

MAT152: Statistical Methods I:
This course provides a project-based approach to introductory statistics with an emphasis on using real-world data and statistical literacy. Topics include descriptive statistics, correlation and regression, basic probability, discrete and continuous probability distributions, confidence intervals and hypothesis testing. Upon completion, students should be able to use appropriate technology to describe important characteristics of a data set, draw inferences about a population from sample data, and interpret and communicate results.
Descriptive Statistics and Poverty: Activity 2 by Lisa Creighton
Students will investigate and develop a better understanding of the global issue of poverty in African countries compared to the United States through statistical analysis.
Objective:
The purpose of this lab is to have students investigate poverty in African countries and the United States. Students will use statistical techniques to compare and contrast levels of poverty. Students will create normal probability plots; and calculate z-scores.
Global Learning Outcomes:
<ol style="list-style-type: none"> 1) Investigate and understand global issues through statistical analysis. 2) Use statistical techniques to draw inferences about global populations. 3) Interpret cross-cultural data and communicate results (<i>in written and verbal formats</i>).
Global Learning Outcomes for this Activity:
<ol style="list-style-type: none"> 2) Use statistical techniques to draw inferences about global populations.
Time:
50 minutes
Materials:
<ol style="list-style-type: none"> 1. Global maps (this example is interactive by country, http://geology.com/world/world-map.shtml) 2. Copies of the Map of Africa for students (http://www.mapsmaps.ru/wp-content/uploads/2010/10/polit_africa4.gif) 3. Copies of the Map of the United States for students: Printable Map List: States in bright colors (http://nationalmap.gov/small_scale/printable/reference.html) 4. Table “Percentage of People in Poverty by State Using 2- and 3- year Averages:” https://www.census.gov/hhes/www/poverty/data/incpovhlth/2014/tables.html 5. Portions of the Data from: http://hdr.undp.org/en/composite/MPI 6. Pencil and paper for individuals. 7. Copies of the attached activity.

Procedure:

The emphasis of this activity is for students to understand the contextual meaning of the statistical analysis performed. Concentrate on reinforcing the meaning as students' progress through the activity.

This activity should be used after teaching the Normal Distribution. Students will need to be able to assess normality, apply the empirical rule and evaluate a normal distribution using z-scores.

This activity is intended to be used after completing activity 2. If Activity 2 is not being utilized, then show some of the videos from Reference 3 to help students understand poverty in the US and Africa.

It is expected that students will be given a copy of the following: Map of Africa (2 from materials) and United States Map (3 from materials); African Country Data Set (Reference 1 Below); and United States Data Set (Reference 2 below and item #3 under materials).

- 1) Divide class into groups of 3-4 students. Each student should complete all of the activities on their worksheet. Grades can be issued as a group or individually.
- 2) Utilizing the Map of Africa and the African Country Data Set, instruct students to place a dot on each country in the data set on the map. This will familiarize students with the geographical location of each country and give them a visual reference of the countries being analyzed.
- 3) Monitor student progress as they complete the rest of the activity. The intent is to check student progress as they progress through the activity insuring that students are drawing reasonable conclusions and to facilitate productive discussions.
- 4) Make sure to emphasize the meaning of the variables. Students may miss the meaning that the area under the normal distribution represents the percentage of countries with the specified percentage of the population below the poverty line.
- 5) Section 6: Sampling, this part of the activity can be optional with time permitting. Help students to develop an understanding of the different sampling methods and the differences in the definition of poverty in each of the studies. Students should grasp, that while both studies measured poverty, because they used different measures and techniques the data set are not directly comparable. Inferences can be made between the data sets, but not absolute comparisons.

Assessment:

Students will complete the following activity, documenting their analysis. Grades can be issued for the groups or individually.

Additional Resources:

- Data sets included under materials

MAT 152: Normal Distribution Activity

For this activity, you will be analyzing data to compare the **Percentage of the Population Living below the Poverty Line** in 37 developing Countries in Africa and the 50 United States including the District of Columbia (51 Total). As you complete the activity, discuss in your groups the differences between the data sets and what may contribute to the differences. The data was taken from the following websites:

1. US Data: Table “Percentage of People in Poverty by State Using 2- and 3- year Averages.”
<https://www.census.gov/hhes/www/poverty/data/incpovhlth/2014/tables.html>
2. Africa Data: Portions of the Data from: <http://hdr.undp.org/en/composite/MPI>

