

Statistics for the Behavioral Sciences

- 1) Pick up a lab worksheet
- 2) Pick up a 'Recitation Rules' sheet

Objectives

- Administrative/Clerical ‘stuff’
- Review Chapters 1 & 2
- Learn basics of SPSS
- Answer practice questions on worksheet

Logistics

Gostab

- Email: gostab.jen@nyu.edu
-

Office Hours: by appointment

Location may change based on the schedule that day

Bring questions to lab, email, and/or office hours

Campus Resources

- University Learning Center
- Wellness Exchange
 - Hotline: (212) 443-9999
- Moses Center for Students with Disabilities
- Center for Multicultural Education and Programs
- Lesbian, Gay, Bisexual, Transgender and Queer Student Center
- Office for Global Spiritual Life
- Office of Global Services

The Basics

Your final grade...

- SPSS assignments: 20%
 - Due in lecture **to Dr. Bauer** before start of class—otherwise, considered late (see syllabus)
- **Lab attendance:** 3%
 - Excused absences require documentation (not details!) to be approved – send me an email
 - No swapping lab sections w/o prior approval

Rules for Recitation

- Sign, tear, and pass forward

Brightspace Resource

Lecture Classes site

vs.

Lab Classes site (or Recitation Classes site)



What is recitation?

We will...

- Learn how to run analyses in SPSS
- Learn how to interpret the output
- Review important concepts
- Use worksheets to guide learning and review
- Answer questions from lecture

We will NOT:

- Go over recommended textbook problems
- Complete SPSS assignments
- Always finish the worksheets in recitation
- Look over exams

SPSS ASSIGNMENTS

Important!
“One-Stop-Shop” Handout

SPSS Assignments

- Due dates are listed on the syllabus
- **Lab handouts** guide you through the analyses you'll need to run
- Turn assignments in **to Dr. Bauer** on due date

SPSS Assignments - Grading

- Not typed: -1 off overall grade
- Output printed from directly SPSS: -2 off overall grade
- Extra output is included: -1 off overall grade
- Split tables: -.2 for each occurrence
- Graphs not properly titled: -.1 for each occurrence
- Critical value is included in addition to test statistic: -.25 each
- Hand-calculating a value that should have been retrieved from SPSS output: -.2 for each occurrence
- See '**SPSS Rules**' and '**SPSS Assignment Grading Expectations**' docs

Where to find SPSS

SPSS in lab rooms (not usually open)

SPSS in most on-campus computer labs

SPSS in Bobst Library 5th floor DATA LAB

Virtual Computer Lab via NYU Home

- Search VCL and follow set-up instructions

Virtual Computer Lab

VCL has gotten better this year! However...

- Problems with VCL do not count as excuses for turning in late assignments!
- Using the VCL may lead to issues with your data and/or your ability to copy-paste your output!

Links to help you...because I am fallible

- <http://www.nyu.edu/its/vcl/faqs/>
- <http://www.nyu.edu/its/vcl/gettingstarted/>
- https://nyu.service-now.com/servicelink/kb_search.do?id=041213019263437

SPSS Assignment Information

- Check that you entered data correctly
- **DOUBLE SIDED assignments (trees)**
- Make sure you answer **ALL** parts of **ALL** questions
- Do SPSS problems in the order on the assignment and label each answer

SPSS Assignment Information

- Title & label graphs
- Box or highlight every answer to hand-calculations
- Only include relevant output
- Resize output & place in word document to reduce excess pages and avoid splitting charts/tables between pages
 - Right-click piece of output in SPSS; select Copy
 - Right-click in Word; select paste as image

SPSS & Academic Integrity

Each assignment must be your original work!

- Absolutely NO sharing of outputs
- <https://www.nyu.edu/about/policies-guidelines-compliance/policies-and-guidelines/academic-integrity-for-students-at-nyu.html>

Any plagiarism of another's assignment will result in a ZERO for the assignment and appropriate disciplinary action.

[we usually find out and it's always a bummer]

Plagiarism

"Collaborating between two or more students who then submit the same paper under their individual names."

"Submitting another student's work with your name on it."

"Paraphras[ing] or restate[ing] someone else's facts, analysis and/or conclusions."

Questions?

Review

(Chapters 1 and 2)

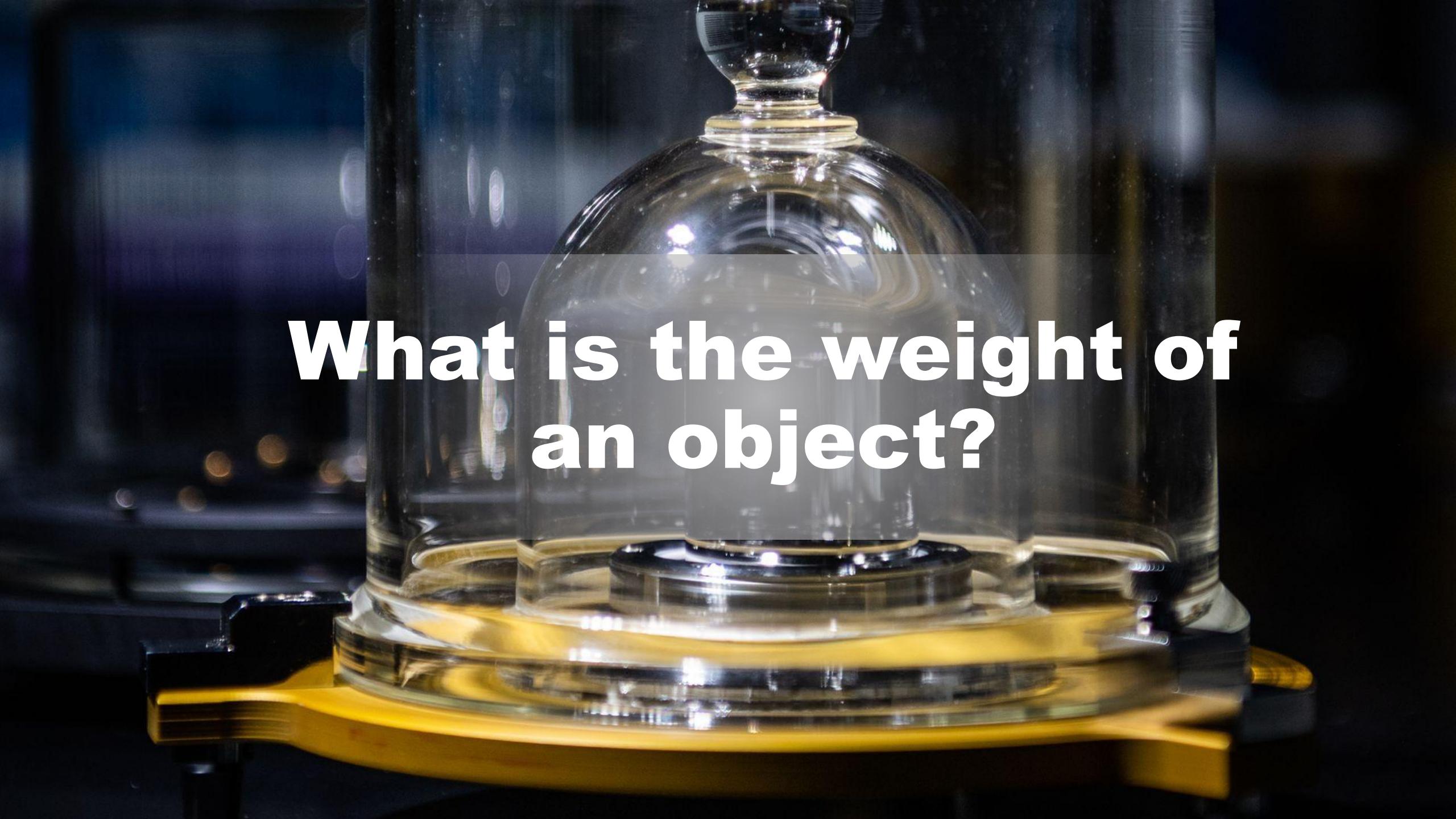
Descriptive vs. Inferential

Descriptive statistics

- Summarizes a set of data collected by a researcher

Inferential statistics

- Uses data collected from a smaller group of people (sample) to make inferences about the general population



**What is the weight of
an object?**

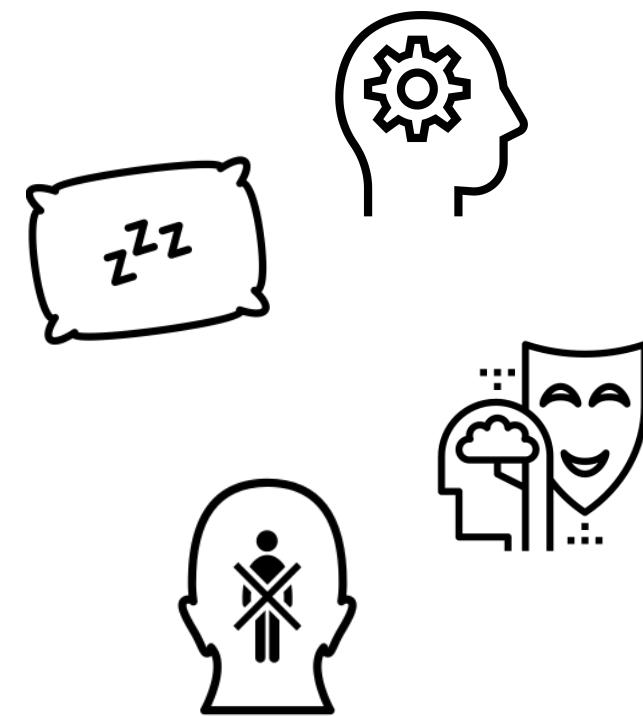
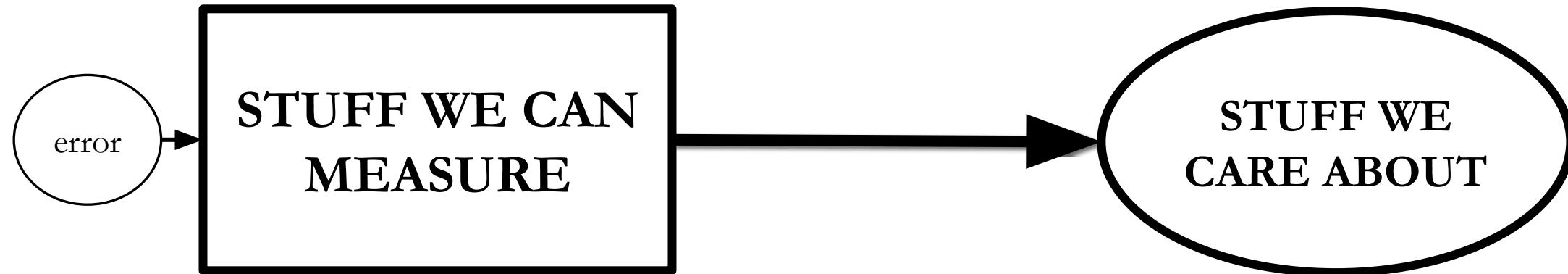
GEOLOGY & GEOPHYSICS

 Project Update



Universal Units Reflect Their Earthly Origins

On Friday, the kilogram will join its fellow metric units with a definition based on fundamental physical constants, but these units maintain links to their roots in the geosciences.





