AP Statistics Summer Assignment

Summer of 2019

Description: AP Statistics is a challenging course. This class approximates a college-level Statistics course and also prepares students for the AP Statistics exam in May which can be used to earn college credit. Due to the rigor of the class, it is vital that students have a strong background in math and come to each class with all assignments completed. *Please note* that simply "finding the answer" is not enough for this course. You must be able to justify and explain your results and apply them to the problem in general.

Due Date: This assignment is due on or before September 6th.

N.B. All work should be typed, double-spaced, using good grammar, spelling, etc. Communication is key to success in statistics. Responses should be in paragraph form and suitable for any writing assignment in English or Social Studies class – do not just answer the questions briefly with bullet points.

Part 1: ***Why Statistics?***

Write a page explaining why high school students should take a statistics class. First, use evidence from the following sources to make your case:

- http://www.ted.com/talks/lang/en/arthur_benjamin_s_formula_for_changing_math_education.html
- http://www.wired.com/magazine/2010/04/st_thompson_statistics/

Then, write a paragraph explaining what you hope to gain from taking a class in Statistics. What are your reasons for signing up for this class?

Part 2: ***"A book is, in fact, less a cause of intelligence than an indicator."***

Read the attached article, "Do Parents Matter?" and complete the following:

- Summarize the results of the data on parenting. What results surprised you? How is the parenting in your life similar to what the article states? How is it different?

Go to the "Hidden Brain" website (http://www.npr.org/series/423302056/hidden-brain) and listen to a recent episode that sounds interesting to you. *Be sure to listen to an entire episode,* ***not a clip*** – episodes are more than 30 minutes long. My favorite recent episode is "What's Not on the Test: The Overlooked Factors that Determine Success"

- Fully summarize the theme of the episode in your own words as well as the individual studies discussed.
    - What were the questions the researchers were asking?
    - How did they try to answer those questions?
    - What did they find?
- What are your personal thoughts on the topic? What did you learn from this episode that changed and/or added to what you previously thought you knew?

Part 3: ***"The information has been set loose."***

Read the attached article, "Cracking the Real Estate Code" and complete the following:

- Summarize the article's findings. Be sure to describe how the realtor uses her "information advantage" to her benefit and describe another example from the world around you where you see this occurring. Has this advantage changed due to 21st-century technology? If so, how?

On the Hidden Brain website, find the episode entitled *When Great Minds Think Unlike: Inside Science's 'Replication Crisis'* from May 24, 2016 (Click on the archive link at the bottom and go to May 2016) where "expert information" is somewhat debunked. Summarize the episode and provide a personal response.

Part 4: ***Interesting Data***

Examining data is an important part of understanding the world, but few things are harder than making meaning from a list of numbers. Fortunately, many groups and individuals are working to find new ways to display data in useful and interesting ways. I want to make sure that you know about two of them before you start the new school year.

1. Gapminder.org is an organization that is working hard to make the world's data accessible. To understand the use and importance of Gapminder, view the following 20-minute presentation - http://www.ted.com/talks/hans_rosling_shows_the_best_stats_you_ve_ever_seen.html
    a. Explore the website – gapminder.org. Click on the option to "Play with the data" under Try Our New Tools. Create an original graph that answers a question you have about the world. Write a short summary of what you graphed, what question it answers, and any trends or patterns you see in the data.
        i. There is a link at the top called "How to Use" if you are confused.
        ii. You can change the variables by clicking the titles themselves in the graph displayed and choosing from a drop-down menu. The colors represent the different continents. Play around with including (or not) certain continents and/or countries.
        iii. Remember that you are seeking to ANSWER A QUESTION with data.
    b. Once you have created a graph that is interesting to you, find the Share links in the upper-right corner and click the button that looks like a paper airplane. Copy the shortcut link to the top of your summary.
    c. An example summary and link is attached.
2. Worldmapper.org creates maps of the world where the size of the country represents the value of the data. Explore the website and look at two related maps and then write a short summary comparing and contrasting the two maps. Right-click on the maps to copy the images, then paste them into your summary. Include the map numbers in your summary.
    a. An example summary is attached.

PART 2

Do parents matter?

By Stephen J. Dubner and Steven D. Levitt

By now, the letters have landed.

The fast-track nursery schools and the "gifted and talented" public schools and the Ivy League colleges have mailed their acceptance letters, and parents everywhere are either a) congratulating themselves for having shepherded their children into the dream school or b) chiding themselves for having failed.

