

Labib Zakaria

ST 412-01,11 Methods of Data Analysis

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HW0

Some stuff to keep in mind for the first question are that people may not have a major (they may be a non-degree/credential seeking student or be in an exploratory studies program where they have not yet declared a major or be doing a post bacc that involves coursework).

However, I am currently in a BS Math major program (hence undergrad) with an option in probability & statistics, specifically in my third year (I will be done with the requirements for my probability & statistics option after this quarter assuming I pass this statistics class & probability III, but I am certainly considering taking more probability & statistic coursework after I finish those requirements & I will also be done with my major specific requirements when I take one of the WICs, which I am planning on doing on the fall with MTH 323 math modelling (it will be interesting doing the paper & presentation in this class & I have a fair bit of math coursework I have taken, so hopefully I have a solid foundation for these) & after that I just need to finish bacc core & obtain extra credits which I am planning to do from math/stats coursework to some extent as well as perhaps a few other types of coursework).

I am not committed to pursuing a masters or PhD when I graduate from my undergraduate program (assuming I graduate, which has progressively been seeming a closer prospect & now seems quite feasible), though I am open to doing so (perhaps at a time when I feel more financially secure & otherwise feel secure in life & I would be secure some time into the future).

My statistics & quantitative background is fairly solid, though certainly not at the level of a researcher in math/stats (or other fields that involve a fairly solid level of statistics/math). I took basic calculus (the MTH 251-6 sequence; I am also LAing for MTH 228 calculus & probability for life sciences II & of course I learned elementary/high school/college algebra having taken

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calculus coursework & LA'd for MTH 111-2), as well as some advanced calculus/analysis & complex analysis (MTH 311-2, 483 [this involved a very slight bit of Mathematica] & am planning to take MTH 411 in the fall; I need to review & strengthen my analysis skills...) (well I do not know if that counts as statistics/quantitative background necessarily in others' eyes, but I would assume so, at least in terms of a theoretical/logical sense).

I also took some applied math classes (MTH 420,427-8, models & methods of applied math & deterministic & stochastic models in math bio i.e. all the MTH 42x classes & may consider taking MTH 524/5 & MTH 420 involved some Python coding & Github) & I took some numerical analysis (MTH 451-2, numerical linear algebra & solutions of ODEs currently taking MTH 453 numerical solutions of PDEs & these involved some MATLAB programming). I also took some discrete math & abstract (& linear algebra) (MTH 341-3 linear algebra I-II & abstract algebra, MTH 355 discrete math & am planning to take MTH 443 abstract linear algebra in the fall; I really need to review & strengthen my linear algebra... also I was thinking it would be cool to learn some differential geometry & having a strong linear algebra background will definitely help) (also not sure if the abstract non-(linear algebra) counts as statistics/quantitative background, probably the most controversial one, but I still assume so).

As one might assume, I also took/learned some probability (otherwise I would not currently be taking probability III, MTH 463-4 & taking MTH 465 & specifically I was also thinking I might take MTH 467 actuarial math too). I have honestly taken a fairly notable proportion of the 4/500 level math classes, but I also have not worked on statistically/mathematically intensive projects yet either, so I guess I should say I am at a beginner/intermediate level in terms of statistical/quantitative background, depending on how you weigh certain factors (background/actual project experience) at least for someone who is trying to do fairly

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statistically/quantitatively involved things (but perhaps in the general population, I would look much more like an expert). Also, I am not sure if LaTeX counts as software, but I have used that a fair bit in typing up my homework & other stuff since 12th grade (I started going to college immediately after high school, also it is probably apparent, I am not using LaTeX currently, but when I am typing up stuff that involves more mathematical notation or I would like to create documents with a bit more flexibility I end up naturally using LaTeX). Overall, I am actively aiming to develop both programming experience & knowledge as well as mathematical/statistical experience & knowledge (particularly to apply towards problems in various fields).

As for why statistics is important for my field, as someone who is directly studying analysis/applied math/probability/statistics, I probably would fairly directly end up being out of significant career opportunities if statistics vanished. I suppose that might be dodging the question at the expense of a quip because that still leaves the question of why statistics is valuable outside of my personal career situation & at the broader scale of my & others' fields & how it is useful in research. There is an intimate connection between probability & statistics (& probability & statistics themselves are to a fair extent applied measure theory & analysis).

Probability theory provides a theoretical language & logical framework to reason about non-deterministic/random phenomena on the rigorous basis of measure theory & other tools of analysis & other mathematical fields (well honestly the actual historical development is largely backwards though I tried to respect this by first mentioning probability theory). Then, when it comes to statistics, we can try to take some (numerical) data about a population in the form of random samples & try to determine possible probabilistic models to describe how some

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numerical measure could vary among the population & doing so can greatly aid in making judgments in various circumstances.

Ultimately, I feel that statistics is at the top of this hierarchy of analysis/probability/statistics in terms of going from theory to application to data & testing hypotheses of relationships in the world & moving away from the rigorous theory of analysis/probability, we allow ourselves more room/distance from rigorous logic & move closer towards the power of making subjective judgments (the subjectivity arises in various different aspects such as the initial choice of research question, experimental design & well the data collection is one as well but I feel like that is least interesting & well as the analysis to answer the research question) aided by this rigorous logic in a nicely balanced fashion. It is in this sense that I feel that statistics is valuable both in terms of my personal career situation & at the broader scale of my & others' fields & how it is useful in research & ultimately in helping to acutely observe & shape the world that we live in. I feel that many others would provide answers of the same sort of nature (though perhaps being more or less sophisticated in terms of their description), though perhaps my background biases my perception & answers & this is not actually as much the case as I would assume (I also feel this has a decent chance of being the case as well as I have been exposed to other people with my background who provide similar sorts of descriptions of applied math/statistics).

As I at least implied before, I don't have research experience nor do I really have quantitative/statistical experience outside of coursework yet (though it is probably a solid time to start building that up; hence many of my statements may seem naive). But, I have faith in statistics to be a great aid in terms of research prospects as I have described & will reference again.

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Again, I will quip & say that I am taking this class because it is required for my probability & statistics option for my degree & also provides credits towards the degree, as it is important to highlight different aspects of a situation. But, more intrinsically (actually we discussed intrinsic & extrinsic motivation & a survey about these ideas at the beginning of ST 411 two quarters ago with Lisa Madsen & I also made references to that concepts during that class), I am taking this class because I appreciate the role of statistics in the sense I mentioned above & also I want to develop programming experience as I believe computers can be useful in efficiently tackling various problems (& yes, I know this is not a programming class, but still we use a bit of coding in this class; also there is definitely a bit of that lucrative career extrinsic motivation I discussed earlier with developing programming experience).

As a math major studying analysis/applied math/probability/statistics, I definitely would be excited by discussion of PCA (I mean principal component analysis as I assume you also meant when you mentioned this acronym in class, but if you meant something else I likely have no clue what you meant). It is a great application of SVD (singular value decomposition) that highlights why it is such a strong foundational technique in applied mathematics/statistics (I do not necessarily expect us to go much into linear algebra). I also probably need to review PCA & get some reminders about SVD (I also need to look back to KL expansions as well). At this point, I have seen how logical advances in foundational mathematical theory have relevance to approaching various problems in the real world & ultimately by considering these two aspects of mathematical theory, one maximizes their mathematical understanding & ability. I have to be honest & say I do not know much about statistics, so I do not think I have much of a clue about what I would like to see covered (after all, why am I taking this class?). No, I do not currently have anything else I would like to share or questions I would like to ask.