

# Meaningful Mathematics: A Social Justice Themed Introductory Statistics Course

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## APPENDICES

This appendix includes a sample of the sorts of activities we used in this course. We are willing to share any additional materials mentioned in the article but not found in this appendix. The list of materials below addresses the mathematical content, with the parenthetical indicating the social-justice framing of the task or question.

We encourage readers to use these resources as-is or to use as seeds for developing their own materials. We would also like to point to the website *Radical Math* [5] as a valuable resource that we returned to regularly as we designed materials for the course. As student engagement increases with the timeliness and relevance of the topics, we consider it best to regularly update the content.

A note on some stylistic choices you will see in the materials: one of the authors has cultivated an intentional informal style in classroom materials; some of what you will see here does not match the formal style of the journal. In the same vein, you will note some materials use non-standard capitalization; this choice is intentional and has led to several productive conversations with students and faculty regarding authority: who has it and who doesn't [4].

1. Understanding Pie Charts (Wealth Distribution)
2. Assessing Histograms (Children in Poverty)
3. Box-plot pre-work (Traffic Density)
4. Peer-assessment of Table sense-making (High-risk Employment)
5. Probability (Jury Selection)
6. Probability (Stop and Frisk)
7. Correlation and Gun Ownership

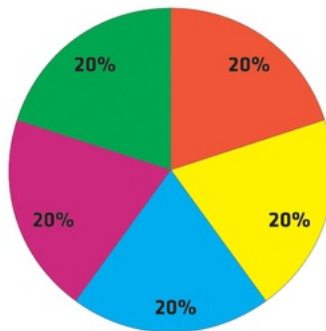
*Graphical Displays of Wealth Distributions*

**Wealth Distribution in the US vs. Sweden-Part 1**

Using the circles below, represent your guess for the distribution of wealth in the US and Sweden. Each slice of the pie chart should represent the proportion of wealth held by one fifth of the population in the country: the yellow slice, by the wealthiest fifth; the blue slice by the next wealthiest, down to the red slice, which represents the poorest fifth, in terms of wealth.



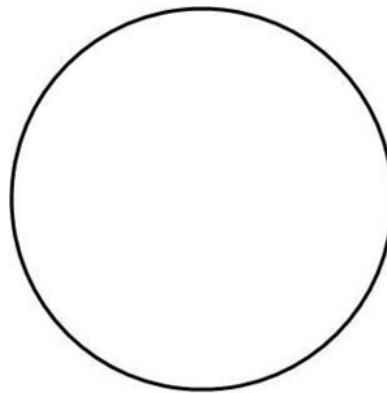
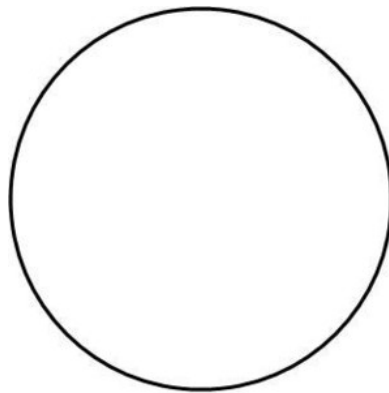
For example: If the wealth were equally distributed (then really there would be no difference between the wealthiest and the poorest), then the pie chart would look like this.



Estimated Distribution of Wealth for:

United States

Sweden

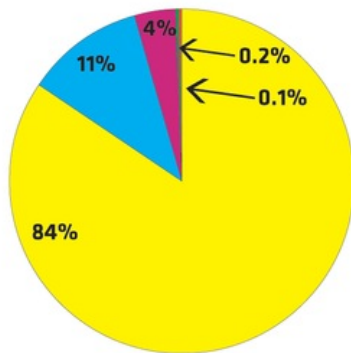


- Share your reasoning with your neighbor.
- What information (besides the actual distribution of wealth) would you have wanted to make this estimate?
- Are your pie charts the same? Why or why not?

