2015

Mathematics in Contemporary Society Chapter 1

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Chapter 1

Fundamentals of Statistics

First of all, what are statistics all about? Where do we find statistics?

In sports, we hear about statistics all of the time. A baseball fan may be interested in the number of home runs hit by his favorite player or favorite team. Perhaps he is interested in the player(s) who hold(s) the record for most hits during a month, year or career. Or perhaps he just wants to know how many games out of first place his favorite team is right now.

In business, we can use statistics to measure the performance of a particular company, industry, or country. A CEO may be interested in the revenue generated by her company for the week, month or year. Perhaps she is interested in how much office expenses have risen over the last five years, or the average monthly sales of the sales staff over the last year.

Every day, we may find ourselves turning on the television or radio to find out about the weather. How cold is it going to be today? What is the record high/low temperature for today? Is rain or snow expected? How much? What is the chance that the snowstorm currently in the Midwest is going to hit New York?

Question 1: Identify a field where statistics are used. What sort of statistical information is of interest to a person in this field?

We've been using the word statistics without giving it a definition:

Statistics is the process of collecting, organizing, presenting and interpreting data. **Data** is the set of values (numerical or nonnumerical) that are being examined. (For example, data may be the numerical GPAs of QCC students or the nonnumerical majors of QCC students.)
Statistics are also the results of the statistical process itself. The twenty highest paid baseball players is an example of baseball statistics.

Before we do any work, there are some other statistical terms that we should know:

The **population** is the complete set of people or things that are of interest to a researcher in a statistical study. A person studying the November 2015 election may be interested in the population of voters from Bayside, Queens County, New York State or the entire country.

Population parameters are the specific characteristics being studied that a research wishes to understand. For a person studying the November election, he may only want to know which candidate received the most votes from the chosen population. Or he may be interested in other voter characteristics, such as age, income, family size and so on (details which may have affected their vote).

A population may be very large or very small; it depends on who the researcher is and what she wants to know. Here are some examples:

Researcher	Population	Possible Parameter(s)
QCC Registrar employee	All QCC students	GPA, Credits Completed, Balance Due College, Major, Telephone Number
Math Faculty Member	MA-321 classes	MA-321 grades, class sizes, number of sections taught per semester
Dr. Wallach	This section of MA-321	Test scores, lab grades, project grades, homework, online attendance
Sports fan	Basketball players	Team records, field goal percentage, points per game
President of IBM	IBM	Income for the last 120 months, Employee salaries, stock price

<u>Question 2:</u> Create your own example following the format above.

As you can see, the population is specific to what the researcher (who is anyone interested in the given population) cares about. The parameter is anything among the many characteristics of the population.

Very often, it is difficult to gather information on the entire population. Researchers often rely on samples.

A **sample** is a subset selected from the entire population. **Sample statistics** are the values and information gathered from the sample (what we sometimes call **raw data**).

For example:

This class is a sample of all QCC students. It is also a sample of MA-321 students. It is also a sample of people living in New York State (if all of the students in this class live in New York).
The New York Mets are a sample of all current baseball players.
The noon temperature for the last week in Bayside is a sample of August temperatures in Bayside in 2015.
The stock price of AT&T on Friday at 5 pm during the entire year is a sample of the stock performance for the entire year.

Ideally, a sample should be a good representation of the population itself. There are different ways to gather a sample:

1) **Simple random sampling** from the entire population. If the population is sufficiently large, a computer can be used to randomly select a sample from all population members (if the entire list is available). On a smaller scale, it could be as simple as placing the names of all population members in a hat and picking names.
2) **Systematic sampling** uses some fixed method to gather sample elements. For example, if the master list of the population is contained on 200 pages of names, we may select only the first name on each page.
3) **Convenience sampling** makes use of the most readily available population members. Dr. Wallach may use his current MA-321 students as a sample of all QCC students, because they are readily available.
4) **Stratified sampling** separates the population into subgroups (for example male/female, child/teenager/adult/senior, or Business/Liberal Arts/Science/History) and makes a fixed number of selections (following the above methods perhaps) from these subgroups. A QCC researcher may deliberately select a sample containing exactly 25 men and 25 women to create a fair representation of each gender.

If the goal is to represent the population well and efficiently, each method offers certain advantages and disadvantages, in terms of time/equipment requirements, cost, reliability, and ease of execution.

