Thoughts on the process of applying for Ph.D.-level jobs in mathematics

April 10, 2015

Applying for jobs in mathematics

- Obtaining academic/industry jobs in mathematics is difficult, and becomes more difficult each year
- There are 1,000 new math PhDs each year, but only 100 new tenure track openings
- Tenure track jobs at research universities generally require a postdoc, unless you are a super-genius who solved some famous open problem
  - Not always the case in 1990's, and certainly not before that
- Even non-research universities are now hiring people with postdoctoral experience
  - 9 of 10 phone interviewees for last year's College of Charleston position had some sort of postdoctoral experience
  - The 10th person was my student, and they interviewed her as a personal favor to me.

Applying for jobs in mathematics

- Labs and industry often only want math Ph.D.'s with computing skills
  - Outside of math, 'Applied' usually means there is some sort of computer program developed as the project goal
    - They expect you to be a competent programmer
    - Industry absolutely does not care if you can prove theorems
    - Some labs may care, but your job is (often) more of a service role to engineers
  - The "purer" you are, the harder it is to get these kinds of jobs
    - You can do algebra and still be 'applied' if there is a realistic serious application and you are doing a significant amount of programming
  - The days of places hiring mathematicians just because they are "smart" and then training them to do other jobs are dwindling
  - Big market in industry now is in predictive analytics/big data, so plan accordingly

Applying for jobs in mathematics

- There are different kinds of jobs, and each requires a different approach
  - Tenure track at research university
    - Places with Ph.D. degree, 2-2 or 2-1 teaching, expectation of 2 papers/year, grants, advising phd students, etc.
    - 3 levels I (MIT), II (Pitt) and III (UNLV)
    - Widely varying starting salaries (70K - 85K, full profs make 125K or so, famous people make up to 300K)
  - Tenure track at research/teaching university
    - Places with M.S. degree, 3-3 teaching load and expectation of 1 paper/year
    - Starting salary 60K, full profs make 90K or so
  - Tenure track at teaching university
    - Places with B.S. degree, liberal arts schools
    - 3-3 or 4-4 teaching load (summers off!)
    - Starting salary 50K - 60K, full profs make 80K or so
  - Industry / labs
    - 80K - 120K starting, more in financial industry
    - 2 weeks vacation / year, 50/60 hour weeks...

Tenure-track research university jobs

- This is the hardest type of job to obtain
  - Usually requires postdoc - they want to be 'sure' about you, and it is always better to have rec letters from different places/people saying that you are good.
    - School name matters, as does advisor reputation
    - Usually, the postdoc school is higher ranked than the school where you get job
    - if you do postdoc at NYU or Berkeley, many places will be interested in you (even if you are not any good)
  - Occasionally, level III research universities may hire people without a postdoc
    - These are usually unattractive places to live (in general, but not always), so they will take risks to get good people early, before they are "established"
- If you want to do this, the most important thing for a PhD student is to get a good postdoc at a big name place with a big name advisor.

Tenure-track research/teaching or teaching university jobs

- These jobs are possible without a postdoc, but it is becoming common that new hires do have some postdoctoral experience
- Much bigger focus on teaching
  - You will need to convince them that your research is amenable to MS/BS students, and that you look forward to working with these students
  - You will have to show them that you like teaching, and that you are good at it (send copies of good teaching evaluations)
    - Getting involved with graduate student organizations and tutoring, etc., can help here
    - Rec letters from students you have taught/tutored can be helpful - but there must be substantial interaction
- Research expectation is 1 paper/year, sometimes less
  - Do your homework to see what is expected
    - Look at the chair's and new people's website to get idea
- Getting job often comes down more to 'how well you fit'
- They want to know if you will be a good colleague to be on committees with (interviews are more personal)

Jobs at Labs/industry

- People who do not like teaching often go this route
  - Just because you hate teaching math101 does not mean you would hate teaching higher level things
  - Faculty at research universities rarely teach below the junior-level
- If you are social and like people around, go to industry instead of a lab
- They generally do not care about your specific research
- They do care about general research area and skill set
  - They want people to help solve their problem
  - They generally do not care about you extending your thesis results
  - SIG gave me linear algebra exam and probability exam over the phone