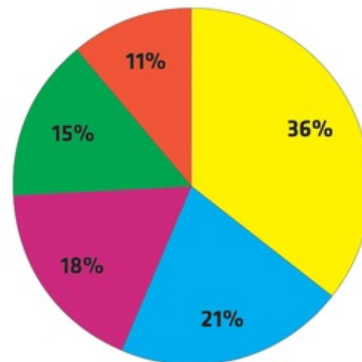
### Wealth Distribution in the US vs. Sweden-Part 2

The circles below represent the actual distribution of wealth in the US and Sweden. Each slice of the pie chart represents the proportion of wealth held by one fifth of the population in the country: the yellow slice, by the wealthiest fifth; the blue slice by the next wealthiest, down to the red slice, which represents the poorest fifth, in terms of wealth.

Actual US Distribution



Actual Swedish Distribution

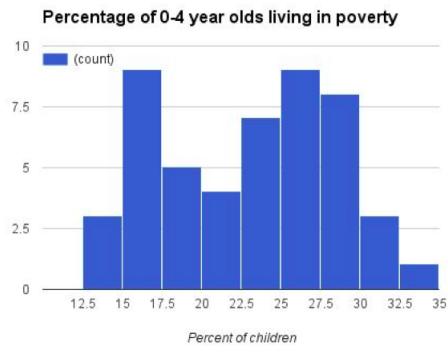
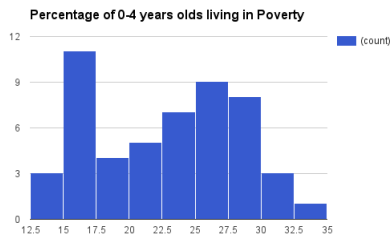
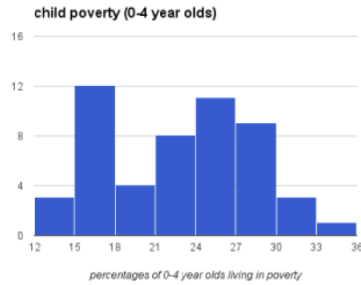


- What questions do you have now that you are seeing the distribution? Or what additional information would you like to know?
- What claims or suggestions can you make about wealth distribution?

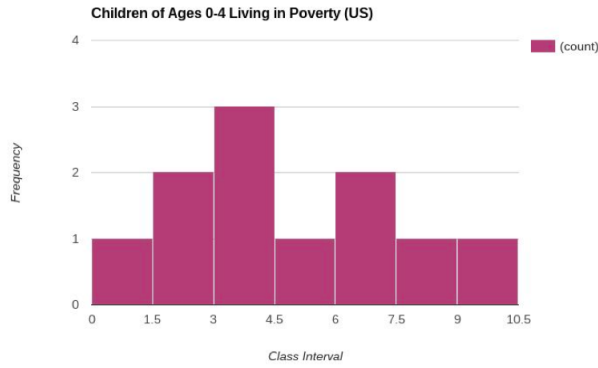
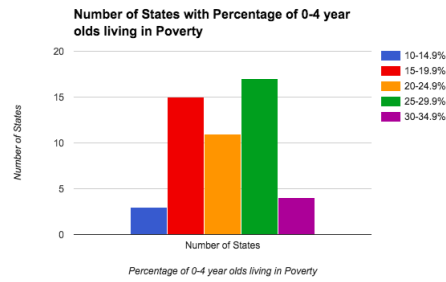
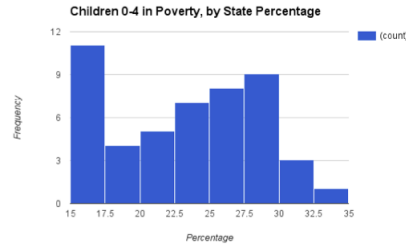
*Creating Effective Histograms*

**histogram reflections**

below are three similar histograms of the “percent of children in poverty” data set. comment on the attributes of each, decide which one you prefer, and be able to explain why.