Question 3: If you needed to gather a sample of 100 students to determine how they will vote in the November election, how would you gather a sample? Why?

Keeping in mind what we have already learned, we can now examine an example of the application of statistical methods.

The Statistical Process

1) **State your goal. Be clear what population you want to study and what information (parameters) you would like to know about the population.**
2) **Choose a representative sample, whose characteristics most closely match the population parameters.**
3) **Collect raw data from the sample.**
4) **Summarize data by calculating averages, making tables, generating graphs.**
5) **Use results to infer population parameters.**
6) **Draw conclusions. Are we satisfied with the results? Are the results accurate? Should we make changes based on what we have found?**

Example: Suppose you want to know study MA-321 classes. Here’s how we can apply the statistical process.

1) Your goal is to determine if MA-321 is a successful course at Queensborough. Your population is all students who have taken MA-321 and the parameter you wish to examine is final grade in the course.

2) a) You have to decide how large of a sample you would like to have. 25 students? 50 students? 100 students? What's large enough? It seems that a larger sample would deliver more accurate results. But the larger the sample, the more work needs to be done to gather it.
b) You need to decide how to obtain a representative sample. Probably one of the best ways would be to have a computer randomly select students from a master list of all MA-321 students. But you may have limited resources. You may have to rely on the grades from the students from specific classes because it may be more convenient to do so.

3) Collect grades as numbers, not letters. *(Numbers can be added up and averaged.)* So let A=4, A- = 3.7, etc.

4) Calculate the average of the final grades. Make a **frequency table** of grades. Create a **bar graph** of final grades. (We will discuss these terms in the future.)

5) Use the sample average as an estimate for the average of the entire population.

6) Draw conclusions from the entire process:
   a) Is the average high enough to call MA-321 a success?
   b) We can compare the sample average to known averages in other courses. Is the sample average higher or lower?
   c) Do we need to make changes in the course to make it easier or more difficult?
   d) Is the research reliable?

For any statistical study, the researcher should be concerned about the potential for **bias**, a situation where a statistical study favors a particular result that is not representative of the population.

For example, a researcher's decision to use only Dr. Wallach's MA-321 classes for this study may very well produce a biased result. Many different professors teach MA-321 at different times during different days. It would probably not be appropriate to represent all MA-321 classes with students from only one professor. (This is particularly true if Dr. Wallach is teaching the only online version of MA-321.)

Let's get to know each other! Here is a simple assignment:

Blackboard Assignment!

I want everyone to participate in a Blackboard Discussion Board. Here's how to do it:

a) Click on the **Discussion Board** text on the left side of the page.

b) Read the instructions for Forum #1. When you know what to write, click on **Introduce Yourself to the Class.**

c) Click on the **Create Thread** button. Type in a **Subject** and type in your **Message** answering the questions given in the instructions. Click on **Submit**.

d) Your message should appear on the forum. You can access it by clicking on the subject.

e) Read someone else's message by clicking on their subject heading. Say hello and respond to their message by clicking on the **Reply** button. (Don't respond to my message unless there are no others posted yet.)

Fundamentals of Statistics (continued)

Now that we know a little about how we may gather a sample, we should consider what kind of statistical study we would like to apply.

Types of Statistical Studies

An **observational study** occurs when researchers observe and measure sample characteristics, but make no attempt to influence or change the sample in any way.

For example, you may select a sample of 100 CUNY students for an observational study. You may measure physical characteristics such as height, weight, eye color, shoe size, etc. You may ask the students who they voted for in the last November election. You may ask them to fill out a survey with 50 questions about their experiences at CUNY. These are all example of possible observational studies, since you as the researcher are merely gathering information from the sample.

Question 4: Give an example of a statistical study that could be conducted as an observational study.

An **experiment** occurs when the researcher is interested in measuring how the sample is altered by the effects of some treatment.

For example, suppose the famous scientist Dr. Memorie has created a Smart Pill® that he believes will increase the thinking skills and memory retention of whoever takes it. He needs to test the pill and comes to QCC to do so. What should he do?

He could visit an MA-010 class and give the Smart Pill® to everyone in the class on the day of an exam and see how everyone does. But is that useful?