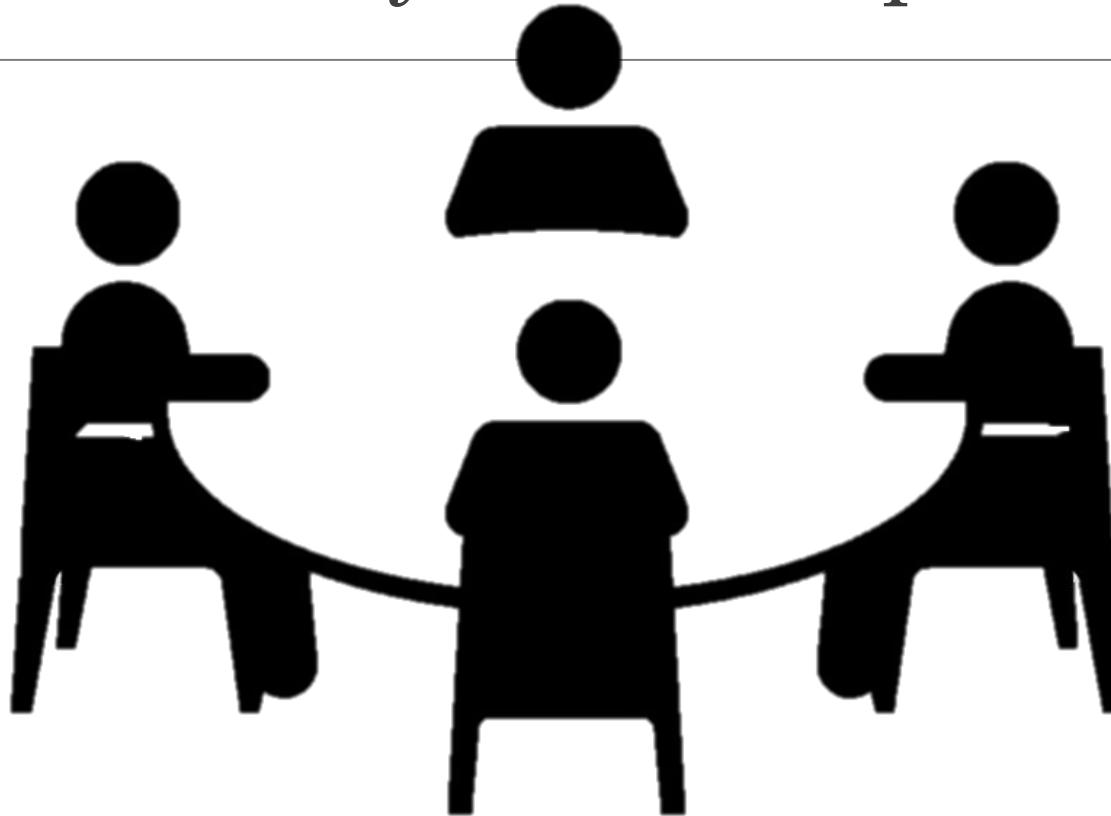
write down one way to measure
love with numbers

60 sec



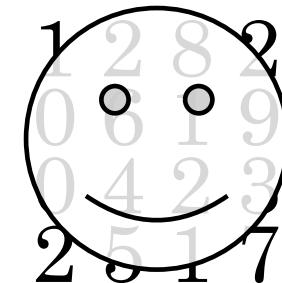
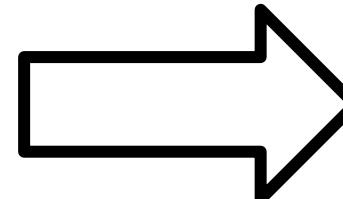
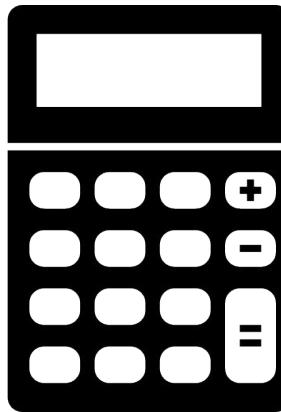
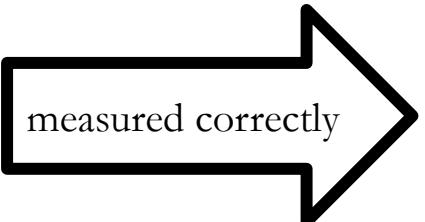
how would you
measure love? ?

what did you come up with?

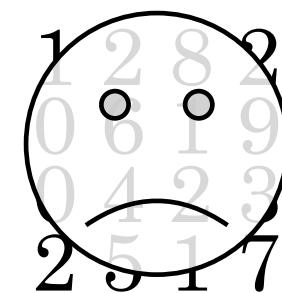
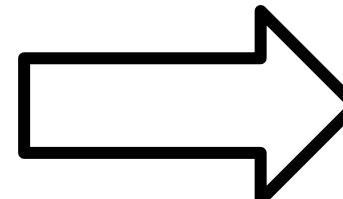
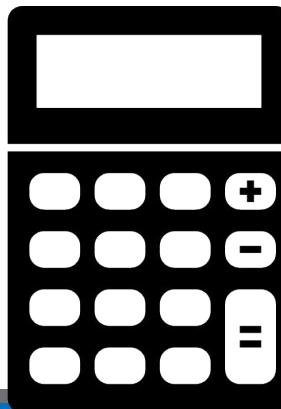
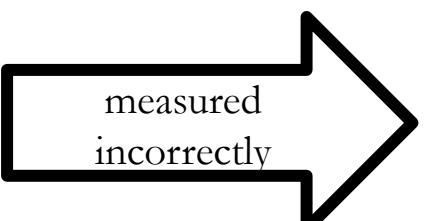


statistics: only as good as the numbers we feed them

1 2 9 2
1 3 2 4
3 4 5 6
2 1 7 7



1 2 9 2
1 3 2 4
3 4 5 6
2 1 7 7



different types of measurement...

nominal

ordinal

interval

ratio

discrete //
continuous

...require different statistics

Scales of Measurement

Nominal Scales

(a.k.a. categorical or qualitative)

- A scale where each value is simply named and represents a distinct **category**



Ordinal Scales

- A quantitative scale on which different values can be placed **in a meaningful order**



Ordinal Scales continued...

- Interval Scale

- Ordinal scales for which the levels are equally spaced



- Ratio Scale

- Interval scales where twice as many units of the variable represents twice as much of that variable; zero means none of the variable



Ratio scales always have the interval property, but interval scales do not necessarily have the ratio property

Continuous vs. Discrete Variables

A Continuous variable...

- Has an infinite number of “levels” between values
- e.g., height, weight,

Discrete variable

- Any variable for which there is no meaningful value in between the finite number of levels
- e.g., number of siblings, congresswomen in the house

Textbook, p. 8: “It is important not to confuse variables with the scales with which they are measured.”

Operationalizing

How would you operationalize and measure love?



Please rate the extent to which you agree with the following statement:

I'm currently in love with someone.

- (1) Completely disagree
- (2) Somewhat disagree
- (3) Neither agree nor disagree
- (4) Somewhat agree
- (5) Completely agree

Independent vs. Dependent

An Independent Variable is...

- A pre-existing or experimentally manipulated condition
- Independent of anything that happens during the experiment

A Dependent Variable is...

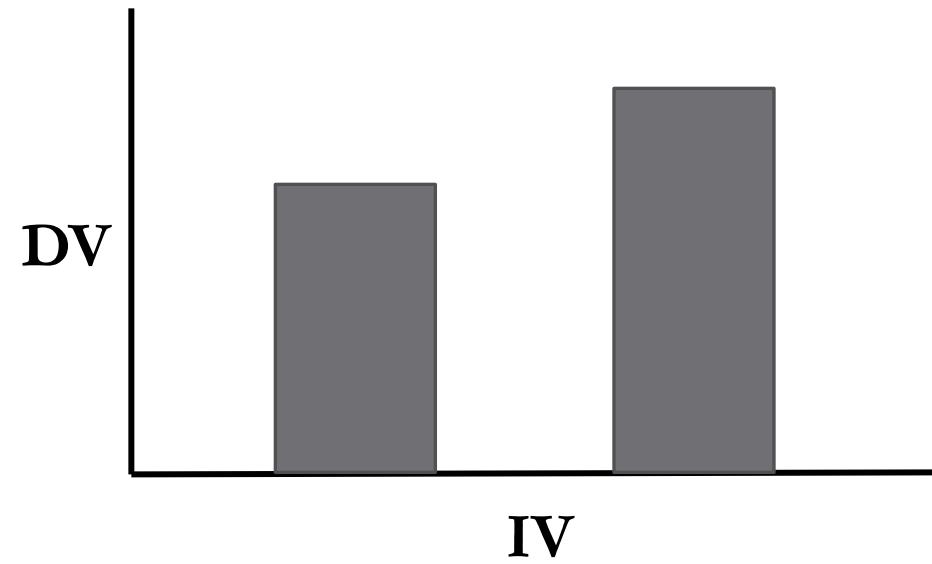
- An outcome which depends, at least partially, on the value of the IV

Independent vs. Dependent

Are kiddos who watch Mr. Rogers more intelligent?