In the first case, the parents may tell themselves: *It was those Mozart quartets we played in utero that primed her for success.* In the second case, they might say: *I knew we shouldn't have waited so long to get him his first computer.* But how much credit, or blame, should parents really claim for their children's accomplishments? The answer, it turns out, is a lot — but not for the reasons that most parents think.

The U.S. Department of Education recently undertook a monumental project called the Early Childhood Longitudinal Study, which tracks the progress of more than 20,000 American schoolchildren from kindergarten through the fifth grade. Aside from gathering each child's test scores and the standard demographic information, the ECLS also asks the children's parents a wide range of questions about the families' habits and activities. The result is an extraordinarily rich set of data that, when given a rigorous economic analysis, tells some compelling stories about parenting technique.

A child with at least 50 kids' books in his home, for instance, scores roughly 5 percentile points higher than a child with no books, and a child with 100 books scores another 5 percentile points higher than a child with 50 books. Most people would look at this correlation and draw the obvious cause-and-effect conclusion: A little boy named, say, Brandon has a lot of books in his home; Brandon does beautifully on his reading test; this must be because Brandon's parents read to him regularly.

But the ECLS data show *no* correlation between a child's test scores and how often his parents read to him. How can this be? Here is a sampling of other parental factors that matter and don't:

•*Matters*: The child has highly educated parents.

•*Doesn't*: The child regularly watches TV at home.

•*Matters*: The child's parents have high income.

•*Doesn't*: The child's mother didn't work between birth and kindergarten.

•*Matters*: The child's parents speak English in the home.

•*Doesn't*: The child's parents regularly take him to museums.

•*Matters*: The child's mother was 30 or older at time of the child's birth.

•*Doesn't*: The child attended Head Start.

•*Matters*: The child's parents are involved in the PTA.

•*Doesn't*: The child is regularly spanked at home.

Culture cramming may be a foundational belief of modern parenting but, according to the data, it doesn't improve early childhood test scores. Frequent museum visits would seem to be no more productive than trips to the grocery store. Watching TV, meanwhile, doesn't turn a child's brain into mush after all; nor does the presence of a home computer turn a child into Einstein.

Now, back to the original riddle: How can it be that a child with a lot of books in her home does well at school even if she never reads them? Because parents who buy a lot of children's books tend to be smart and well-educated to begin with — and they pass on their smarts and work ethic to their kids. (This theory is supported by the fact that the number of books in a home is just as strongly correlated with math scores as reading scores.) Or the books may suggest that these are parents who care a great deal about education and about their children in general, which results in an environment that rewards learning. Such parents may believe that a book is a talisman that leads to unfettered intelligence. But they are probably wrong. A book is, in fact, less a *cause* of intelligence than an *indicator*.

The most interesting conclusion here is one that many modern parents may find disturbing: Parenting technique is highly overrated. When it comes to early test scores, it's not so much what you do as a parent, it's who you are.

It is obvious that children of successful, well-educated parents have a built-in advantage over the children of struggling, poorly educated parents. Call it a privilege gap. The child of a young, single mother with limited education and income will typically test about 25 percentile points lower than the child of two married, high-earning parents.

So it isn't that parents don't matter. Clearly, they matter an awful lot. It's just that by the time most parents pick up a book on parenting technique, it's too late. Many of the things that matter most were decided long ago — what kind of education a parent got, how hard he worked to

build a career, what kind of spouse he wound up with and how long they waited to have children.

The privilege gap is far more real than the fear that haunts so many modern parents — that their children will fail miserably without regular helpings of culture cramming and competitive parenting. So, yes, parents are entitled to congratulate themselves this month over their children's acceptance letters. But they should also stop kidding themselves: The Mozart tapes had nothing to do with it.

Stephen J. Dubner and Steven D. Levitt are the authors of Freakonomics: A Rogue Economist Explores the Hidden Side of Everything.

Bibliography

Dubner, S., & Levitt, S. (2005, May 3). *Do Parents Matter?* Retrieved May 27, 2015, from USA Today: http://usatoday30.usatoday.com/news/opinion/editorials/2005-05-03-parents-edit_x.htm

PART 3

Cracking the Real Estate Code

Is your agent really working for the enemy? A user's guide to home economics (and how to beat the expert industry).

By Steven D. Levitt and Stephen J. Dubner

It's one of the biggest bets you can place on another person: You hire a real estate agent to sell your home.