It probably will not be, even if everyone gets 100 on the exam. Why not? Because it's hard to know how students would have done without the pill. We need something as a basis of comparison. Perhaps if the class were split in half or we used two classes…

Usually, an experiment follows something like the following procedure:

1) The researcher divides the sample into two equally sized groups.
2) The **treatment group** receives the special treatment that the experiment is trying to examine.
3) The **control group** receives no special treatment.
4) Differences between the groups are measured, usually by some standard measure (such as an exam).

So how does this apply to Dr. Memorie? He could:

1) Divide one class into two groups. Or use two classes taught by the same teacher. (The idea is the two groups should be as alike as possible.)
2) The treatment group or treatment class receives the Smart Pill® one hour before an exam.
3) The control group receives no treatment before the exam.
4) Differences between the groups are measured by exam performance. For example, how does the average of the treatment group compare to the average of the control group? Is there a <u>significant difference</u>?

At the end of the experiment, Dr. Memorie should be very careful about getting overly excited about the results.

a) If the treatment group has an exam average of 85.7 and the control group has an average of 84.8, that alone may not be considered to be a large enough difference. The size of the groups is important here. If both groups contained 1,000 students, the doctor may consider a small difference like 0.9 points as a significant difference. For smaller sample sizes, like 30 or so (15 in the treatment group, 15 in the control group), a larger difference is desirable to recognize it as a significant difference.
b) It may happen that the treatment group, by coincidence, has the smarter students and the result is not really a surprise at all. To counter this affect, the experiment can be repeated several times either by switching the groups or examining completely new samples. Most experiments (particularly for pharmaceuticals) go through repeated trials to determine if the results are measurable and predictable.
c) Of course, there is always a concern for harmful side effects. In this situation, the treatment group should be monitored for any ill effects after the experiment. Unfortunately, some side effects may take a long time to surface. Others may only happen to very specific people (because of age, gender, overall health, medical conditions, etc.). Others occur only by coincidence. That's why there are so many side effect warnings given with most medications (dry mouth, sleepiness, hair loss, and so on and so on).

d) Dr. Memorie should also know that researchers conducting experiments should be aware of the psychological impact of receiving "special" treatment. The control group is given a pill before the exam. Perhaps it is even suggested that they will do better on the exam. More attention is paid to the treatment group than the control group. The power of suggestion may cause the treatment group to feel better, have increased confidence and ultimately do better on the exam. Perhaps the pill isn't as important as the attention…

The belief that some treatment will cause positive results, even when there is no physical or scientific reason for it, is referred to as the **placebo effect**. It has been found that people who believe that something positive is going to happen can make it happen in their minds to such a degree it becomes real.

<u>Question 5:</u> Give another example of an experiment where a placebo effect may take place in the sample being studied.

How do we combat the placebo effect? We don't necessarily prevent it from happening; we just want to be able to account for it in a study. There are two possibilities for an experimenter:

A **single-blind experiment** with a placebo can be used. A **placebo** is a sugar pill with no active ingredients that looks like an ordinary pill.

If Dr. Memorie's experiment is conducted by giving the treatment group the Smart Pill® and giving the control group an identical placebo, the placebo effect can be countered because everyone is being given the same perceived benefit. Any measurable difference should be caused by the effects of the real pill.

But there is the suggestion that the researchers own awareness of the treatment group may cause him or her to treat the treatment group differently (with increased attention, more smiles, etc.) than the control group. Therefore:

A **double-blind experiment** by placebo occurs when even the researcher doesn't know which group is the treatment group and which is the control group. If the researcher's assistant codes the actual pills and the identical placebos, and reveals the code to the researcher only after the experiment is complete, the researcher cannot treat any sample member differently.

<u>Question 6:</u> Create your own experiment, with something other than a pill. Write up the process you would follow.

Case-Control Studies

A **case-control study** is used when the researcher allows the sample participants to form their own specific subgroups to be studied. It often suggests that it would be inappropriate for the researcher to do so.

Suppose a researcher at QCC would like to compare the grades of students who drink regularly (three or more drinks per day) and students who do not. She is faced with a difficult problem—some students at QCC are under the legal drinking age of 21. Even so, selecting students at random may yield a sample of mostly one type of student (which would be biased). Questioning students about their drinking habits while selecting them can be awkward and uncomfortable for all concerned.

So what can done? If messages are posted about a research opportunity, along with the types of students desired, the sample participants can decide which group they belong to. This prevents the awkwardness and inconvenience of having the researcher determining who belongs in which group. Of course, it is hoped that sample participants correctly place themselves in the proper group.

