

Analysis of Student Assessments

Chad E. Michalek

Step 1: Determine the Type of Variable

» Variable type determines the process

Discrete Variables

- Variables that can only take on a finite number of values and the numbers of the values do not necessarily confer meaning as numbers
- Also referred to as categorical, dichotomous

Nominal:

- Variables that do not have numerical or ordered meanings
- Values are labels (words) rather than numbers
- Examples: religious background, geographic region of the country, political party affiliation

Ordinal:

- The values are named categories that have some order to them
- Examples: Likert scale questions

Continuous Variables

- ▶ Variables that have mathematical or numbered properties, on a scale
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Interval:

- ▶ Variables that have a measurement where the difference between two values is meaningful
- ▶ Example: temperature (e.g., the difference between the temperature of 30 and 40 is the same as between 70 and 80, and 0 degrees does not mean "no temperature")

Ratio:

- ▶ Variables that have all the properties of an interval variable, and also has a clear definition (absolute value) of zero
- ▶ Example: age, weight

Step 2: Plot the Data in a Histogram

- ▶▶ What the data looks like will determine the statistics to report

How to Create a Histogram in Excel

- 1) **Open Microsoft Excel.**
- 2) **Enter data that you want to be in a histogram in a row and in a different row enter appropriate bins** (i.e. if you want to separate grades based on a 10 point scale 60, 70, 80, 90, 100 would be the bins).
- 3) **Click on the Tools menu and select Data Analysis.** If there is not a Data Analysis option under the Tools menu, you may need to install the add-in. You can install the add-in by selecting the Add-Ins option under the Tools menu. Check the box next to Analysis ToolPak and click OK. A window will open.
- 4) **Click on Histogram to select the histogram option and click OK.** Another window opens.

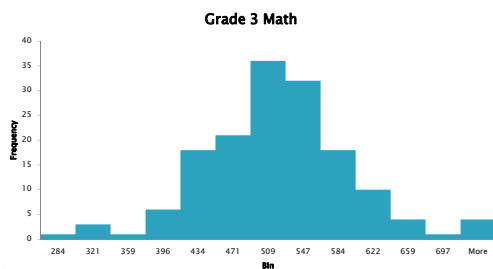
How to Create a Histogram in Excel

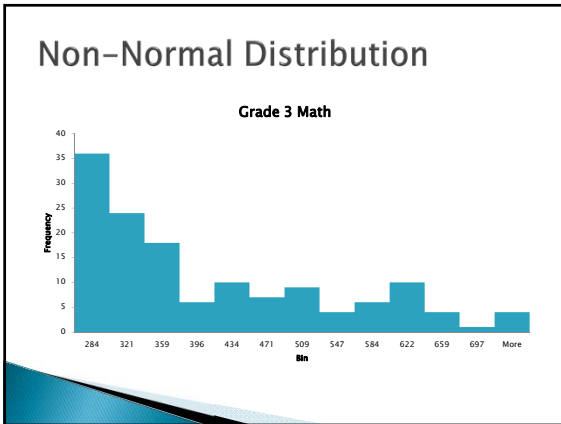
- 5) Select the input range (this is your data) then select the bin range.
- 6) Check the chart output box.
- 7) Click OK.
- 8) Finished.

Step 3: Determine if the Data is Approximately Normal or Not

- » Normal data uses different statistical measures than non-normal data

Approximately Normal Distribution





Step 4: Calculate the Measure of Central Tendency

» The center is a key component of every distribution

Center if the Distribution is Normal

Mean

- » The average of the values.
- » How to calculate in Excel:
 - 1) **Use the "AVERAGE" function in Excel to find the mean of a set of numbers.** Enter the range of numbers in your Excel spreadsheet. Click where you want the mean (Average).
 - 2) **Click "Formulas" and select the "Insert Function" tab.** Enter the numbers in your Excel spreadsheet in either a row or a column.
 - 3) **Scroll down and select the "Average" function.**
 - 4) **Enter the cell range for your list of numbers in the number 1 box, for instance D4: D13 and click "OK".**
 - 5) **The mean (average) for the list will appear in the cell you selected.**