She sizes up its charms, snaps some pictures, sets the price, writes a seductive ad, shows the house aggressively, negotiates the offers, and sees the deal through to the end. Sure, it's a lot of work, but she's getting a nice cut. On the sale of a $300,000 house, you'll typically pay a 6 percent agent fee of $18,000. That's a lot of money. But you tell yourself that you never could have sold the house for $300,000 on your own. The agent knew how to - what's that phrase she used? - "maximize the house's value." She got you top dollar, right?

A real estate agent is every bit the expert. She is better informed than you about your home's worth, the state of the housing market, even the buyer's frame of mind. You depend on her for this information.

As the world has grown more specialized, countless such experts have made themselves similarly indispensable. Doctors, lawyers, contractors, auto mechanics: They all enjoy informational advantage. And they use that advantage to help you.

Right?

Information can be a beacon, or information can be a cudgel; it depends on who wields it and how. In any transaction, it's common for one party to have better information than the other. In the parlance of economists, this is information asymmetry. There's value in asymmetry; it's the reason why someone, such as a consumer, will pay someone else, an expert, for his knowledge.

Of course, sometimes an expert might manipulate his advantage for his own benefit. If your doctor suggests that you have an angioplasty - even though current research suggests that angioplasty often does little to prevent heart attacks - your first thought won't likely be that the doctor is using his informational advantage to make a few thousand dollars for himself or his buddy. But as David Hillis, an interventional cardiologist at the University of Texas Southwestern Medical Center in Dallas, explained to *The New York Times*, a doctor may have the same economic incentives as a car salesman or a funeral director or a mutual fund manager: "If

you're an invasive cardiologist and Joe Smith, the local internist, is sending you patients, and if you tell them they don't need the procedure, pretty soon Joe Smith doesn't send patients anymore."

Or consider these findings of a 1996 medical study: Obstetricians in areas with declining birthrates are much more likely to perform cesarean section deliveries than obstetricians in growing areas - suggesting that when business is tough, doctors may try to ring up more expensive procedures.

The Internet, of course, is all about smoothing over these asymmetries; in one industry after another, from life insurance to used cars, the Web has eliminated the expert's upper hand by giving once-exclusive information to the online masses. But some industries have been slow to change - real estate among them.

The best way to observe information asymmetry at work is to measure how an expert treats you versus how he performs the same service for himself. Real estate provides the perfect opportunity, since housing sales are a matter of public record, and real estate agents often do sell their own homes. Recent data covering the sale of nearly 100,000 houses in suburban Chicago show that more than 3,000 of those houses were owned by agents.

Before plunging into the data, a question: What is the agent's incentive when selling her own home? Simple: to make the best deal possible. Presumably, this is also her incentive when selling your home; after all, her commission is based on the sale price. And so your incentive and the agent's incentive would seem to be nicely aligned. But commissions aren't as simple as they seem. First of all, a 6 percent commission is typically split between the seller's agent and the buyer's. Each agent then kicks back half of her take to her agency. Which means that only 1.5 percent of the purchase price goes directly into your agent's pocket.

So on the sale of your $300,000 house, her personal take of the $18,000 commission is $4,500. Still not bad, you say. But what if the house was worth more than $300,000? What if, with a little more effort and patience, she could have sold it for $310,000? After the commission, that puts an additional $9,400 in your pocket. Yet the agent's additional share - her personal 1.5 percent - is a mere $150. So maybe your incentives aren't aligned after all. Is the agent willing to put out all that extra time and energy for just $150?

There's one way to find out: measure the difference between the sales data for houses that belong to real estate agents themselves and the houses they sold on behalf of clients. Using the information from those 100,000 Chicago homes, and controlling for any number of variables - location, age and quality of the house, aesthetics, and so on - it turns out an agent keeps her own home on the market an average of 10 days longer and sells it for an extra 3-plus percent, or $10,000 on a $300,000 house. When she sells her own house, an agent holds out for the best offer; when she sells yours, she pushes you to take the first decent offer that comes along. Like a stockbroker churning commissions, she wants to make deals and make them fast. Why not? Her share of a better offer - $150 - is too puny an incentive to encourage her to do otherwise. So her job

is to convince you that a $300,000 offer is in fact very good, even generous, and one that only a fool would refuse.

This can be tricky. The agent doesn't want to come right out and call you a fool. So she merely implies it - perhaps by telling you about the bigger, nicer, newer house down the block that has sat unsold for six months. This is the agent's main weapon: the conversion of information into fear. Consider this true story, related by John Donohue, a law professor who in 2001 was teaching at Stanford University: "I was just about to buy a house on the Stanford campus, and the seller's agent kept telling me what a good deal I was getting because the market was about to zoom. As soon as I signed the purchase contract, he asked me if I would need an agent to sell my previous Stanford house. I told him that I would probably try to sell without an agent, and he replied, 'John, that might work under normal conditions, but with the market tanking now, you really need the help of a broker.'"