Watch: Yes
or No

Intelligence
level



Experimental vs. Correlational

Experimental

- Involves groups created by the researcher
- Participants are randomly assigned to these groups
- The independent variable is said to be *manipulated*

Correlational

- Groups *selected* by the researcher,
not manipulated
- Be cautious about making
causal conclusions



Population vs. Samples

Populations

- A (theoretically large) set of numbers
- Doesn't necessarily have to be people
- Described by **parameters**

“Our population of interest is...”

Samples

- A subset of a population
- Described by **statistics**
- Hopefully as representative as possible

Graphs

Bar Graph

- Appropriate for discrete variables
- Used when scales are nominal or ordinal
- Bars do not touch

Histogram

- Appropriate for continuous data (interval/ratio scales)
- Bars DO touch
- Upper and lower real limits are represented

Stem-and-leaf plot

- Conveys most information about **individual** scores

SPSS Worksheet

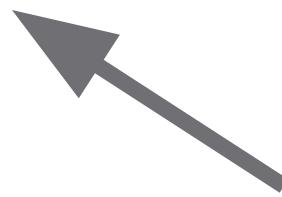
Part I: Learning with SPSS

Introduction to SPSS

3 types of files:

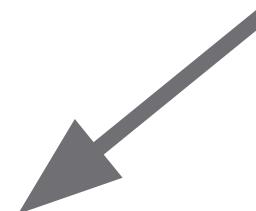
- **Data file** ([my_awesome_dataset.sav](#))

- Enter, label, view data, and perform statistics



- **Syntax file** ([my_sweet_syntax.sps](#))

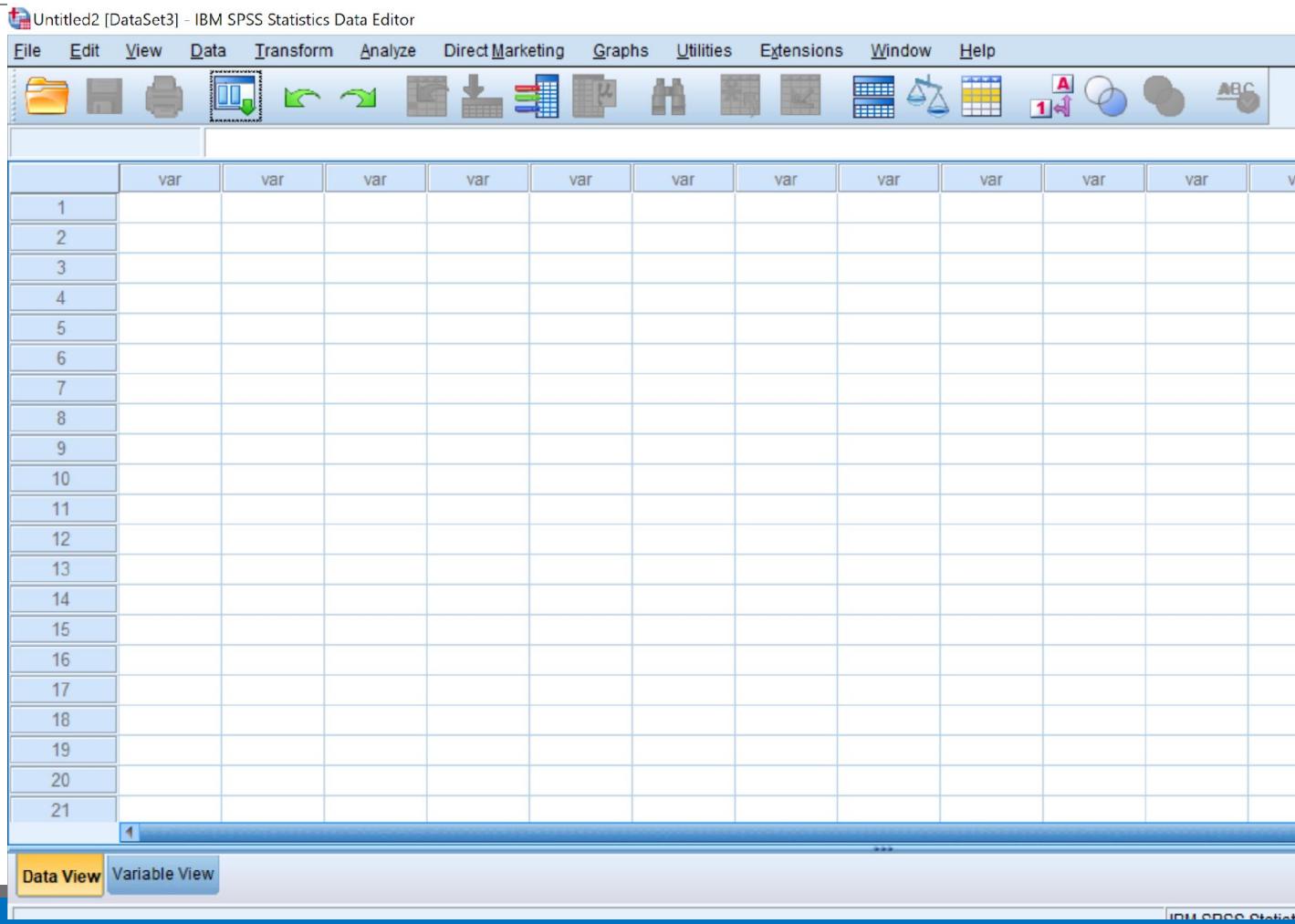
- Transforms your commands to SPSS language



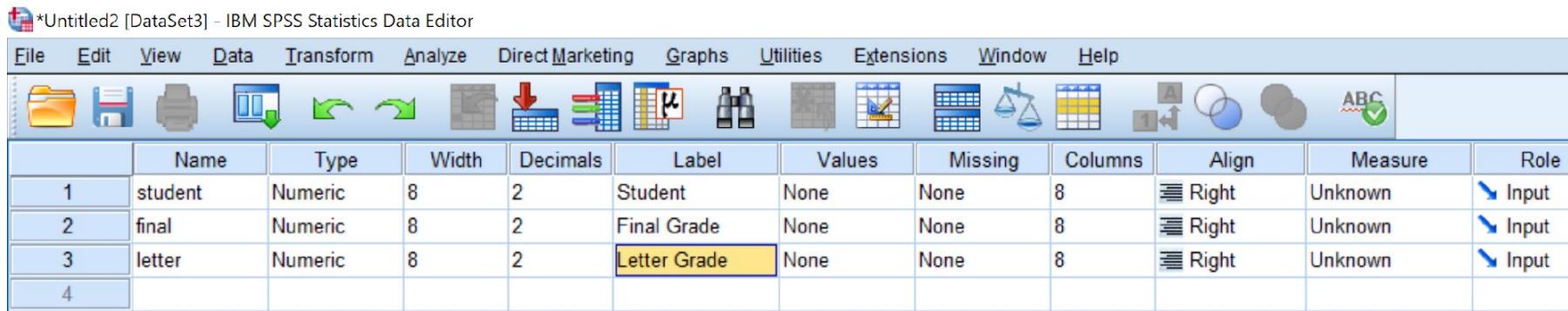
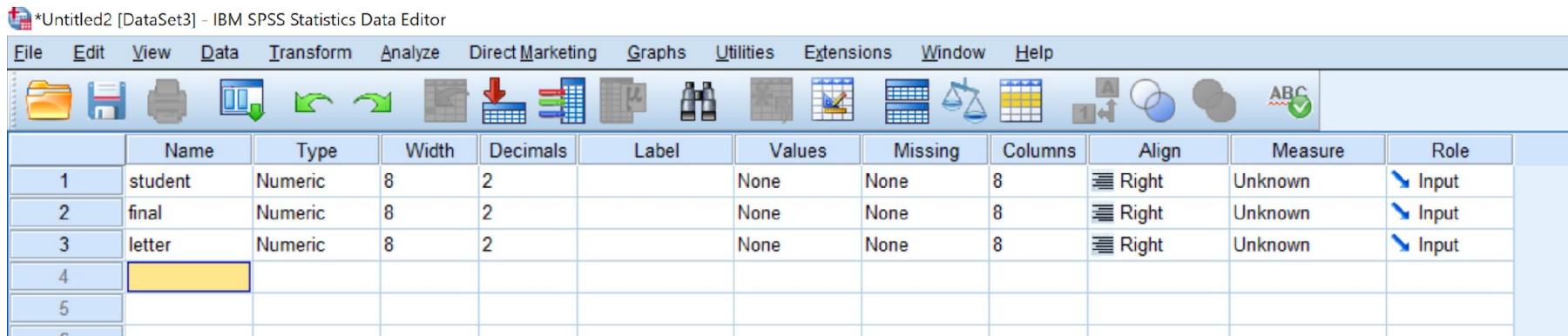
- **Output file** ([my_glorious_output.spo](#))

- See the results of the statistics that you run, presented in tables, graphs, etc.