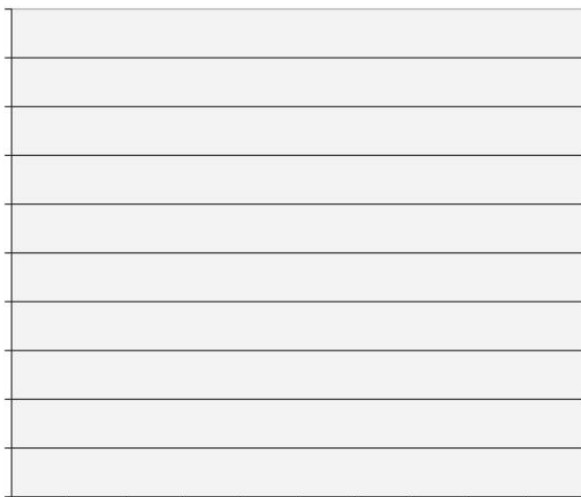
1) Utilizing the Map of Africa and the African Country Data Set, place a dot on each country in the data set on your map. Familiarize yourself with the geographical location of each country. Keep in mind as you complete the lab that these are the countries represented by the data which you will be analyzing.

2) Find the mean and standard deviation for each of the two data sets and record your results in the table below. What can you infer from these results?

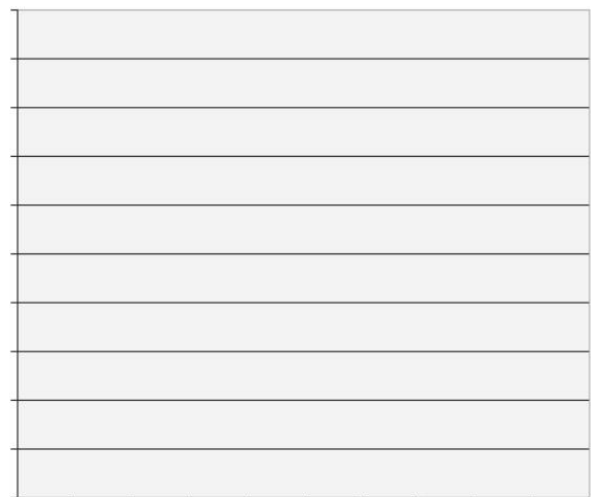
	African Countries	United States
Mean		
Standard Deviation		

3a) Normal Probability Plots and Z-scores: Create a Normal Probability Plot for each set of data. Draw a rough sketch of your plot. Can we conclude that the data is normally distributed?

Africa Data Set



United States Data Set

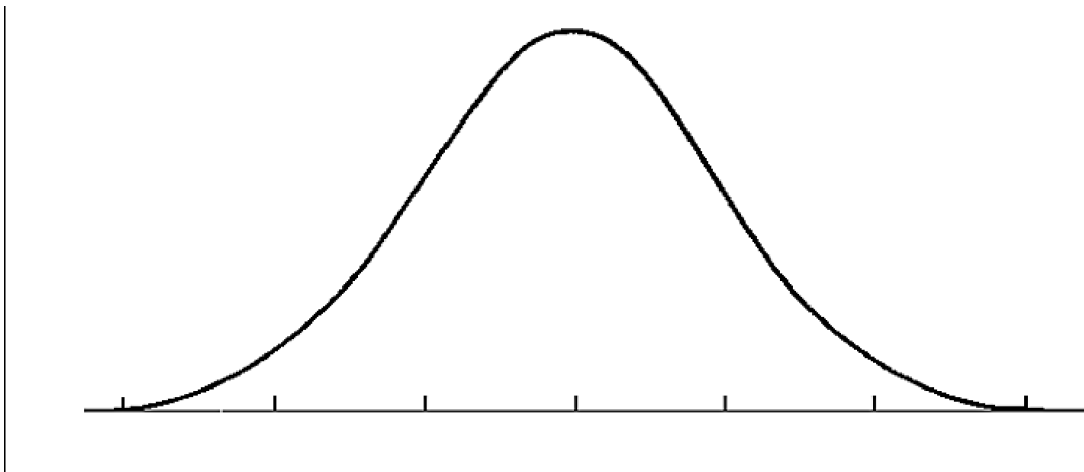


3b) Does the data appear to be normally distributed for the United States Data set? Why or Why not?

