics Con't'd

- If instead we are looking for relationships (e.g., correlation analysis), the size of the relationship replaces the size of the difference.

Therefore, researchers seeks to:

1. find large differences (or relationships)
2. hold down unwanted variability
3. obtain large samples.

(Good research must also worry about internal and external validity, and the ultimate goal: building theories.)

Basic principles of inferential statistics Con't'd

Name of Test	Formula (conceptual)	What it does
t-test	$t = \frac{\text{Mean Difference}}{\text{Error Variance}}$	Difference between two means
Analysis of Vari- ance	$F = \frac{\text{Differences Among Means}}{\text{Error Variance Within Groups}}$	Differences among many means, with many IVs
Chi-Square Test	$\chi^2 = \frac{\text{Extent to which frequencies are not consistent with the null hyp}}{\text{Size of sample}}$	Differences in frequencies; or relationship between nominal variables

Procedure for Performing an Inferential Test

Here is a step-by-step procedure for performing inferential statistics.

1. Start with a theory

(TV violence reduces children's ability to detect violent behavior because it blurs the distinction between real and fantasy violence)

2. Make a research hypothesis

(Children who experience TV violence will fail to detect violent behavior in other children)

3. Operationalize the variables
4. Identify the population to which the study results should apply (Kids in developed nations)
5. Form a null hypothesis for this population
($H_0: \mu_H = \mu_L$, where μ_H is mean accurate detection of violence by children with high prior exposure to TV violence; μ_L is low prior exposure)
6. Collect a sample of children from the population and run the study
7. Perform statistical tests to see if the obtained sample characteristics are sufficiently different from what would be expected under the null hypothesis to be able to reject the null hypothesis.

Levels of quantitative analysis

<i>Levels of quantitative analysis</i>	<i>Types of data</i>
Descriptive statistics	Variable frequencies; averages; ranges
Inferential statistics	Assessing the significance of data and results
Simple interrelationships	Cross-tabulation or correlation between two variables
Multivariate analysis	Studying the linkages between more than two variables

Source: L Blaxter et al. (2001) p. 216.

- Some major measures that are commonly used in descriptive statistics are :-
 - Frequency distribution
 - Measures of Central Tendency
 - Measures of Variability or Dispersion
- Frequency distribution includes frequency distribution tables, graph, ... etc.
- Measures of Central Tendency include Mean, Median and Mode.
- While Measures of Variability include Standard deviation (Variance), the minimum and maximum values of variables and skewedness.

Frequency Distribution Graph:

- A frequency distribution graph is basically a picture of the information available in a frequency distribution table.
- Frequency distribution graph includes:
 - Histogram (graph for interval or ration data)
 - Bar graph (graph for nominal or ordinal data)

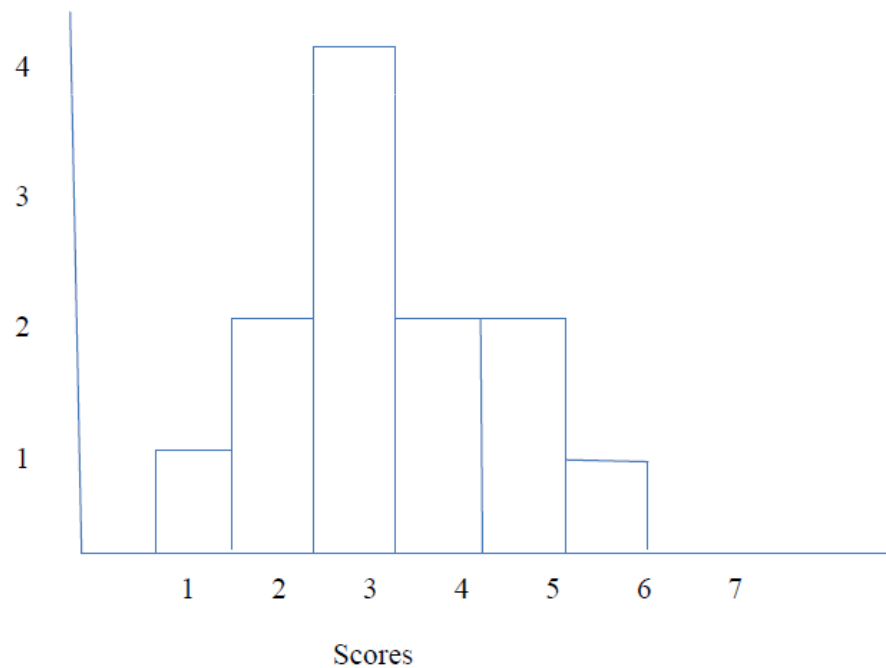


Fig. Histogram

<i>X</i>	<i>f</i>
6	1
5	2
4	2
3	4
2	2
1	1

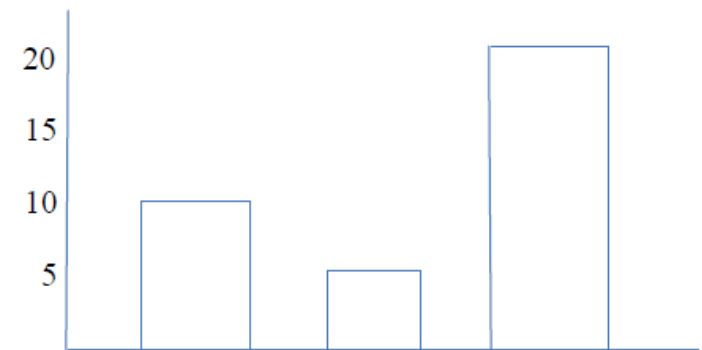


Fig. Bar graph

Assignment 7 (7.5%)

- What distinguishes statistical statistics from descriptive statistics? (2.5%)
- Describe where and how we use statistical and descriptive statistics (5%)

Note:

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Deadline: August 26, 2020

Thank you

Your ? Through email