A case-control study is somewhat like an experiment in that there two different (although there may be more) groups being studied to understand how they are different. But the researcher is usually not treating the groups any differently—often the research being conducted is observational in nature. The different groups often have the same measures, take the same test, are asked the same questions, etc.

Homework:

For 1) -3), describe the population and population parameters that are of interest to the researcher. Describe a possible sample and what sample statistics could be used.

1) You own some stock in Verizon, Inc. and would like to know how the stock has performed in the last five years.
2) Dr. Wallach is interested in knowing if the lab component of MA-321 has been successful over the last four years.
3) A meteorologist is interested in how temperature levels in Bayside in the month of January have been for the last 50 years.

For 4)-6), describe which method of sampling may be most appropriate for obtaining a sample.

4) The Democratic Party would like to predict the future outcome of the election for governor of New York.
5) Dr. Wallach would like a sample of Fall 2015 MA-321 students with 3 students from each class.
6) A student researcher has a limited amount of time to find out how students feel about parking around campus.
7) A New York City researcher is trying to predict the results of the upcoming election for President. What kinds of potential bias should she be aware of?

For 8)-11), describe what kind of study would be the most appropriate for the researcher who is trying to:

8) determine the average GPA of Queensborough students.
9) see the effects of drinking Super Dooper Joltz soda in the morning.
10) examine the effects of smoking marijuana upon job retention.
11) create a profile of the "average" twenty year old in New York.

Evaluating a Statistical Study

Very often the results of a statistical study are reduced to a concluding statement. As careful students of statistics, we need to be aware of ways to question the validity of statistical results in an intelligent manner.

Consider the following concluding statements that are results of statistical studies:

A) "Studies show that men drink more soda than women."

Do you believe this statement? Does it make sense?

We shouldn't have to question whether or not a study took place. We have to assume that a study of some kind occurred. A sample of men and women were gathered, and based on a survey of sample participants it was observed that the men (in the sample) drank more soda than women. This is used to make a general statement about men and women. But we can have many questions about the process itself:

1) What was the goal of the study? Was it just to measure the soda consumption of men and women, or was there anything else?
2) What population was being examined? Does men and women mean anyone above the age of 17? Where is the population? New York? The United States? The world?
3) What kind of study was used? We would think this would be an observational study. But how was the information gathered from the sample? By direct questioning? By a survey? By observing behavior over a period of time?
4) Depending on the population, the researcher should have selected a sample that is a good representation of the population. What procedures did the researcher follow?
    a) How was the sample gathered? By random sampling? Convenience sampling? Stratified sampling? Random sampling is generally believed to be more likely to yield a representative sample, but it is often more time consuming and expensive than other methods.
    b) When was the sample gathered? The time of day can affect which members to the population are available for selection, particularly for convenience sampling from available population members.
    c) Where was the sample gathered? The researcher may draw a sample from a limited area to represent a larger population. Often, this is not

appropriate. Should Bayside adults represent all of New York City? Should New York City adults represent all of New York State? Should New York State adults represent all of the United States?

In the end, we should be satisfied that the goal of the study was clear, the population is clearly understood, and the sample was selected in such a way that the population as a whole could be fairly represented.

B) "A recent study by the HRC Tobacco Corporation concluded that smoking cigarettes presents no danger to your overall health."

Do you believe this statement? Does it make sense?

Again, we shouldn't have to question whether or not a study took place. We should be able to believe that this statement is the result of some kind of statistical study. However, we can have many questions about the process itself:

1) We obviously have to be concerned about the research being biased, so that the population is not represented fairly by the population. Clearly, HRC would like to achieve a favorable result from studying the health effects of smoking. What sort of bias is a concern here? There are two major types:
    a. **Selection bias** occurs when the sample is selected in such a way that the population is not fairly represented. It is often intentional, but may sometimes be unintentional. HRC could have carefully selected a sample that would produce favorable results. For example, they could have gathered a sample of 100 smokers between the ages of 20 and 29. By selecting young smokers, they could avoid worrying about the long term effects of smoking and perhaps give the impression that smoking was less harmful.
    Selection bias is always of particular concern in a statistical study, because a biased, knowledgeable researcher is likely to know methods of achieving a specific result.
    b. **Participation bias** occurs when sample participants, who are often voluntary, tend to misrepresent the population. This often means the sample is generated by attracting (intentionally or unintentionally) a certain king of participant.

