

Math 111x – Everyday Mathematics

Term Paper

Although papers in mathematics courses are a bit unconventional, the purpose of this course is to teach quantitative reasoning skills useful in everyday life. Your paper will give you a chance to practice that.

You will choose a topic, find some data and quantitative information about it, perhaps form a hypothesis, explore "what-if" questions, make estimates, analyze data, and draw conclusions. In other words, you will use many of the techniques and ideas of this course to make a quantitative analysis of a topic that interests to you.

You may work with a classmate and submit a joint paper.

If there's a topic that would work well in another course you are taking you can consider writing about it if you clear that in advance with me and the other instructor.

What should I write about?

The best way to do well in this assignment is to write about something that really matters to *you*. Here are some ideas to get you started thinking about your topic. (This is not a list for you to choose from, it's a guide as to the kinds of topics that might - or might not - work.)

- Business plans.

What would it take to open a beauty salon? A bike store? A photography business? Can my garage band make enough money to support me? Can my rugby club or softball league break even sponsoring a tournament?

Each of these questions will lead to a good paper. You'll need to collect information (often from personal or job experience or a friend in the business), build a spreadsheet, ask what-if questions and analyze the outcomes. You'll be successful if you have access to data and enough knowledge of the activity to make sense of it.

Your business plan probably has two parts. The first is the estimate for the startup costs. The second is the estimate of the cash flow in and out once the business is up and running. I strongly suggest you focus on the second part. For startup costs, just imagine you will have to borrow the money, and put the monthly loan payment down as an expense in your monthly cash flow

spreadsheet. You can vary that amount to see how much you could afford to borrow.

- Can I afford to buy a house?

This is a common question and a common topic. Sometimes it works, but most of the time it doesn't. Much more than the cost of a mortgage is involved. The best papers start by imagining lifestyles and family structure and trying to quantify those in some sense before plugging in numbers. This New York Times article and calculator will be helpful if you're thinking about this topic. www.nytimes.com/2014/05/22/upshot/five-questions-you-need-to-ask-yourself-before-buying-a-home.html

- Sports.

There are lots of numbers on the sports pages. Some students really care about them. That's a good place to begin. But it's only a beginning. Try to steer clear from topics such as "do the teams with the highest salaries win the most?" or "are superstars worth the big bucks?" Answering these questions actually involve some very sophisticated mathematics (see sports analytics). If you want to try a paper on sports, you should start with smaller questions. And you must be careful to find real data to think about. You can't use the paper just to sound off about your own firm opinions.

- Personal budgets.

This sometimes works and sometimes doesn't. To do it well you have to collect data on your actual income and expenses over a reasonable period of time, estimate things you can't pin down exactly, take into account large expenses that don't happen every week or month, build a spreadsheet and then ask and answer reasonable "what-if" questions. There are many web sites that offer Excel spreadsheets you can personalize and fill in to create your budget. Look at several and find one that matches your needs. Don't try to build your own from scratch. A popular question here is, "Can I afford to move out of my parent's house?"

- Transportation

Can I afford to buy a car? Is it better to drive to school or walk/bike/carpool? I suggest to students tackling these types of questions that they try to quantify the parts of the decision that aren't monetary: time, convenience, etc. You should

also consider several alternatives – ie, uber, etc. - not just a simple comparison of commuting costs.

- Current events topics.

You can do a good paper on a current controversy only if you phrase the questions narrowly enough. One common error is to write a paper that's just a platform for expressing your own opinions, perhaps quoting experts with whom you agree. You can't do justice to global warming in a paper for this course (too broad). You probably can't do justice to energy independence (ask a more directed question). You might be able to manage income inequality (again, which aspect do you want to focus on). On any of these topics you'd do well to argue both sides of an issue, using data to support contradictory opinions before you come to a conclusion.

Two tips

- If you're doing any kind of business plan (dog training, personal fitness, ...) you should be sure to google search for business plans in your kind of business. They will give you some idea of the kinds of things you need to consider. Of course real plans will call for a lot more detail than you can provide in your paper.

In your spreadsheet, you should separate startup costs from ongoing income/outgo. The income/outgo part is more important. Do that first. Assume you will borrow money to get started, and include paying off that loan as outgo from your running business.

- If you are going to use lots of data from the web to do your analyses (sports statistics, poverty rates) you should NOT be typing it into Excel one number at a time. Many websites let you download tables in "csv" format. "csv" stands for "comma separated values" - and Excel can load those files. Even if csv is not available there are tricks that let you cut data and then paste it into Excel. If you show me your data source I can help with that.