Steps 1-3



Steps 4 & 5; Step 6



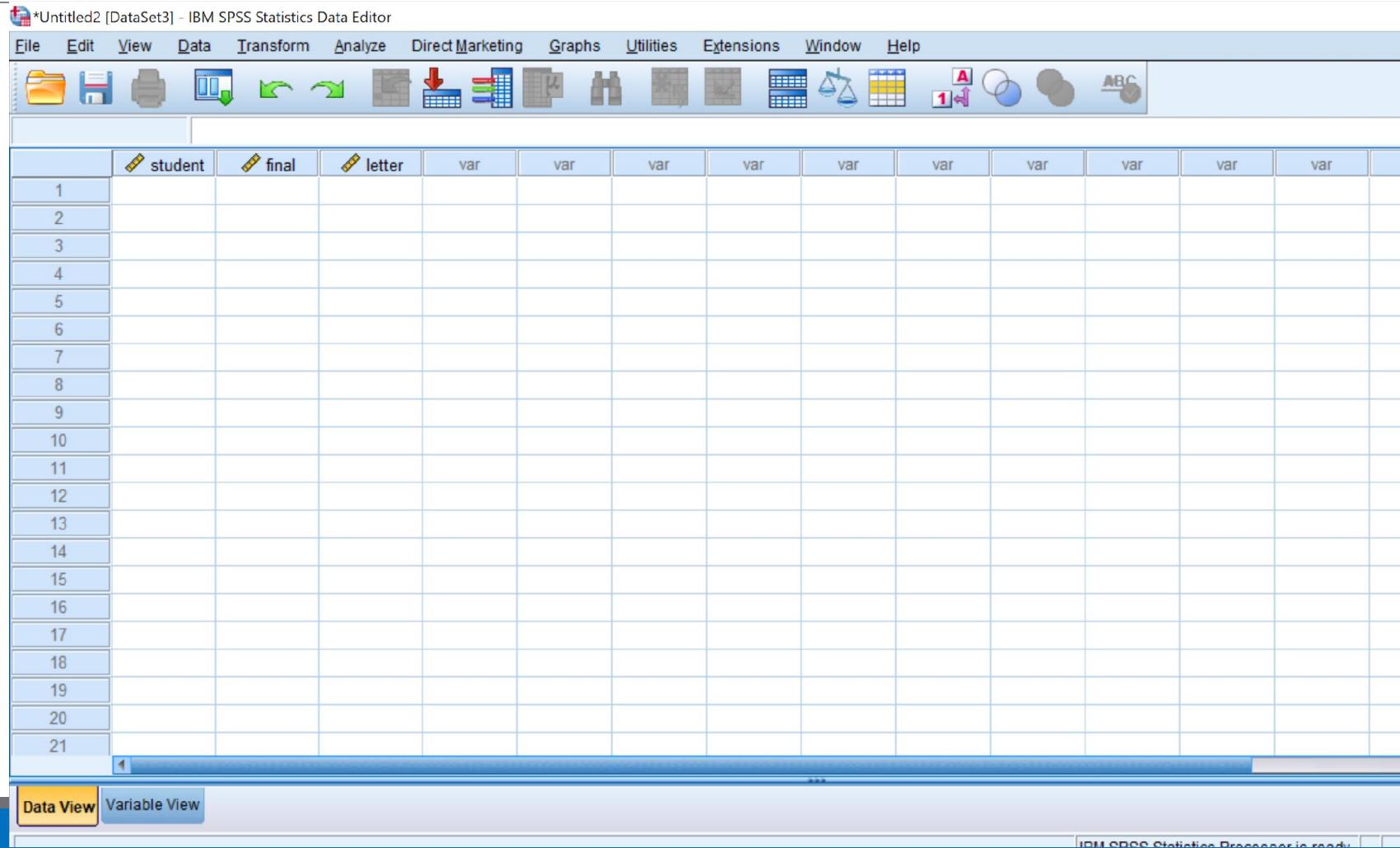
Step 7

The screenshot shows the SPSS Data View window. A 'Value Labels' dialog box is open over the data grid. The data grid contains three rows of variables: 'student', 'final', and 'letter'. The 'letter' row has its 'Values' field highlighted in yellow. The 'Value Labels' dialog box has the following fields:

- Value: 0
- Label: F
- Add: 1.00 = "D"
2.00 = "C"
3.00 = "B"
4.00 = "A"
- OK, Cancel, Help buttons

The screenshot shows the SPSS Data View window again. The 'letter' row now has its 'Values' field filled with '{.00, F}...'. The rest of the data grid remains the same as in the previous screenshot.

Step 8 – Data View

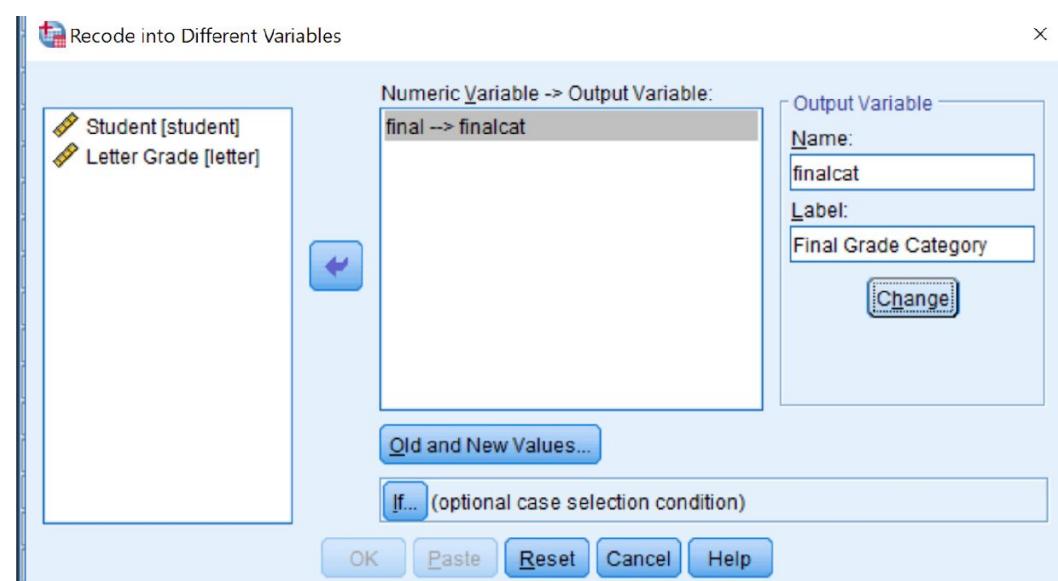
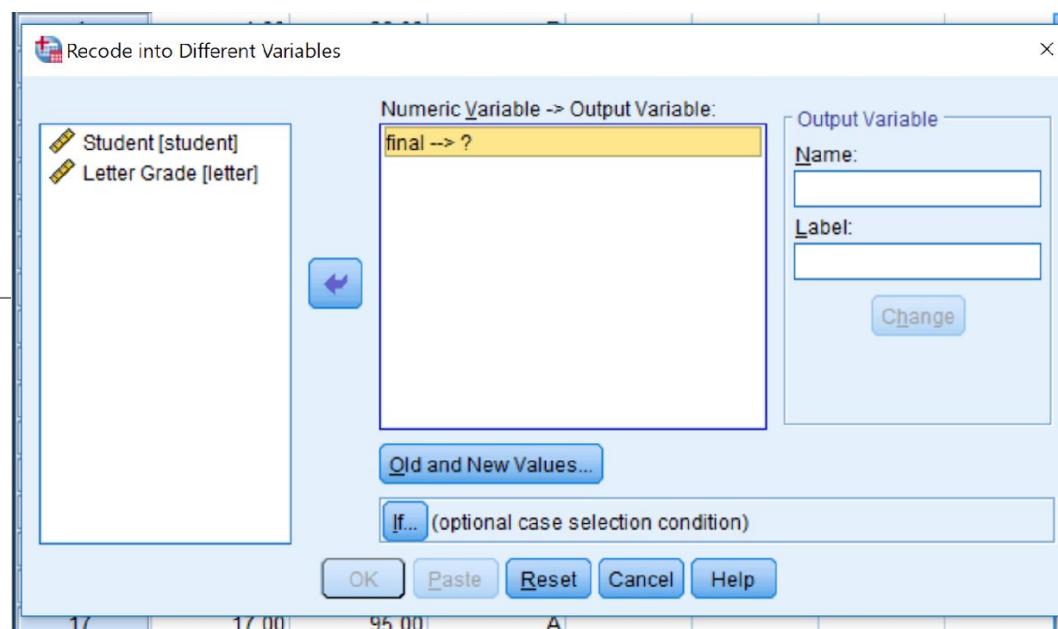
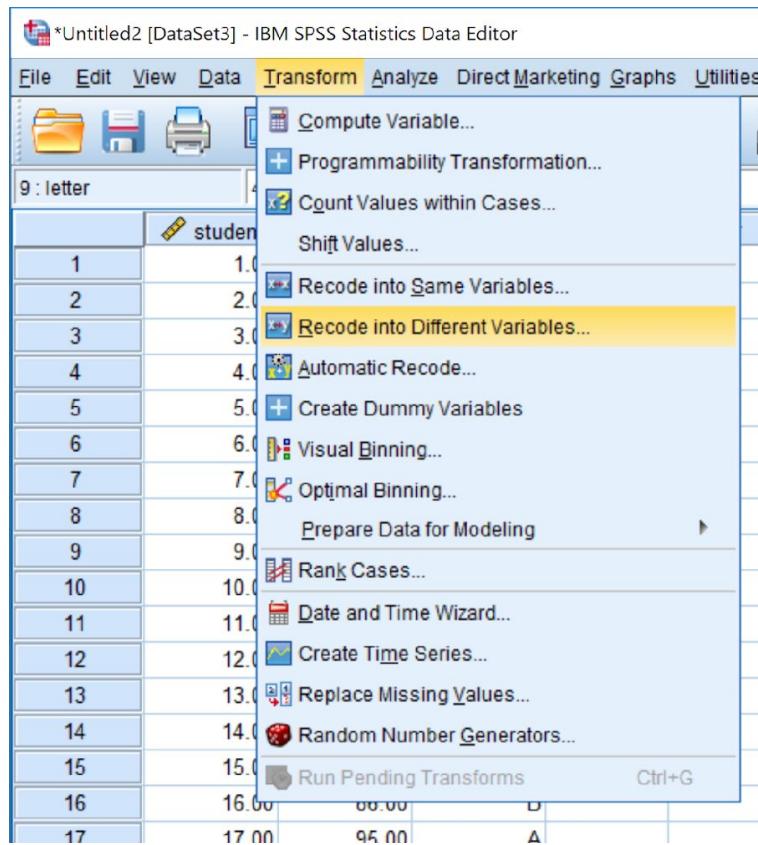