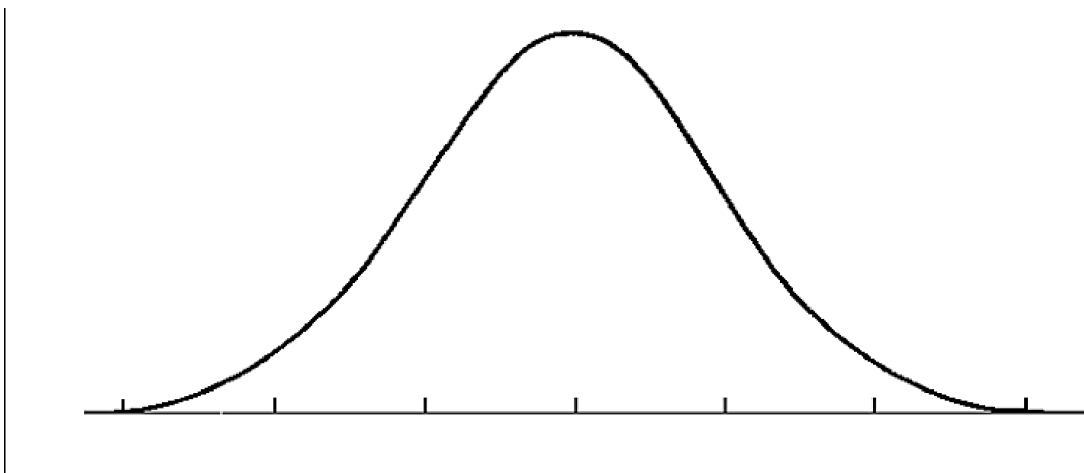
3c) Does the data appear to be normally distributed for the African Country States Data set? Why or Why not?

4a) Label the normal distributions using the mean and standard deviations from part 2 out to three standard deviations.

African Data Set:



United States Data Set.



4b) Using the Empirical Rule fill in the table below specifying the range for each percentage of data.

Percentage of data	Range for Africa Data Set	Range for United States Data Set
Middle 68%		
Middle 95%		
Middle 99.7%		

4c) Compare the Middle 68% ranges for the two data sets? Which is wider? How do they compare to each other?

4d) Compare the Middle 95% ranges for the two data sets? Which is wider? How do they compare to each other?

4e) Compare the Middle 99.7% ranges for the two data sets? Which is wider? How do they compare to each other?

5a) Assuming that both data sets are normally distributed, calculate the z-score for both sets of data for the following percentage of people living in poverty and calculate the % of Countries/States which have the specified % of the population living in poverty.
 (Hint: Using a TI-83/84 use: 2nd Vars; Opt 2: normalcdf(LB, UB, μ , σ)

10% or less	
African Data	US State Data
z-score:	z-score:
% of Countries:	% of States:
30% or less	
African Data	US State Data
z-score:	z-score:
% of Countries:	% of States:
Above 50%	
African Data	US State Data
z-score:	z-score:
% of Countries:	% of States:

5b) Discuss your results.

6) Sampling: Review the 2 websites to determine how the data was collected. Write a brief explanation of the sampling method for each of the data sets and then discuss whether it is appropriate to compare the results from the two data sets.

6a) Sampling Method for the Africa Data:

6b) Sampling Method for the US Data:

6c) Discussion:

7) Reflect on the activity and your calculations. Write a summary discussing the following. What have you learned about poverty in the US and in Africa? What conclusions can you draw? What additional information would have been helpful?

Reference 1: Poverty in African Countries:

Portions of the Data from: <http://hdr.undp.org/en/composite/MPI>

Table 6: Multidimensional Poverty Index: developing countries

Source: <http://hdr.undp.org/en/composite/MPI>

Country	Year and survey ^a	Population living below income poverty line (%)	
		National poverty line	PPP \$1.25 a day
	2005–2014	2004–2014 ^e	2002–2012
Benin	2011/2012 D	36.2	51.6
Burkina Faso	2010 D	46.7	44.5
Burundi	2010 D	66.9	81.3
Cameroon	2011 D	39.9	27.6
Central African Republic	2010 M	62.0	62.8
Chad	2010 M	46.7	36.5
Congo	2011/2012 D	46.5	32.8
Congo (Democratic Republic of the)	2013/2014 D	63.6	87.7
Côte d'Ivoire	2011/2012 D	42.7	35.0
Djibouti	2006 M		18.8
Egypt	2014 D	25.2	1.7
Ethiopia	2011 D	29.6	36.8
Gabon	2012 D	32.7	6.1
Gambia	2013 D	48.4	33.6
Ghana	2011 M	24.2	28.6
Guinea	2012 D/M	55.2	40.9
Guinea-Bissau	2006 M	69.3	48.9
Kenya	2008/2009 D	45.9	43.4
Liberia	2013 D	63.8	83.8
Madagascar	2008/2009 D	75.3	87.7
Malawi	2010 D	50.7	72.2
Mali	2012/2013 D	43.6	50.6
Mauritania	2011 M	42.0	23.4
Morocco	2011 N	8.9	2.57
Mozambique	2011 D	54.7	60.7
Namibia	2013 D	28.7	23.5
Niger	2012 D	48.9	40.8
Nigeria	2013 D	46.0	62.0
Rwanda	2010 D	44.9	63.0
Sao Tome and Principe	2008/2009 D	61.7	43.5
Sierra Leone	2013 D	52.9	56.6
South Africa	2012 N	53.8	9.4
Sudan	2010 M	46.5	19.8
Swaziland	2010 M	63.0	39.3
Tanzania (United Republic of)	2010 D	28.2	43.5
Togo	2013/2014 D	58.7	52.5
Tunisia	2011/2012 M	15.5	0.7
Uganda	2011 D	19.5	37.8

Population below national poverty line: Percentage of the population living below the national poverty line, which is the poverty line deemed appropriate for a country by its authorities. National estimates are based on population-weighted subgroup estimates from household surveys.

Population below PPP \$1.25 a day: Percentage of the population living below the international poverty line \$1.25 (in purchasing power parity terms) a day.

Reference 2: Table “Percentage of People in Poverty by State Using 2-year Averages:”
<https://www.census.gov/hhes/www/poverty/data/incpovhlth/2014/tables.html>

Percentage of People in Poverty by State Using 2-Year Averages:

(People as of March of the following year. For information on confidentiality protection, sampling error, non-sampling error, and definitions, see see <ftp://ftp2.census.gov/programs-surveys/cps/techdocs/cpsmar14.pdf>)

State	2-year average			
	2010-2011		2012-2013 ¹	
	Percentage	90 percent confidence interval ² (+/-)	Percentage	90 percent confidence interval ² (+/-)
United States.....	15.1	0.2	14.7	0.2
Alabama.....	16.3	2.1	16.4	1.3
Alaska.....	12.1	1.9	10.5	1.9
Arizona.....	18.0	2.3	19.6	2.1
Arkansas.....	17.0	2.1	18.6	2.7
California.....	16.6	0.7	15.4	0.6
Colorado.....	12.7	1.5	11.2	1.4
Connecticut.....	9.3	1.2	10.8	1.1
Delaware.....	12.9	1.3	13.7	1.5
District of Columbia....	19.7	1.8	19.9	1.8
Florida.....	15.4	0.9	15.1	0.9
Georgia.....	18.6	1.5	17.2	1.5
Hawaii.....	12.2	1.7	12.5	1.7
Idaho.....	14.8	2.3	13.7	2.2
Illinois.....	14.1	1.0	12.9	1.1
Indiana.....	15.9	1.9	13.4	1.4
Iowa.....	10.4	1.1	10.5	1.0
Kansas.....	14.4	2.0	13.6	1.3
Kentucky.....	16.8	2.0	18.9	1.8
Louisiana.....	21.3	2.1	20.2	2.9
Maine.....	13.0	1.5	12.5	1.4
Maryland.....	10.1	1.1	10.1	1.0
Massachusetts.....	10.7	1.3	11.6	1.4
Michigan.....	15.3	1.4	14.1	1.4
Minnesota.....	10.4	1.2	11.0	1.1
Mississippi.....	20.0	1.7	22.2	2.4
Missouri.....	15.2	2.2	14.5	2.1
Montana.....	15.5	2.4	14.0	2.2
Nebraska.....	10.2	1.7	11.6	1.6
Nevada.....	16.0	1.8	16.6	1.8
New Hampshire.....	7.1	1.0	8.6	1.0
New Jersey.....	11.2	1.3	10.2	1.2
New Mexico.....	20.2	2.2	21.0	2.8