Step 1: Picking a research area

- My recent observation is that there about an equal number of pure and applied academic jobs each year
- Recent trends are math bio and uncertainty quantification
  - UQ is the math end of big data / predictive analytics
    - Can study UQ in probability, analysis, PDEs, numerical analysis, etc.
  - math bio is becoming saturated
    - Find an area that NIH is funding such as math neuroscience, drug design, biomedical applications
    - Beware of 'biomath' that is not application-oriented

Step 1: Picking a research area

- You still have to pick a subject you like, but keep the end goal in mind!
- If you are at at tier I school (MIT, Berkeley, Harvard, U. Chicago etc.), you can study whatever you want, and probably you will do fine
- If you are at a tier II school, you are often better off picking an area in applied math
  - The reason for this is the amount of competition
  - Many of the Tier I schools are 'pure-math' snobs
  - They have very few, if any, people doing applied math (and what they call 'applied' is not really applied, e.g. analysis of PDE or mathematical physics)
  - Thus, almost all of their graduates (your competition) are pure math people
  - Also, applied math makes you more attractive to (most) labs - labs are more interested in the skill set you bring to the table, and not necessarily your thesis research

Step 2: Picking an advisor

- Step 2 in the process of obtaining a job begins with picking the right advisor
- The best way to pick an advisor is to decide what kind of job you want, and pick an advisor whose former students are doing those jobs
  - In general, bad students of good advisors get better jobs than good students of bad advisors
  - Also look for grants (NSF and NIH in particular), papers/year in top journals
  - Picking an advisor based in 'they inspire you when they teach' is a bad strategy
  - Also, how long do their students take to graduate? 5 years or 10 years?
  - Are their students still doing research?
    - If 0/5 of their students are still doing research, ask yourself why you are going to spend the next 3 years spending day/night learning about that research field.
  - If your goal is 4-4 teaching school, pick the advisor that can get you finished fastest

Step 2: Picking an advisor

- Who is in your advisor's network?
  - Postdocs often come from personal connections with your advisor
  - Does your advisor have a large network, or at least do a lot of people know who they are?
  - Do they write papers with lots of different people, or just by themselves?
  - Does anyone care about their results? You can check citation counts. Again, do they have grants?
- Picking more junior faculty as advisors is ok, but you have to be careful
  - The advantage is they will have more time for you, and care more that you succeed
  - The disadvantage is that they know less people (important for postdoc jobs), and it is not always clear how good they are (they have not had time to amass big research records yet)
  - They better be cranking out research at a good pace
- A good strategy can be to be co-advised by a junior and senior faculty member (not always possible)

Step 3: Picking the right type of position for you

- You want to pick a job you will be successful at!
- You want a job you can enjoy!
- With more money comes more work and more stress
- ...sometimes, we do not get a choice
  - Your first job need not be your forever job
- Many PhD's are not cut out to be academic researchers at PhD level schools
  - It is good to be ambitious, but also be realistic
  - Lots of stress, must get major grants and discover major results, very high tenure standards
  - You typically don't know if you can handle this until almost done with graduate school, maybe not even then
  - An honest advisor usually knows, and will tell you
  - Creativity and independent thought are critical
  - Somewhat independent of grades/coursework
  - You really need to love doing research

Step 3: Picking the right type of position for you

- It is often better to be one of the top people at a lesser school, rather than an average person at a great place
  - You will make more money
  - You will get more resources
  - You will have less stress

Step 4: Applying for jobs in mathematics

- One common theme for all jobs is that applications need to be personalized - 'open area' positions can have hundreds of applicants, all of which have Ph.D.'s in math, most of whose CV's look just as good as yours on paper
  - Cover letters must be specific to each place
  - You need to make them think their institution is a good fit for you, and you are a good fit for them
  - What do you bring to the table that they can use?
  - Why do you want to work there?
  - What specifically do you like about that place? Make it sound like they have something great there, and you want to be a part of it.
  - If it is in a strange place that most people don't want to go (South Dakota, Erie, Cleveland, North Dakota, Idaho, etc.) and there is some specific reason why you want to go there, tell them! e.g. my sister lives there