Steps 8 & 9

The figure consists of three side-by-side screenshots of the IBM SPSS Statistics Data Editor. The left screenshot shows the 'Data View' tab selected, displaying a table with four columns: student, final, letter, and var. The 'letter' column contains categorical data (A, B, C, D, F) which are not yet visible in the data cells. The middle screenshot shows the 'View' menu open, with the 'Value Labels' option highlighted. The right screenshot shows the 'Data View' tab selected again, but now the 'letter' column displays the corresponding value labels (A, B, C, D, F) next to the numerical values in the 'letter' column.

| | student | final | letter | var |
|----|---------|-------|--------|-----|
| 1 | 1.00 | 86.00 | 3.00 | |
| 2 | 2.00 | 46.00 | .00 | |
| 3 | 3.00 | 93.00 | 4.00 | |
| 4 | 4.00 | 83.00 | 3.00 | |
| 5 | 5.00 | 27.00 | .00 | |
| 6 | 6.00 | 74.00 | 2.00 | |
| 7 | 7.00 | 88.00 | 3.00 | |
| 8 | 8.00 | 26.00 | .00 | |
| 9 | 9.00 | 96.00 | 4.00 | |
| 10 | 10.00 | 92.00 | 4.00 | |
| 11 | 11.00 | 93.00 | 4.00 | |
| 12 | 12.00 | 88.00 | 3.00 | |
| 13 | 13.00 | 94.00 | 4.00 | |
| 14 | 14.00 | 79.00 | 2.00 | |
| 15 | 15.00 | 87.00 | 3.00 | |
| 16 | 16.00 | 86.00 | 3.00 | |
| 17 | 17.00 | 95.00 | 4.00 | |
| 18 | 18.00 | 89.00 | 3.00 | |
| 19 | 19.00 | 61.00 | 1.00 | |
| 20 | 20.00 | 80.00 | 3.00 | |
| 21 | | | | |

Step 10



Step 10 (continued)

*Untitled2 [DataSet3] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Extensions Window Help

Recode into Different Variables: Old and New Values

New Value: Value: 3
System-missing
Copy old value(s)

Old --> New:
85 thru 100 --> 1
70 thru 84 --> 2

Add Change Remove

Output variables are strings Width: 8
Convert numeric strings to numbers ('5'->5)

Continue Cancel Help

| | Name | Type | Width | Decimals | Label | Values | Missing | Columns | Align |
|----|----------|---------|-------|----------|--------------------|-------------|---------|---------|-------|
| 1 | student | Numeric | 8 | 2 | Student | None | None | 8 | Right |
| 2 | final | Numeric | 8 | 2 | Final Grade | None | None | 8 | Right |
| 3 | letter | Numeric | 8 | 2 | Letter Grade | {.00, F}... | None | 8 | Right |
| 4 | finalcat | Numeric | 8 | 2 | Final Grade Cat... | None | None | 10 | Right |
| 5 | | | | | | | | | |
| 6 | | | | | | | | | |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |
| 11 | | | | | | | | | |
| 12 | | | | | | | | | |
| 13 | | | | | | | | | |
| 14 | | | | | | | | | |
| 15 | | | | | | | | | |
| 16 | | | | | | | | | |
| 17 | | | | | | | | | |
| 18 | | | | | | | | | |
| 19 | | | | | | | | | |
| 20 | | | | | | | | | |
| 21 | | | | | | | | | |
| 22 | | | | | | | | | |

Value Labels

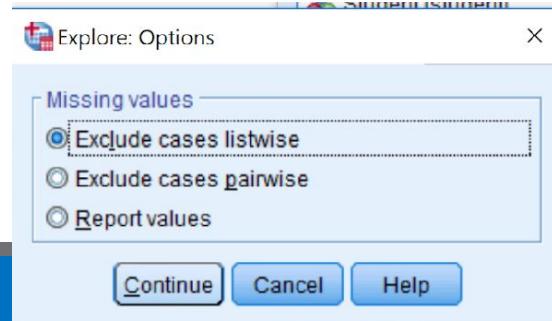
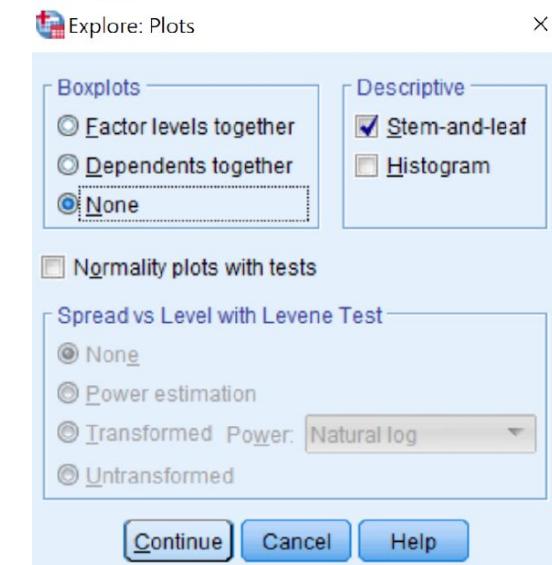
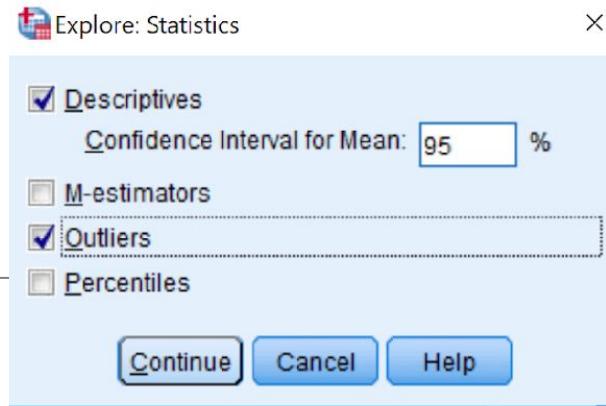
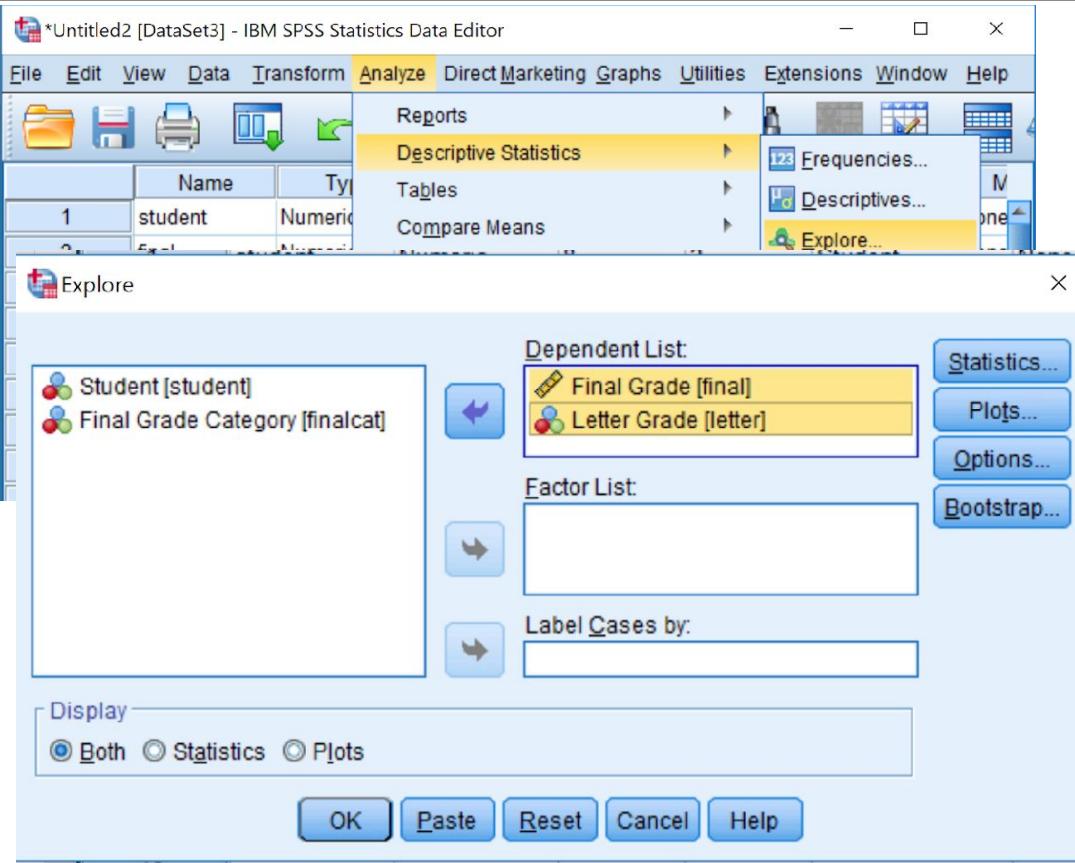
Value: 3 Label: Low
1.00 = "High"
2.00 = "Medium"

Add Change Remove

OK Cancel Help

Data View Variable View

Steps 11-14



Summary Table Output (Steps 11-14)

| Case Processing Summary | | | | | | |
|-------------------------|-------|---------|---------|---------|-------|---------|
| | Valid | | Missing | | Total | |
| | N | Percent | N | Percent | N | Percent |
| Final Grade | 20 | 100.0% | 0 | 0.0% | 20 | 100.0% |
| Letter Grade | 20 | 100.0% | 0 | 0.0% | 20 | 100.0% |

Does it make
sense to get an
average letter
grade?