In five minutes, a zooming market tanked. Such are the marvels that can be conjured by an agent in search of the next deal.

So a big part of a real estate agent's job is to persuade the homeowner to sell for less than he would like while at the same time letting potential buyers know that a house can be bought for less than its listing price. To be sure, there are subtler means of conveying this information than blatantly telling the buyer to bid low. The Chicago study also reveals how agents exert influence through the listings they write. A phrase like "well maintained," for instance, is full of meaning to an agent - the house is old but not quite falling down. A savvy buyer will know this (or find out once he sees the place), but to the retiree who is selling the house, "well maintained" might sound like a compliment, which is just what the agent intends.

An analysis of the language used in real estate ads shows that certain words are powerfully correlated with the final sale price of a house. This doesn't necessarily mean that labeling a house "well maintained" causes it to sell for less than an equivalent house. It does, however, indicate that when an agent labels a house "well maintained," she is subtly encouraging a buyer to bid low.

So consider the terms in the box on the previous page: A "fantastic" house is surely fantastic enough to warrant a high price, right? What about a "charming" and "spacious" home in a "great neighborhood!"? No, no, no, no, and no.

In fact, the terms that correlate with a higher sales price are physical descriptions of the home itself: granite, Corian, and maple. As information goes, such terms are specific and straightforward - and therefore pretty useful. If you like granite, you might like the house; but even if you don't, "granite" certainly doesn't connote a fixer-upper. Nor does "gourmet" or "state-of-the-art," both of which seem to tell a buyer that a house is, on some level, fantastic.

"Fantastic," meanwhile, is a dangerously ambiguous adjective, as is "charming." These words, it turns out, are real estate agent code for a house that doesn't have many specific attributes worth describing. "Spacious" homes, meanwhile, are often decrepit or impractical. "Great neighborhood" signals to a buyer that, well, *this* house isn't very nice but others nearby may be. And an exclamation point in a real estate ad is bad news for sure, a bid to paper over real shortcomings with false enthusiasm.

If you study an ad for a real estate agent's *own* home, meanwhile, you see that she emphasizes descriptive terms (especially "new," "granite," "maple," and "move-in condition") and avoids empty adjectives (including "wonderful," "immaculate," and the telltale "!"). She patiently waits for the best buyer to come along. She might tell this buyer about a house nearby that just sold for $25,000 *above* the asking price, or another house that is the subject of a bidding war. She is careful to exercise every advantage of the information asymmetry she enjoys.

But even the agent's advantage has been eroded by the Internet. After all, anyone can now get online and gather information about sales trends and housing inventory and mortgage-rate tremors. And recent sales data is starting to show the results. Agents still get a higher price for their own homes than for comparable homes owned by their clients - but since the proliferation of real estate Web sites, the gap between the two prices has shrunk by a third. The information has been set loose.

Adapted from Freakonomics: A Rogue Economist Explores the Hidden Side of Everything*, copyright Steven D. Levitt and Stephen J. Dubner, published by William Morrow. Levitt is an economist at the University of Chicago. Dubner is an author and journalist.*

Bibliography

Dubner, S., & Levitt, S. (2005, May). *Cracking the Real Estate Code.* Retrieved May 27, 2015, from Wired Magazine: http://archive.wired.com/wired/archive/13.05/realestate.html?pg=1&topic=realestate&topic_set=