    Suppose a sign was posted:

Smoking Survey!!!

Test the Health Effects of Smoking

Sponsored by HRC Tobacco

$50 for your participation!

> What kind of sample participants will this sign attract? Participants may tend to believe that healthier people are more desirable (look who's conducting the survey). Participants are paid; so the sign could attract profit seekers looking to make money (who may tend to be younger, or perhaps may even be nonsmokers looking to make some money). It may be easy to gather a sample using volunteers, but volunteers are only useful to the extent that the population can be well represented by them.

Whenever research is conducted by an industry upon its own product, we as students of statistics must be very careful in considering whatever results may be obtained.

The magazine Consumer Reports (check it out sometime) has made a business of conducting unbiased research on almost all products sold in the United States. This seems preferable to the industry testing itself.

Question 7: Give an example of a statistical study where selection bias may be a factor. Give an example of a statistical study where participation bias may be a factor.

C) "Drinking Zappy Cola makes you feel good!"

What do you think about this statement? Does it sound familiar?

Many commercials (for soda, beer, automobiles, detergent, etc.) portray the image of the users of the product being much happier from their consumption of it. But how do we measure "feeling good"? How much better should you expect to feel from drinking a soda?

The **variable(s) of interest** in a statistical study are the value(s) or characteristic(s) that a statistical study attempts to measure. Some values are difficult to measure and at times specifically define (happiness, love, desire, talent, interest, energy, etc.), but many studies attempt to measure increases and decreases of these values in response to common items (like a can of soda or an air freshener).

It is certainly better when statistical results are measurable and objective. If I tell you the average QCC student weighs 147.3 pounds, you don't have to question my calculations. If I tell you the average QCC student scores 6.7 on the Wallach Happiness Scale, you should have many more questions about how I measured happiness.

We should be very careful about statistical results that attempt to measure feelings or emotions.

(The next example was written before the last election in November 2014 election. Now we know what happened!)

D) "In August 2014, a poll of 1000 adults in New York State by AP Inc. indicated that Andrew Cuomo will receive 51% of the vote for Governor of New York State in the November 2014 vote, with a margin of error of 4%. Therefore, he will win the election."

Was it time for Democrats to celebrate back then? Or not?

We saw many polls last year, so we should spend some time thinking about them.

1) We may question whether 1,000 adults is a large enough sample to forecast the fate of the state. Statistical research has shown that large populations (with millions of people) can be relatively well represented by much smaller samples. Of course, public opinion of political candidates, unlike height and weight, are subjective measures which can change continuously throughout the year. Today's response could be very different than next month's response.
2) The **margin of error** describes the level of confidence a statistical researcher has in a particular result and is often seen when percentages are given. To predict Cuomo will receive 51% of the vote with a margin of error or 4% means the actual percentage is probably going to be between 47% (51%-4%) and 55% (51%+4%). Sometimes (as in this case), the variation is too high to be able to reasonably predict an outcome.

<u>Question 8:</u> Find a recent election poll on the internet or in a newspaper. If you can't find one for an upcoming election, use a poll from the last one. Report the results. What percentages were given? How many people were surveyed? What is the margin of error? What do you think of the poll?

E) "After comparing lung cancer rates in New York City and upstate New York, it was determined that auto pollution causes lung cancer."

What do you think? Is it a reasonable conclusion?

Researchers sometimes attempt to analyze differences between different populations (people in New York City and people living upstate) in isolation of other factors. It is certainly true that there is more auto pollution in New York City than there is upstate. There may certainly be higher lung cancer rates in NYC than there is upstate.

But is that the only difference between the two regions? There are many other factors: way of life, percentage of people who smoke, presence of secondhand smoke, other pollution, and so on, that may be ignored by this kind of research.

Confounding or conflicting variables are other values and characteristics of significance that may be ignored in a statistical study. Confounding variables sometimes prevent the actual truth of statistical results from becoming known.

A statistical study that focuses on only one characteristic while ignoring other significant contributing factors is not being conducted responsibly.

F) Consider the wording of the following questions:

> "Do you support the goals of the freedom fighters attempting to bring democracy to Iraq after years of persecution by a tyrant?"
>
> "Do you support the never-ending, senseless conflict in Iraq and our continued efforts to safeguard a country that obviously doesn't want us there?"
>
> "How do you feel about the conflict in Iraq?"