| Descriptives | | | |
|--------------|----------------------------------|-------------|---------|
| | Statistic | Std. Error | |
| Final Grade | Mean | 78.1500 | 4.78720 |
| | 95% Confidence Interval for Mean | Lower Bound | 68.1303 |
| | | Upper Bound | 88.1697 |
| | 5% Trimmed Mean | 80.0556 | |
| | Median | 86.5000 | |
| | Variance | 458.345 | |
| | Std. Deviation | 21.40899 | |
| | Minimum | 26.00 | |
| | Maximum | 96.00 | |
| | Range | 70.00 | |
| | Interquartile Range | 17.50 | |
| | Skewness | -1.701 | .512 |
| | Kurtosis | 1.902 | .992 |
| Letter Grade | Mean | 2.6500 | .31014 |
| | 95% Confidence Interval for Mean | Lower Bound | 2.0009 |
| | | Upper Bound | 3.2991 |
| | 5% Trimmed Mean | 2.7222 | |
| | Median | 3.0000 | |
| | Variance | 1.924 | |
| | Std. Deviation | 1.38697 | |
| | Minimum | .00 | |
| | Maximum | 4.00 | |
| | Range | 4.00 | |
| | Interquartile Range | 2.00 | |
| | Skewness | -1.003 | .512 |
| | Kurtosis | -.108 | .992 |

Extreme Vals & “stemplots”

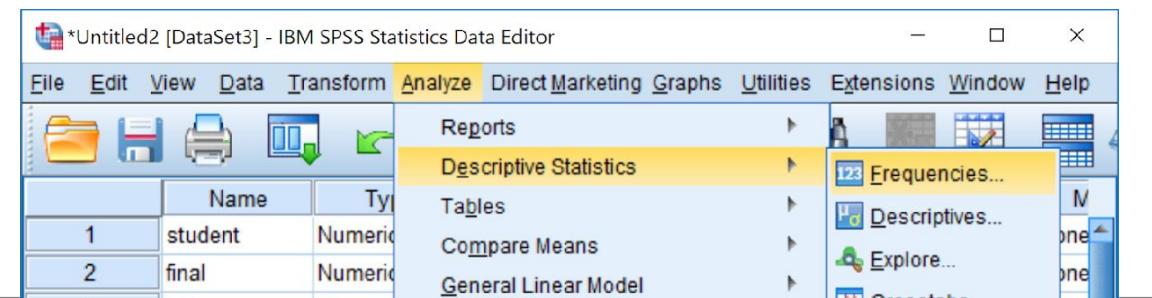
| Extreme Values | | | | |
|----------------|---------|-------------|-------|-------------------|
| | | Case Number | Value | |
| Final Grade | Highest | 1 | 9 | 96.00 |
| | | 2 | 17 | 95.00 |
| | | 3 | 13 | 94.00 |
| | | 4 | 3 | 93.00 |
| | | 5 | 11 | 93.00 |
| | Lowest | 1 | 8 | 26.00 |
| | | 2 | 5 | 27.00 |
| | | 3 | 2 | 46.00 |
| | | 4 | 19 | 61.00 |
| | | 5 | 6 | 74.00 |
| Letter Grade | Highest | 1 | 3 | 4.00 |
| | | 2 | 9 | 4.00 |
| | | 3 | 10 | 4.00 |
| | | 4 | 11 | 4.00 |
| | | 5 | 13 | 4.00 ^a |
| | Lowest | 1 | 8 | .00 |
| | | 2 | 5 | .00 |
| | | 3 | 2 | .00 |
| | | 4 | 19 | 1.00 |
| | | 5 | 14 | 2.00 ^b |

a. Only a partial list of cases with the value 4.00 are

| Final Grade Stem-and-Leaf Plot | | |
|--------------------------------|-------------|-----------|
| Frequency | Stem & | Leaf |
| 3.00 | Extremes | (=<46) |
| 1.00 | 6 . | 1 |
| .00 | 6 . | |
| 1.00 | 7 . | 4 |
| 1.00 | 7 . | 9 |
| 2.00 | 8 . | 03 |
| 6.00 | 8 . | 667889 |
| 4.00 | 9 . | 2334 |
| 2.00 | 9 . | 56 |
| | | |
| | Stem width: | 10.00 |
| | Each leaf: | 1 case(s) |

| Letter Grade Stem-and-Leaf Plot | | |
|---------------------------------|-------------|-----------|
| Frequency | Stem & | Leaf |
| 3.00 | 0 . | 000 |
| 1.00 | 1 . | 0 |
| 2.00 | 2 . | 00 |
| 8.00 | 3 . | 00000000 |
| 6.00 | 4 . | 000000 |
| | Stem width: | 1.00 |
| | Each leaf: | 1 case(s) |

Steps 15-18



The image displays three overlapping dialog boxes from the SPSS 'Frequencies' analysis.

- Frequencies Dialog:** Shows variables Student [student], Letter Grade [letter], and Final Grade Category [finalcat]. The 'Display frequency tables' checkbox is selected. Buttons at the bottom include OK, Paste, and Cancel.
- Frequencies: Statistics Dialog:** Shows 'Variable(s)': Final Grade [final]. Under 'Percentile Values', 'Quartiles' and 'Percentile(s)' checkboxes are checked, with a value of 100.0 entered. Under 'Central Tendency', Mean, Median, and Mode are checked. Under 'Distribution', Skewness is checked. Buttons at the bottom include Cancel and Help.
- Frequencies: Charts Dialog:** Shows 'Chart Type' with 'Histograms:' and 'Show normal curve on histogram' selected. Buttons at the bottom include Continue, Cancel, and Help.

Frequency Distribution

(Steps 15-18)

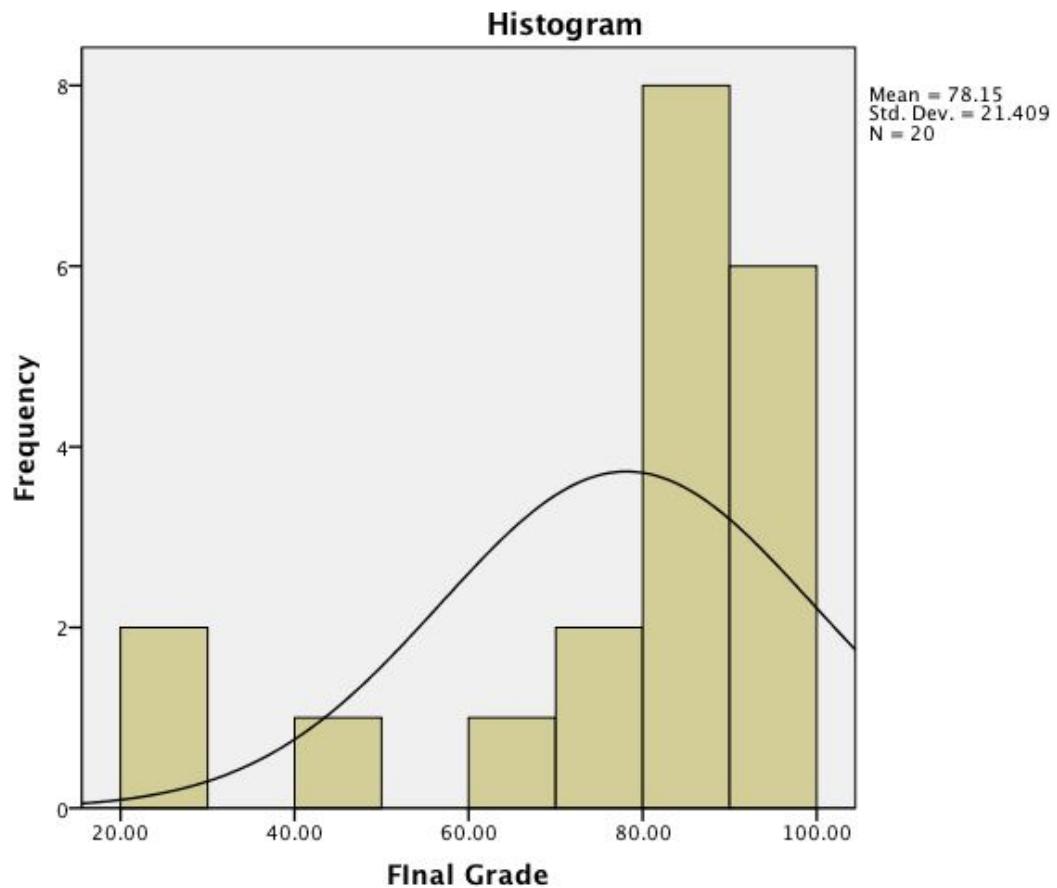
| Statistics | | |
|------------------------|---------|--------------------|
| Final Grade | | |
| N | Valid | 20 |
| | Missing | 0 |
| Mean | | 78.1500 |
| Median | | 86.5000 |
| Mode | | 86.00 ^a |
| Skewness | | -1.701 |
| Std. Error of Skewness | | .512 |
| Percentiles | 25 | 75.2500 |
| | 50 | 86.5000 |
| | 75 | 92.7500 |
| | 100 | 96.0000 |

a. Multiple modes exist. The smallest value is shown

| Final Grade | | | | | |
|-------------|-----------|---------|---------------|--------------------|-------|
| | Frequency | Percent | Valid Percent | Cumulative Percent | |
| Valid | 26.00 | 1 | 5.0 | 5.0 | 5.0 |
| | 27.00 | 1 | 5.0 | 5.0 | 10.0 |
| | 46.00 | 1 | 5.0 | 5.0 | 15.0 |
| | 61.00 | 1 | 5.0 | 5.0 | 20.0 |
| | 74.00 | 1 | 5.0 | 5.0 | 25.0 |
| | 79.00 | 1 | 5.0 | 5.0 | 30.0 |
| | 80.00 | 1 | 5.0 | 5.0 | 35.0 |
| | 83.00 | 1 | 5.0 | 5.0 | 40.0 |
| | 86.00 | 2 | 10.0 | 10.0 | 50.0 |
| | 87.00 | 1 | 5.0 | 5.0 | 55.0 |
| | 88.00 | 2 | 10.0 | 10.0 | 65.0 |
| | 89.00 | 1 | 5.0 | 5.0 | 70.0 |
| | 92.00 | 1 | 5.0 | 5.0 | 75.0 |
| | 93.00 | 2 | 10.0 | 10.0 | 85.0 |
| | 94.00 | 1 | 5.0 | 5.0 | 90.0 |
| | 95.00 | 1 | 5.0 | 5.0 | 95.0 |
| | 96.00 | 1 | 5.0 | 5.0 | 100.0 |
| Total | 20 | 100.0 | 100.0 | | |

Histogram

Shape?