PART 4

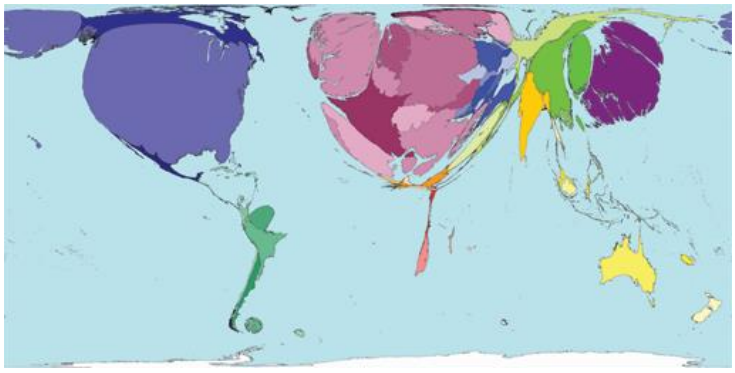
Gapminder: http://bit.ly/2HUWDYu

The graph I made compared Primary school completion and Babies per woman. Generally, the graphs shows that the higher the percentage of people completing primary school, the lower number of births per woman. More specifically, all of the European countries have relatively low birth rates and high school completion rates. Switzerland actually surprised me as having the lowest Primary school completion rate of just over 60%, though they still average less than two births per woman. African countries show the widest variation of any other continent – ranging from Niger with only 16% Primary school completion and almost 8 births per woman to South Africa and Tunisia with almost 80% Primary school completion and around three births per woman. Both Asia and the Americas were primarily found in the high school completion – low birth rate clusters, but both groups also had outliers such as Afghanistan, Lao, Honduras, and Haiti.

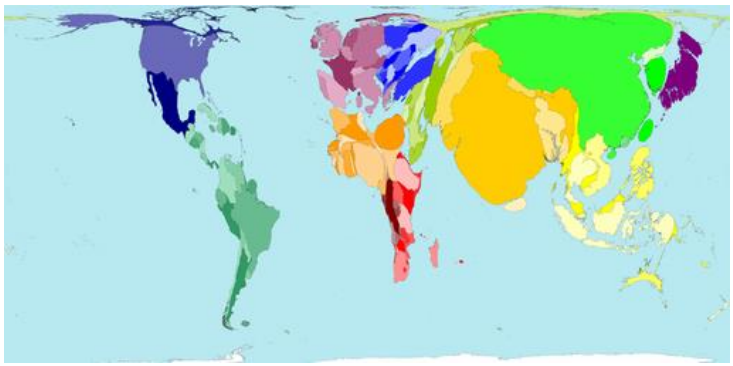
I created this graph because a prominent theory is that the more people in a community complete basic schooling, the better the economic outlook is for that nation. When women are both uneducated and spending much of their post-puberty life in child bearing and rearing, they are unable to contribute to the national economy. Furthermore, having one-income households in areas of poor education and large families almost guarantees a poverty level existence. The data on this graph, though it is from 1993 – long before the wars in the middle east, North Africa, the Haitian earthquake and the current struggles in Central America – shows a long term trend of economic difficulties in these areas may stem from not only the troubles listed, but also traditional attitudes towards family planning and education.

Worldmapper.org

Map 205 – Biomedical Research



Map 255 – Life Expectancy



The maps I chose compare the amount spent on Biomedical research and the life expectancy of people born in 2002. I thought that the more a country spent on research, the longer people would live in that country. However, the maps do not agree with my hypothesis. The countries with the longest life expectancy appear to be China, Indonesia and India, but they spend very little on Biomedical research comparatively. The largest spenders on Biomedical Research appear to be the United States and Western European countries. These countries do not have the longest life expectancy, though. In fact, they seem to be proportionally the same as all of South America and even some parts of Africa while those countries spend almost nothing on research. I'm sure cultural differences such as diet and other factors contribute to the long life span, but it's interesting how little research spending seems to matter.

	Elements required	Comments	Points Earned
Part 1 (10 points possible)	Submitted on or before the due date (5 points)		
	Uses evidence from Dr. Benjamin (1 point)		
	Uses evidence from Mr. Thompson (2 points)		
	Expresses a personal goal for the class beyond "I need math and don't want to take AICE." (2 points)		
Part 2 (20 points possible)	Submitted on or before the due date (5 points)		
	Article summary includes all major points (3 points)		
	Summary includes elements from personal experience (3 points)		
	Appropriate podcast episode found and cited. (2 points)		
	Summary includes all major points (3 points)		
	Thoughtful reasoning for your opinion on their conclusion included (4 points)		
Part 3 (20 points possible)	Submitted on or before the due date (5 points)		
	Article summary includes all major points (3 points)		
	Summary includes additional example from your own experience (3 points)		
	Podcast episode found and cited. (2 points)		
	Summary includes all major points (3 points)		
	Thoughtful reaction to findings included (4 points)		
Part 4 (20 points possible)	Submitted on or before the due date (5 points)		
Gapminder	A description of what is on each axis, what the circle size represents, which countries are shown, and for which years the graphs display meaningful data (5 points)		
	A question is stated that the graph addresses (1 point)		
	Trends or patterns are described (3 points)		
Worldmapper	Two different maps are printed and identified by map number (2 points)		
	Similarities between the maps are identified (or lack of similarities is explained to be key feature of the maps) (2 points)		
	Differences between the maps are identified (or a lack of differences is explained to be a key feature of the maps (2 points)		