Is each question asking the same thing? Is each question likely to lead to the same result? Which question is most likely to receive the most honest reaction from a person being questioned?

A researcher can elicit unintentional (or maybe intentional) reactions to questions depending on the way she asks those questions. Survey questions should be as objective as possible (as in the last question) so sample participants are not given any suggestion as to how they "ought to feel."

Question 9: A professor tells you that students in online courses are learning the material better than students learning in the classroom. Give five questions that you would ask the professor to test the validity of his claim.

Here is your first assignment in Excel:

Lab Assignment #1—Introduction to Excel
Due ________________

You are teaching an MA-101 class with 10 students. The class has four exams, each with an equal weight. Create a worksheet that will:

a) List each student by name.
b) List the exam scores for each student.
c) Calculate the final average for each student.
d) Calculate the average for each exam.

How to Create This Spreadsheet in Excel:

1) As before, you will notice that a spreadsheet contains a rectangular grid of cells, into which text, numbers or formulas may be entered. Columns are labeled A, B, C, …; rows are labeled 1, 2, 3, …. Each field has a column/row address, such as A1 or B7.
2) Place a heading into cell A1 by clicking on it (it may already be highlighted) and typing the words **Student**

Name and pressing Enter. You will automatically go to cell A2.

3) If the column is too small, you can expand the size of column A by moving the cursor between the top of the A column and B column. Hold the left button of the mouse and move right so the column expands in size. Release the button when you create the column size desired.

4) Start typing in ten student names in column A, from A2 to A11. You may expand the column again if necessary.

5) Repeat steps 2)-4) in columns B, C and D and E using the headings **Exam #1**, **Exam #2**, **Exam #3**, and **Exam #4**. Enter ten exam scores in each column.

6) You are now ready to obtain averages for each student. Type **Final Average** in cell F1. Adjust the column size if necessary.

7) To calculate each student's average, you will use a formula. Go to column F and click on the cell F2, right next to the first row of exam scores. Hit the **AutoSum** button, which looks like this: **Σ** and is located in the **Editing** window. You should get a formula that looks something like: =SUM(A2:E2). This represents the sum of the values in B2,C2,D2 and E2. Press Enter. What appears is not the formula but the numerical sum of the exam scores. But we want an average, not just a sum. Go back to the formula cell and press the key F2 (top of the keyboard). You can now edit the cell. Add /4 so it looks something like this =SUM(A2:E2)/4. Press Enter. You should now have the average of your first student's four test scores.
*(You can also hit the arrow right next to **AutoSum** and select the **Average** option.)*

8) Fortunately, you do not have to repeat the process for the nine other students. Simply go back to the first average. Click on the **Copy** Button (in the **Clipboard**). Using the mouse, sweep over the other nine cells immediately below. Press Enter (or hit the **Paste** Button). You now have ten averages!

9) To calculate exam averages, you will follow a similar process. Click on the cell immediately below Exam #1 scores (this may be field B12 or B13). Hit the **Σ** key. You

should get a formula that looks something like: =SUM(B2:B11). This represents the sum of the values in B2,B3,…B11. Press Enter. What appears is not the formula but the numerical sum of the ten exam scores. Go back to the formula cell, press F2 and add /10 so it looks something like this =SUM(B2:B11)/10. Press Enter. You should now have the average of Exam #1 scores.

10) Repeat the copying process in 8) to calculate averages for Exam #2, Exam #3 and Exam #4. Your worksheet should now look something like this:

Student Name	Exam #1	Exam #2	Exam #3	Exam #4	Final Average
Joe Smith	95	99	75	93	90.5
Susan Curtis	86	75	75	92	82
Lou Hernandez	78	88	78	75	79.75
Mohamed Khan	75	86	99	86	86.5
Jennifer Jones	86	79	75	94	83.5
Luis Rivera	94	84	86	82	86.5
Harry Adams	82	75	75	96	82
Pedro Rivera	73	68	86	97	81
Ingrid Berman	86	88	85	99	89.5
Amy Davis	77	72	86	100	83.75
	83.2	81.4	82	91.4	

11) Personalize your file with headings, fonts and colors. Be sure to place your name somewhere on the worksheet. You can now print the worksheet by clicking **File** tab> **Print** Button).

12) Bring the printed copy to the next class meeting or e-mail it to me at PWallach@qcc.cuny.edu