Step 5: Interviewing

- Interviewing for tenure track jobs
  - You are NOT interviewing to be someone's postdoc
    - Have a good answer to 'what are you going to work on in the next few years?'
    - You are mainly going to do YOUR research, not help someone else (don't seem too eager to help someone else - unless you are interviewing for a postdoc)
    - You want to be friendly and at least seem like you want to collaborate with others in similar fields
  - If you think the school is "below you"
    - You are arrogant for even thinking that, and remove that thought from your head
    - It shows, and you will not get hired
  - Every person you talk to should be taken seriously, as they all have the power to kill your application
    - Even the graduate students
    - Usually, you get a schedule of people to talk to (30 or 60 minute meetings each) - look up each one's webpage and get some conversation points
    - You should at least look everyone up online anyways

Step 5: Interviewing

- Do not discuss anything controversial
  - Politics, religion, race or gender issues, pure vs. applied math
  - Listen, but do not comment unless necessary
  - If you must comment, be vague and avoid taking a side "yeah, that is a tough issue..."
  - Change the subject! There will be a time for you to give your opinions (after tenure)
- Your talk is critical
  - Rehearse!
  - Dress appropriately
  - Avoid writing on board if possible
  - Many in room do not know your field
  - They evaluate you as a teacher based on your talk
  - Do not lose them on slide 2!
  - Prepare to finish in 45 minutes, no longer (people will ask questions) - going over 60 minutes for a 4pm talk will kill your application
  - Teaching schools (also) want a lecture for an undergraduate class - start preparing that early

Step 5: Interviewing

- Very helpful to go to EVERY talk of EVERY job candidate at your school
  - Look at their CV
  - Do not be satisfied that you are the best in your class in grad school
  - You have to be better than the people being hired there

Step 5: Interviewing

- Do not discuss money unless they bring it up first
  - You can usually find things out online beforehand
  - The time to discuss is if you get an offer
- Negotiating salary
  - If you have multiple offers, then absolutely you should do this
  - Can often squeeze out 2K - 5K
  - Tough to do if you only have 1 offer, unless first offer is very unfair
    - If this happens, approach gently: 'I don't understand this salary figure. It is very low compared to what similar institutions are paying, for example the two 2013 new hires at your institution in computational math are making 76K and 78K, and you are offering me 50K.'
    - Don't put yourself in a position that you will have to turn down the job if they don't give you an extra 5K
  - Salary figures for many public schools are available online

Step 5: Interviewing

- Interviewing at Lab is similar to interviewing at research university
  - Often, you have to give a talk
  - Meet with several people for 30-60 minutes
  - They will try to get a feel for your strengths/skills, and see where you might fit best
- Industry interview is similar, but without the talk
- Often, 50-80% of the people you meet with will not understand your research to know what 'caliber' it is
  - They will be evaluating you based on whether they think you will be a good colleague
  - Be friendly and polite

Step 5: Interviewing

- Stupid things I have seen by job candidates that killed their chances
  - Ordering fish at lunch, then getting it boxed up and carrying it around all afternoon, stinking...
  - Saying to graduate students at a lower tier-II school, from a guy with PhD and postdoc at tier 1 places, 'Unless you come from a big name school with a big name advisor, you're screwed in the job market'
  - Acting smug and 'above' the people at that institution
  - Acting like they want to be my postdoc
  - Dressing bad - jeans, suits that clearly do not fit
  - Smoking
  - Ordering alcohol at dinner, unless everyone else does and then they tell you it is ok for you to do
  - Talk taking 70 minutes
  - They stunk (body odor or too strong perfume/cologne)
  - Sitting inappropriately - leaned back on chair with feet up, revealing crotch
  - Being gross - sweaty armpits and raising arms above head, etc.