Non-Normal Distributions & Measures of Central Tendency

Mode: most frequently occurring score

- Unimodal vs. multimodal

Median: “Middle number”

- More robust with skewed distributions

Mean: average (sum of all observations/# of observations)

- Pulled in direction of skew

Non-Normal Distributions & Measures of Central Tendency

- If skewed... What to use?
 - MEDIAN
- BONUS: Best measure of variability in skewed distribution?
 - SIQR: semi-interquartile range

$$\frac{Q_3 - Q_1}{2}$$

Steps 20 & 19

*Untitled2 [DataSet3] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Extensions Window Help

student final letter finalcat

| | Name | Type | Width | Decimals | Label | Values | Missing | Columns | Align | Measure | Role |
|----|----------|---------|-------|----------|--------------------|-----------------|---------|---------|-------|---------|-------|
| 1 | student | Numeric | 8 | 2 | Student | None | None | 8 | Right | Nominal | Input |
| 2 | final | Numeric | 8 | 2 | Final Grade | None | None | 8 | Right | Scale | Input |
| 3 | letter | Numeric | 8 | 2 | Letter Grade | {.00, F}... | None | 8 | Right | Nominal | Input |
| 4 | finalcat | Numeric | 8 | 2 | Final Grade Cat... | {1.00, High}... | None | 10 | Right | Scale | Input |
| 5 | | | | | | | | | | Ordinal | |
| 6 | | | | | | | | | | Nominal | |
| 7 | | | | | | | | | | | |
| 8 | | | | | | | | | | | |
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| 18 | | | | | | | | | | | |
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| 20 | | | | | | | | | | | |
| 21 | | | | | | | | | | | |
| 22 | | | | | | | | | | | |

Data View Variable View

*Untitled2 [DataSet3] - IBM SPSS Statistics Data Editor

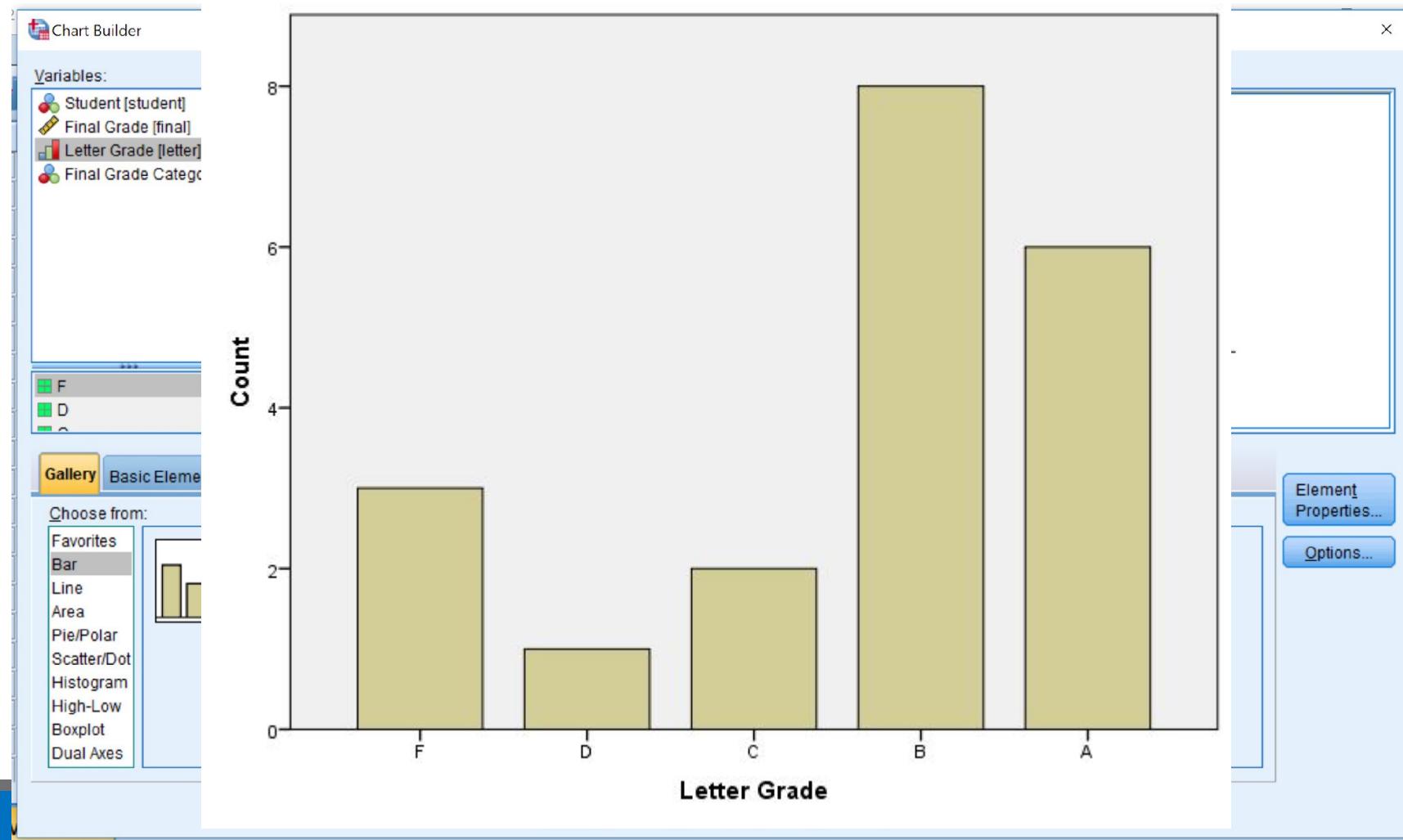
File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Extensions Window Help

student final letter finalcat

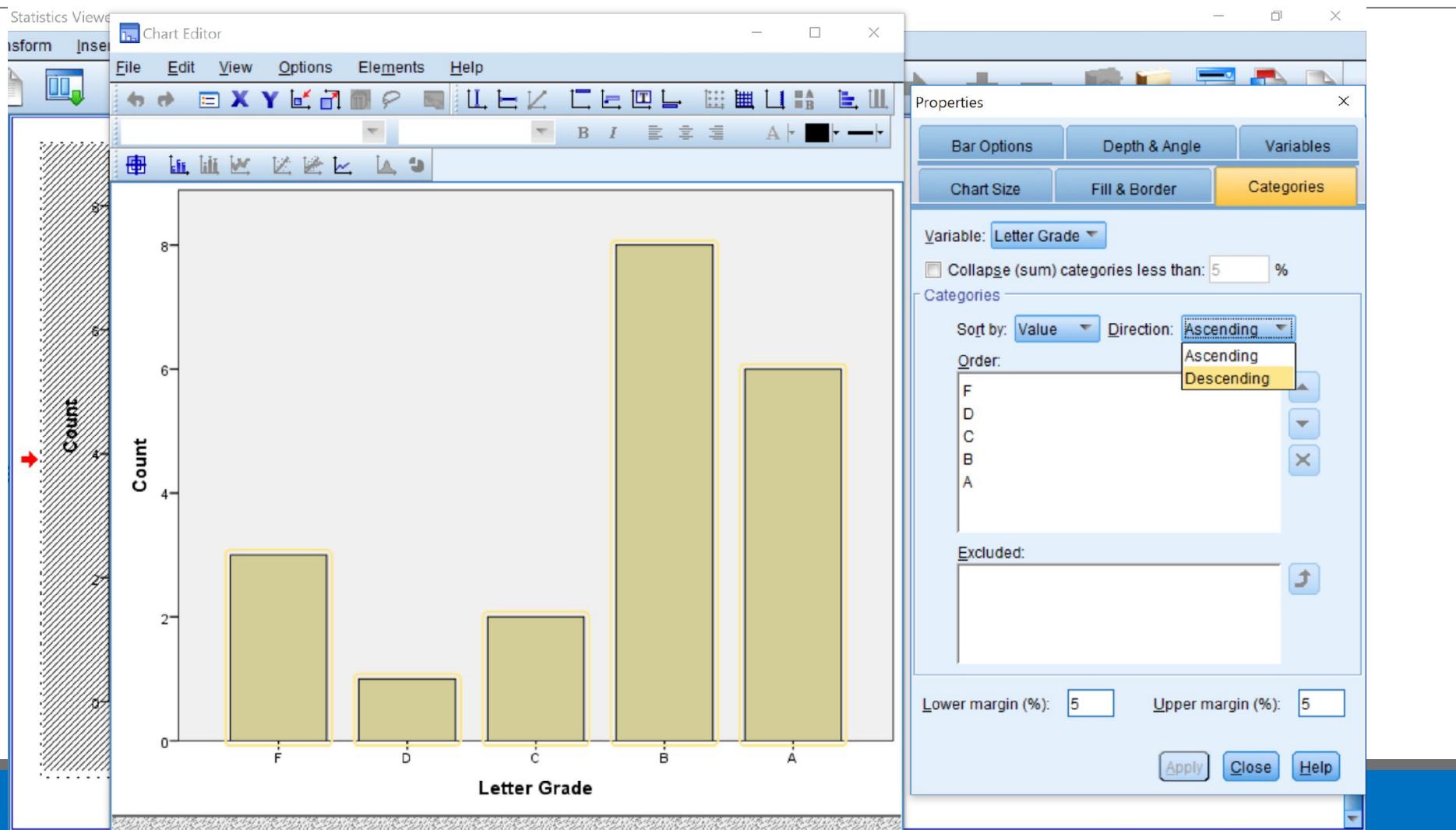
| | Name | Type | Width | Decimals |
|---|----------|---------|-------|----------|
| 1 | student | Numeric | 8 | 2 |
| 2 | final | Numeric | 8 | 2 |
| 3 | letter | Numeric | 8 | 2 |
| 4 | finalcat | Numeric | 8 | 2 |