Center if the Distribution is NOT Normal

Median

- ▶ The middle number (in a list of sorted numbers).
- ▶ How to calculate in Excel:
 - 1) **Use the "MEDIAN" function in Excel to find the mean of a set of numbers.** Enter the range of numbers in your Excel spreadsheet. Click where you want the median.
 - 2) **Click "Formulas" and select the "Insert Function" tab.** Enter the numbers in your Excel spreadsheet in either a row or a column.
 - 3) **Scroll down and select the "Median" function.**
 - 4) **Enter the cell range for your list of numbers in the number 1 box, for instance D4: D13 and click "OK".**
 - 5) **The median for the list will appear in the cell you selected.**

Step 5: Calculate the Spread

- ▶▶ The spread is a key component of every distribution

Spread if the Distribution is Normal

Standard Deviation

- ▶ The amount of variation or dispersion from the mean.
- ▶ A **low standard deviation** indicates that the data points tend to be very close to the mean.
- ▶ A **high standard deviation** indicates that the data points are spread out over a large range of values.
- ▶ How to calculate in Excel:
 - 1) **Use the STDEV function to compute the standard deviation.** Place your cursor where you wish to have it appear.
 - 2) **Click on "Formulas" and select the "Insert Function" (fx) tab again.**
 - 3) **Scroll down the dialog box and select the STDEV function.**
 - 4) **Enter the cell range for your list of numbers in the number 1 box and click OK.**
 - 5) **The standard deviation will appear in the cell you selected.**

Spread if the Distribution is NOT Normal

Interquartile Range (IQR, Midsread, or Middle Fifty)

- ▶ The measure of statistical dispersion, being equal to the difference between the upper and lower quartiles.
- ▶ How to calculate in Excel:
 - 1) Use a custom formula to compute the interquartile range. Place your cursor where you wish to have it appear.
 - 2) Click on the formula box and enter `=percentile(a1:a10,0.75)-percentile(a1:a10,0.25)` in which a1:a10 correspond to your range of values.
 - 3) Press Enter.
 - 4) The interquartile range will appear in the cell you selected.

Step 6: Display and Calculate the Shape

- ▶▶ The shape is a key component of every distribution

Shape of the Distribution

Histogram

- ▶ Use the information in Slide 7 to create a histogram

Skewness

- ▶ The measure of the asymmetry of a distribution about its mean.
- ▶ **Positive skewness** indicates a distribution with an asymmetric tail extending toward more positive values.
- ▶ **Negative skewness** indicates a distribution with an asymmetric tail extending toward more negative values.
- ▶ How to calculate in Excel:
 - 1) Use the SKEW function to compute the skewness. Place your cursor where you wish to have it appear.
 - 2) Click on "Formulas" and select the "Insert Function" (fx) tab again.
 - 3) Scroll down the dialog box and select the SKEW function.
 - 4) Enter the cell range for your list of numbers in the number 1 box and click OK.
 - 5) The skewness will appear in the cell you selected.

Example

» Student Test Scores

Example Dataset

Classroom Math Assessment Results (30 scores):

63, 63, 69, 72, 72, 72, 73, 74, 78, 78,
78, 78, 80, 81, 81, 82, 84, 84, 84, 85,
86, 87, 89, 89, 90, 92, 93, 96, 97, 99

Example Dataset

Step 1: Determine the type of variable.
This is a continuous variable.

Step 2: Plot the data in a histogram.

Histogram

Bin	Frequency
63	2
66	1
69	1
72	3
75	2
78	4
81	4
84	3
87	2
90	1
93	1
96	1
99	1

Example Dataset

Step 3: Determine if the data is approximately normal or not.

The data is approximately normal.

Step 4: Calculate the measure of central tendency.

The mean is 81.63.

Step 5: Calculate the spread.

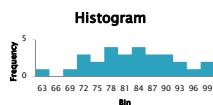
The standard deviation is 9.39.

Example Dataset

Step 6: Display and calculate the shape.

The skewness is -0.13

Example Dataset Analysis



Mean: 81.63
Standard Deviation: 9.39
Skewness: -0.13

Questions