Along the way

The paper is due at the last class of the semester. But there are deadlines along the way that you must meet. Watch the homework assignments for due dates.

- Provide a list of three or four possible topics for me to comment on and advise about. If you hope or plan to work with a classmate, make sure you submit a joint list with topics you agree on.
- Turn in a typewritten description of your choice of topic. Explain why you chose the topic. Include preliminary questions you will try to answer and ideas about where you will find the data you need. (The best papers start out with questions that you do not already think you know the answers to.) List at least three different sources; at least one of must be a print source (it may be available on the web, but must also exist in print). Even if your topic is personal (e.g. your budget) you will need independent supporting data.
- Turn in an outline of your paper. That outline should be more than just a list of section headings.
 1. It should start with a good first paragraph spelling out the questions you will try to answer.
 2. That should be followed by some information about where you will be getting your data. Those should be places where you have already looked, so you won't be disappointed when you visit and discover that what you hoped to find isn't there. (If your topic requires more data about your own life than about something reported elsewhere, you should already have it. So include it.)
 3. Then I'd like to see you tell me what you plan to do with the data - that is, what will the rest of the paper look like.
 4. Here's an alternative idea. If you don't like to work from outlines, you can use this opportunity to write a very rough draft of the whole paper - ask the questions, analyze the data, tell me how that data answers them.
 5. If you will be using Excel - and most of you should - describe the form of the spreadsheet in your outline (what data will be entered? What will be computed? What graphs will you have). Start the spreadsheet and populate it with some of the data you have already collected (see item 2 above). Attach the spreadsheet.
- Turn in a rough draft of your paper. This draft should include the analysis of data or information, the answers to your questions, and an overview of your conclusions, supported by all necessary graphs and data. References should be clearly listed.
- Final Submission. Hard copy. E-mail attachments will **not** be accepted. Proofread and spellcheck your paper.

How will I grade your paper?

Here is what I will look for:

- Did you follow the basic instructions and meet the deadlines?
- Does your paper have a solid introduction and does it state your hypothesis or theme? Does it have a good conclusion that summarizes what you did?
- Does your paper include an exploration of the data? Did you look at some "what-if" questions and try to answer them, either using Excel or by looking for other information? Do you describe this carefully and clearly in your paper?
- Do your data and analyses support your conclusions?
- Is the mathematics correct? Did you include units, when necessary, and make correct and complete statements?
- Are the graphics visually appealing, easy to read, and properly labeled?
- Did you interpret the graphics for the reader, and highlight important details from the graphs and charts?
- Did you cite your references using one of the standard styles?
- Is your paper typed, properly formatted, spell-checked?

How long should the paper be?

The correct answer is simply "as long as it needs to be to make your argument, not longer." So the actual length depends on the complexity of the questions you are asking.

I expect about 5 pages, double spaced (but not big type and large margins and almost all graphs). Your paper may include some graphs or tables, but most of it will consist of the words you choose to explain your questions and conclusions.

Here are some suggestions for structure (not topics)

- Did something you discovered surprise you? Did you start out thinking one thing and have to change your mind because the data told you otherwise? If so, that's a story.
- Did you find people arguing from the same (or similar) data to reach opposite (or different) conclusions? Or lying with statistics in ways we've seen? If so, you might speculate on their motives. Remember that noting that two things happened does not necessarily mean that one caused the other.
- Writing in the first person ("I thought", "I discovered") is OK. You don't need the anonymity of "they say" or "it is known that". (Of course just "I think" unsupported by quantitative reasoning isn't OK.)
- If you can frame your paper so that you actually enjoy writing it then it is much more likely to be a good paper.

Don't just go out and grab some numbers from the internet and paste them into a document. Your paper should tell a story - one you care about. It doesn't need to be

long, but it does need to be interesting - I hope compelling. I would like to find out things I didn't know before - things that aren't generally accepted as common knowledge. So if you write a paper that says there are more poor people than rich people or that smoking causes cancer I won't be very impressed.

Be sure to acknowledge your sources. I will **NOT** be happy if pretty much everything comes from wikipedia, or from the first hit in your google search. Data you find on the web that comes from a real publication (rather than existing just on the internet) is generally more reliable. So you should acknowledge your sources' sources too: instead of "I found this at such-and-such-a-website" you should be able to say "The data at such-and-such-a-website comes from such-and-such a government publication(or scholarly study, or industry propaganda organization)" Use a standard style for citing references and see the suggested link in the section about grading for more information.

How can I get help?

- Ask me! I am happy to read drafts, answer questions, guide you in choosing your topic, and help you work through the process of writing this paper.
- Make an appointment with the Writing Center! They'll be able to help with structure and proofreading edits.