Chart Builder...
Graphboard Template Chooser...
Weibull Plot...
Compare Subgroups
Regression Variable Plots
Legacy Dialogs

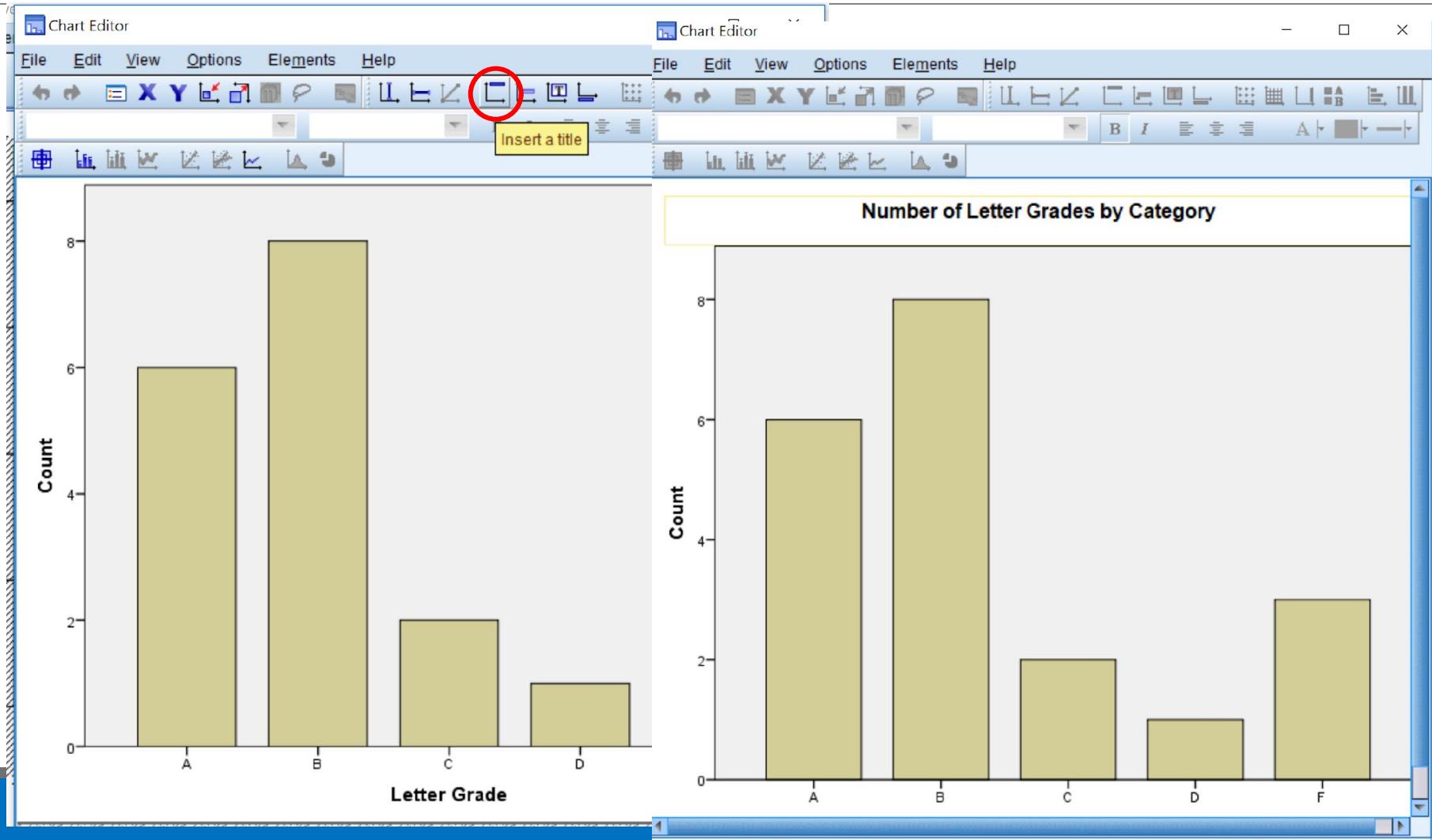
Steps 21 & 22



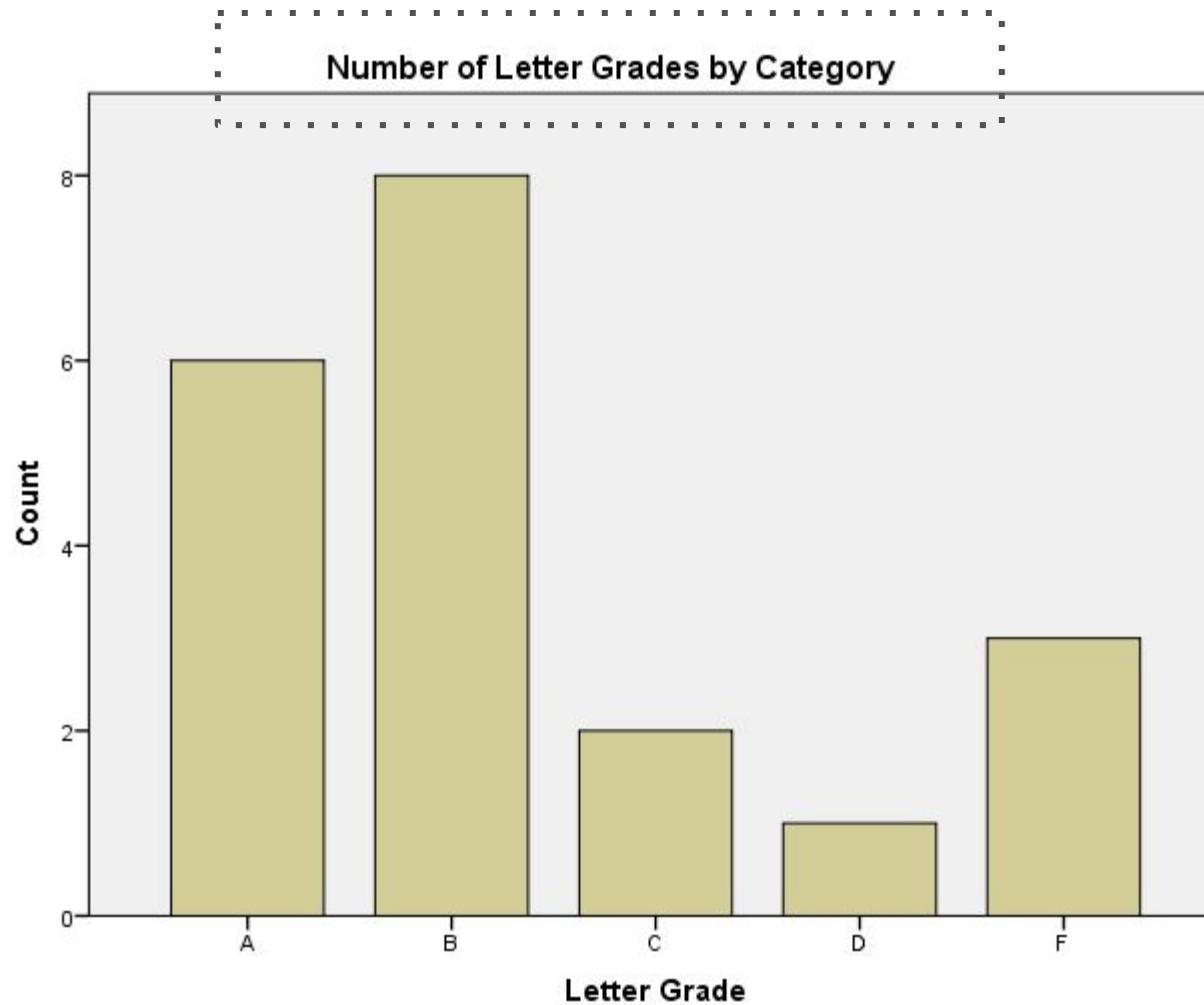
Steps 23-24



Adding a title!



Bar Graph Output (Steps 19-24)



Part II: Variable Review

Question 1

A researcher is interested in studying whether children exposed to cocaine *in utero* have different reaction times on a button pressing task than children who have experienced neurological trauma at birth.

Independent Variable

A) What is the independent variable?

Type of traumatic exposure

(Level/Group 1: cocaine *in utero*)

(Level/Group 2: neuro-trauma at birth)

B) Continuous or discrete?

Discrete

C) Level of measurement?

Nominal (or categorical)

Dependent Variable

D) What is the dependent variable?

Reaction time

E) Continuous or discrete?

Continuous

F) Level of measurement?

Ratio

G) The researcher compares the average reaction time of both groups. Are these reaction times parameters or statistics?

Statistics (assuming that the researcher used a sample)

Question 2

A researcher is interested in comparing high school students from private schools with those from public schools on how strongly they agree with their parents on political issues (on a scale from 1-7; 1 = strongly disagree, 7 = strongly agree).

Independent Variable

A) What is the independent variable?

Type of school

Private vs. Public

B) Continuous or discrete?

Discrete

C) Level of measurement?

Nominal

Dependent Variable

D) What is the dependent variable?

Degree to which students agree with parents political views

E) Continuous or discrete?

Continuous (Remember: describes variable itself, not scale)

F) Level of measurement?

Ordinal (Remember: scale on which we are measuring DV)

G) Experimental or correlational?

Correlational

Question 3

A teacher is interested in whether length of study time (in minutes) for her students accounts for differences in exam grades (as measured in letters: A, B, C, D, F). She is just interested in how study time affects her class and records the average study time for all her students.

Independent Variable

A) What is the independent variable?

Length of study time

B) Continuous or discrete?

Continuous

C) Level of measurement?

Ratio

Dependent Variable

D) What is the dependent variable?

Exam grades

E) Continuous or discrete?

Discrete

F) Level of measurement?

Ordinal

Ga) Descriptive or inferential study?

Depends on how you look at it

Gb) What is the population here?

All the students

A Quick Math Note

Summation & Squaring

- $(\sum X)^2$ means summate and then square
- $\sum X^2$ means square and then summate