New York.....	16.0	1.0	15.9	0.9
North Carolina.....	16.4	1.6	17.9	2.0
North Dakota.....	11.3	1.5	10.6	1.2
Ohio.....	15.2	1.6	14.5	1.4
Oklahoma.....	15.1	2.0	16.0	2.1
Oregon.....	14.3	1.7	14.3	1.5
Pennsylvania.....	12.4	1.0	13.1	1.3
Rhode Island.....	13.7	1.4	13.6	1.4
South Carolina.....	18.0	1.6	16.3	1.5
South Dakota.....	14.1	2.6	11.5	1.8
Tennessee.....	16.5	2.1	18.4	2.3
Texas.....	17.9	1.1	16.9	1.0
Utah.....	10.5	1.4	9.6	1.6
Vermont.....	11.2	1.4	10.0	1.1
Virginia.....	11.0	1.1	10.5	1.2
Washington.....	12.1	1.5	11.8	1.3
West Virginia.....	17.2	2.1	17.0	2.9
Wisconsin.....	11.6	1.4	11.2	1.3
Wyoming.....	10.1	1.5	10.7	1.4

*An asterisk preceding an estimate indicates change is statistically different from zero at the 90 percent confidence level.

¹Data are based on the CPS ASEC sample of 68,000 addresses. The 2014 CPS ASEC included redesigned questions for income and health insurance coverage. All of the approximately 98,000 addresses were eligible to receive the redesigned set of health insurance coverage questions. The redesigned income questions were implemented to a subsample of these 98,000 addresses using a probability split panel design. Approximately 68,000 addresses were eligible to receive a set of income questions similar to those used in the 2013 CPS ASEC and the remaining 30,000 addresses were eligible to receive the redesigned income questions. The source of the 2013 data for this table is the portion of the CPS ASEC sample which received the income questions consistent with the 2013 CPS ASEC, approximately 68,000 addresses.

²A 90 percent confidence interval is a measure of an estimate's variability. The larger the confidence interval in relation to the size of the estimate, the less reliable the estimate. Confidence interval shown in this table are based on standard errors calculated using replicate weights. For more information, see "Standard Errors and Their Use" at <<ftp://ftp2.census.gov/library/publications/2014/demo/p60-249sa.pdf>>.

³Details may not sum to totals because of rounding.

Source: U.S. Census Bureau, Current Population Survey, 2011 to 2014 Annual Social and Economic Supplements.

Reference 3: Videos Resources

MAT 152 Global Distinction Project

The first section of films are accessible from Films on Demand, which is part of NC LIVE. Students would have to access the films through their school's proxy server, or by using the NC LIVE password.

Economic Gaps: Globalization—A Real-World View

Segment title: Why the Poorest Countries in the World are in Africa

Segment title: Why is America Rich?

Segment title: Poverty in Africa (this is really good)

Decaying Cities: Reclaiming the Rust Belt

Segment title: Poverty in the United States: Philadelphia

49 Million Americans in Poverty 9:12 min. (informative, but pretty dry)

What Poor Child Is This? Poverty and America's Children

Segment title: 16k for family of 3, one in six children live in poverty, more than 30 years ago and rising 2:03 min.

Segment title: Welcome to Poverty, USA 3:01 min.

Segment title: Out of Sight and Oversized 1:27 min.

YouTube Videos

Poverty in the United States

Segment title: Tour Poverty USA -4:05 min.

<https://youtu.be/g3iRRsoqoMI>

Segment title: CBS Evening News - Family Faces the Growing Edge of Poverty -3:50 min.

<https://youtu.be/bv48A9BSews>

Segment title: Home Families Seattle-5:05

<https://youtu.be/TKsnABYo-UI>

Segment title: The New Homeless-4:15

<https://youtu.be/obho7uBg3-A>

Segment title: Going Hungry in America-3:46

<https://youtu.be/FBQSCQcfY18>

Poverty in Africa

Segment title: Hunger Crisis in West Africa-4:33

<https://youtu.be/pC3kKsn19AE>

Three Children, three counties

<https://www.youtube.com/watch?v=H42b9iWeFMA>

Segment title: 15m People in Ethiopia Will Need Food Aid by 2016-3:00

<https://youtu.be/9IKqAtJiZUY>

Segment title: Children Living in Poverty-4:34 (Ghana)

https://youtu.be/fQVqgskFM_8

Segment title: Poverty in Sierra Leone-4:42

https://youtu.be/0hPF_n4st2o

Segment title: Global National-Sierra Leone Poverty-2:20

<https://youtu.be/7uGiwVdGT6w>

Sunkari's story, Freetown, Sierra Leone

<https://www.youtube.com/watch?v=RFYWQEabSe0>