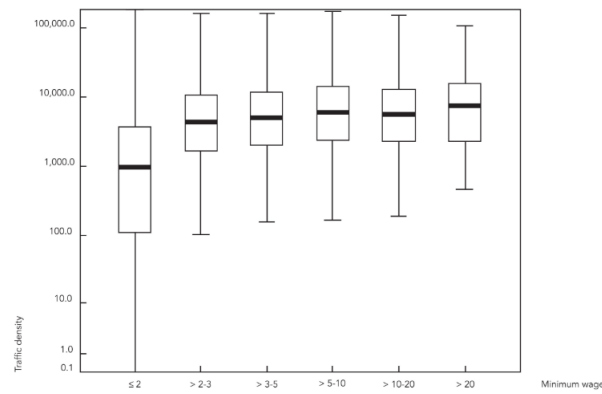
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*Box-plot Pre-work*

**making sense of box plots**

here is a graph that shows the distribution of traffic density for income groups (grouped by number of times the areas income is at or above minimum wage - so that if the areas income is 4 times more than minimum wage the area is represented in the third box-and-whiskers plot). the traffic density is measured in the annual average number of vehicles per hour.



1. how does the traffic compare across the different income groups?
2. why do you think that matters?
3. if you didn't already - make sure your answers include numerical details from the graphs.

*Numerical, Graphical, and Verbal Descriptions of Data*

**Estimated Number and Percentage of Workers  
Employed in High-Risk Occupations-2010 US census data**

Characteristic	Number	Percentage
<b>Sex</b>		
Male	12,240,312	21.1
Female	4,438,820	8.9
<b>Race/Ethnicity</b>		
Hispanic	4,009,024	24.4
White, non-Hispanic	9,584,598	13.0
Black, non-Hispanic	2,277,643	20.8
American Indian/Alaska Native	97,197	20.2
Asian	494,505	9.2
Hawaiian or Pacific Islander	47,318	17.8
Multiple Races	168,847	15.1
<b>Educational Attainment</b>		
No education beyond high school	11,095,900	25.6
Education beyond high school	5,583,142	8.6
<b>Place of Birth</b>		
United States	12,253,418	13.9
U.S. territory	110,365	19.9
Foreign Country	4,315,349	22.1

1. here are two examples of sentences students wrote to try and make some sense of this data.
  - Even though United States birth citizens make up a higher number of people employed in high-risk occupations, immigrants make up a higher percentage (22.1 % vs 13.9%).
  - Those who have no college education are more likely to work in high-risk occupations.

for each of these statements make a graph (or multiple graphs) that help convey this information. (please do this using technology and email the results to me - the data is on the back of this page).



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2. here are some sentences that are about the issue raised on location of birth. read them all and decide which one you think would be the best to give to the Senator you're working for. write down some reason why you would include the one you chose, and why you wouldn't choose the ones you decide against.

- It is noticeable that people's birthplace have something to do with high risk employment. The population numbers for US is higher than Foreign countries but the percentage is higher for Foreign countries.
- I noticed that a high number of employees born in the US work high risk jobs but the number of employees born in a foreign country represent a much higher number. It could have to do with income, education, and opportunities of the employees.
- There are almost 3 times more people employed that were born in the US than a foreign country, yet people born in foreign countries are twice as likely to have a high risk occupation.
- There are 12,253,4118 men and women born in the United States that work in High-Risk occupations. This is only 13.9 % of the working population. For Foreign Countries, they make up 22.1%, a little less than a quarter, of all people that in high-risk occupations. Even though that 22.1 percent represents 4,315,349 people.

*Probability using Jury Bias & Stop and Frisk*

**Jury Bias:** Six black students at Jena High School in central Louisiana were arrested in December 2006 after a school fight in which a white student was beaten and suffered a concussion and multiple bruises. The six black students were charged with attempted murder and conspiracy. They faced up to 100 years in prison without parole. The fight took place amid mounting racial tension after a black student sat under a tree in the schoolyard where only white students sat. The next day three nooses were hanging from the tree.

For Mychal Bell's (one of the six students) trial, in which he was charged with second-degree battery and conspiracy to commit second-degree battery, an all-white jury was selected in his parish. Here is how jury selection works:

**Step 1: A Jury Pool:** People are randomly selected from a government computer database and receive a summons to report to the courthouse and be part of a jury pool.

**Step 2: Voir Dire:** Attorneys from both sides question everyone in the jury pool. The purpose of this questioning is to determine who shows no bias towards one side or the other and to truly have an impartial jury.

**Step 3: Jury Panel:** The attorneys are to agree on all twelve people to be selected to be on a jury panel. If one attorney does not want a person on the jury, that person will not be selected for the jury.

According to the US Census, the population in the jury pool's parish is 85.6% white (1,844 people) and 14.4% people of color (310 people).

1. If the selection of the jury was truly random and was in accordance with the demographics of the parish in Louisiana, approximately how many of the jurors should have been white? Approximately how many of the jurors should have been black? How do you know?
2. What was the probability of selecting an all-white jury?
3. Did Mychal have a "fair" trial? Was there any suggestion of bias in the jury selection?

**Stop and Frisk** (a practice used in many places in the US, but most recently a topic in New York City) is a practice in which police officers stop and question a pedestrian, then frisk them for weapons and other contraband. Recently, the stop and frisk program was ruled unconstitutional and ineffective at preventing crime. We will consider the first part of the claim.

The population of NYC in terms of race and ethnicity is as follows:

Non-hispanic White	44%
Non-hispanic Black	25%
Latino/a	28%
Other	3%

Data from the 2009 Stop and Frisk program provided by the NYPD

2009	Stopped	Arrested used	Force found	Contraband found	Weapon
White	53,601	3,255	10,041	1311	912
Black	306,965	18,022	75,424	5218	3417
Latino/a	178,690	10,959	48,607	2698	1348
Other	36,901	2,229	7,380	369	191
Total					

1. Complete the bottom row of the table.
2. What is the probability that a person stopped was a NYC resident who is black or latino/a ?
3. What percentage of the population in NYC is black or latino/a?
4. What was the probability that a person was stopped and was innocent (*i.e.*, not arrested)?
5. What is the probability that a stop ends in a weapon being found?
6. Given that a white NYC resident was stopped, the probability that they were arrested was  $3,255/53,601$  or .0607 (6.07% of the time). Calculate this probability for a black resident? A latino/a resident?
7. Given that a NYC was stopped, what is the probability that force was used against them if they were white? black? latino/a?
8. Given a stop occurred, which group (white, black, or latino/a) had a larger probability of being found to have a weapon.
9. Why do you think this practice was ruled unconstitutional?

*Correlation and Gun Ownership*

Use the data about gun-related issues (gun.xlsx is available from authors) to draft a policy suggestion.

Contextualize this assignment by assuming that you are an aide to a US Senator who has asked you to look at this data and come up with a policy suggestion that they (the senator) could support based off of this data.

**Requirements**

- You must summarize the data, letting the Senator know what variables are included and what comparisons between variables were possible.
- You must make a clear policy statement that discusses an appropriate federal policy the senator can support using this data set.
- Your policy suggestion must use some of the correlations you find between the variables, supported both with a graph of the relation as well as any measures of correlation strength or weakness. (You don't have to use all of them, but you must use at least two.)
- Your explanations, graphs, and measures should take into account outliers (any exceptionally strange values you find in the data set). If you decide to remove a value from consideration because you think it is an outlier - you must clearly explain why, and what possible consequences that may have on policy.
- Reports must be typed, include clear and professionally presented graphs, and be written in a formal style appropriate to the context.

## References

- [1] Gutstein, E. and Peterson, B. (Eds.) (2005), *Rethinking Mathematics: Teaching Social Justice by the Numbers*, Milwaukee, WI: Rethinking Schools, Ltd.
- [2] Solman, Paul, *How Does the US Slice the Pie?*, PBS NewsHour, <https://www.pbs.org/newshour/arts/easy-as-pie-inequality-in-downloadable-charts>. Aired 12 August, 2011.
- [3] Wheatley, M. J. (2002), *Turning To Each Other: Simple Conversations to Restore Hope to the Future*, San Francisco: Berrett-Koshler Publishers, Inc.
- [4] Wallace, D.F. 2001, Tense Present: Democracy, English and Wars over Usage" *Harper's Magazine* 302; 1811; (pp. 39-58).
- [5] Yang, K.W., Radical Math <http://www.radicalmath.org/> Accessed October 2016