Re: Career advice needed.

Source: http://sci.tech−archive.net/Archive/sci.physics.research/2004−07/0205.html

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tessel_at_tum.bot
Date: 07/09/04

Date: 9 Jul 2004 04:49:07 −0400

On Tue, 6 Jul 2004, WishfulThinker wrote:

> I obtained a BS in History four years ago and have been working as a
> software developer.

That is indeed an unusual background, but you can probably make it work in your favor.

> I have always felt under−challenged by my current work, however, and for
> a long time have been feeling the urge to do something more important
> for humanity. Recently I have been contemplating the possibility of
> getting back to school as a Physics undergrad, with the goal of
> eventually engaging in nuclear energy research. I just turned 27.

What city do you live in? LA? There are a fair number of large public unis in California; a talented and determined student can acquire a superb education in physics/math at any of these, including UCLA. Several people who post here semiregularly are full professors at math or physics departments in CA, or elsewhere on the west coast, and can no doubt provide help to a deserving aspiring student.

Here is a widely accepted fact (?) which might help put your "wishful thinking" in perspective: pursuing a career (or even an advanced degree) in math/physics is inherently risky and there are no guarantees of success, −no matter how good your UG background−. The good news is that everyone who sits on an Admissions Committee will know very well that determination and talent are much more important than preparation in terms of eventual success, as defined by earning an advanced degree.

Of course, many (most?) math/physics Ph.D.s wind up working as programmers or sysadmins or in the financial/insurance industries, so you might find yourself programming again one day, but if so, probably you would be doing something more interesting (and better paid)!

And if you are a really superb programmer, this is likely evidence of genuine talents (e.g. patience, ability to focus and to think abstractly) which will probably also serve you well in a math/physics related career.

> 1. Am I nuts?

Heck, no matter what your background, you −need− to be nuts to attempt math/sci graduate school! :−/

> Have you ever heard of such a thing?

I do know of several cases of a Math graduate program accepting extraordinary students (including overaged returning students) who did not have an UG degree of any kind. The talent of these students came to light in various ways, but all, AFAIK, were enrolled in an undergraduate degree program, were spotted by an alert professor, and were promoted forthwith to graduate school.

Unless you have many tens of thousands of dollars in your savings account, or know something I don't, I am not sure that obtaining a second B.A. is financially feasible. But one great thing about −grad school− in the U.S. is that American citizens who qualify to enter a Ph.D. program in math, applied math, or physics, can often have their tuition waived and may even receive a generous living stipend (perhaps in return for some TAing).

I am not sure about physics, but you might be surprised how slight the entry requirements can be for −graduate− applied math programs and even for most "pure math" programs, in terms of level of preparation. Admissions Committees are probably far more impressed by hard evidence of extraordinary talent and determination.

Be aware that a lot of applied math could equally well be called "applied physics" or even just plain "physics".

At least if you are willing to try applied math, I can think of departments where the real entry requirements are probably limited to a solid background in two years of undergraduate math (maybe eight courses).

In your case, on the theory that "the best evidence of success is success", you could proceed as follows:

1. identify a uni with a suitable grad program and advanced undergrad courses (applied math/physics faculty will probably have home pages describing their research, so you can surf the web looking for topics you find exciting),

2. choose an upper level course like UG real analysis or complex analysis or both, in which you would compete against the best UGs at your large public uni, and find out the prerequisites for this course,

3. study these prereqs on your own from books (by paying a yearly fee you can probably arrange to use your local college library; if not, you can buy suitable textbooks via Amazon or whatever),

4. next time the course is offered, move to the uni town, sign up for the course as an extramural student (this means that you pay your own tuition but don't enroll as an undergraduate degree student), and earn an A+ in first quarter/semester,

5. even better, see if you can sign up to take the Putnam exam (a national talent−search exam in math),

6. apply to enter the graduate program at your uni the next Fall, paying particular attention to your application essay (explain clearly why you believe you can make your background work to your advantage in their program); be sure ask your prof. in the course to write a −blind− letter of recommendation for your application (the department will probably want numerous letters and such like, but most of these requirements can be waived, especially if you have a faculty member backing your application),

7. if successful, you would probably receive a tuition waiver, a generous stipend for first year, and you would be allowed (even required) to spend your first year acing the UG courses which will prepare you for first year graduate school; if not, repeat steps 4−−6 as often as neccessary,

8. do well in the first year, do well in the second year (taking the standard first year graduate courses), pass the first hurdles (written exams, language exam), and you are on your way!

The point is, this route would enable you to entirely −skip over− the time and expense of a second UG education. Most faculty will immediately appreciate that this is superfluous in a case like yours (life experience and all that). Even if it didn't work out, you would have not suffered a huge financial hit as a penalty for even making the attempt.

If this plan seems discouraging, complicated and circuitous, well, I would respond that −research− is discouraging, complicated and circuitous! In fact, if you are rebuffed the first time around you apply to a graduate program, if I were you I'd make precisely this point in your application essay the second time around: "I have taken an inventive approach, I've modified my approach in reaction to an initial setback, and as you can see I'm not giving up". I have no doubt they will take the point: initiative, adapatibility, and sheer stubbornness are all essential character virtues in this game.

I don't know if you could try something analogous with physics substituted for applied math above, but I suspect you that could. If not, if you are dead set upon physics at all costs, if you got into a math program and had a good first year, you could very likely transfer to the physics program of UCLA or whatever after a year of math, as long as you can somehow demonstrate a mastery of enough UG level physics. And a year of math certainly never hurt any physics student!

A third option: have you thought about pursuing a career as a historian of physics? You already have the historical background; the math/physics

background is IMO far more important (and far harder to acquire, to judge from the work of most practitioners in this field). Are you are good at documenting your programs? A clear and fluent writer in natural language? If so, if you got into a degree program in The History of Science (they are not easy to find, but they do exist), you might well find you have a −better− background (programming) than your peers. If this sounds intriguing, do some web surfing, and read some books by west coast practitioners.

Hmm... I've been awaiting the opportunity to go off on another rampage with the theme "all history is a lie", but I see that this is not the moment to do this :−/

> 3. How hard would it be for me to re−enter

[snip]

> compared to someone fresh from highschool?

I can think of "reentering students" who initially expressed a similar fear. One of them was clearly excelling after only a few weeks.

I doubt that your chances of success at jumping into a graduate program (after taking and excelling in a few courses in the department of interest as an extramural student, doing very well on a talent search exam, or some other way to make your mark) are affected by your level of preparation as much as by your determination and talent. Irrespective of preparation, I think character virtues plus talent are invaluable.

> 2. I need to brush up on my rust−encrusted math skills. What areas of
> math should I work on BEFORE re−entering university, and up to what
> level? What other academic areas should I prepare myself on?

Well, for either applied math or physics you will certainly need a strong background in differential equations and real and complex analysis. For this you need a strong background in "abstract linear algebra" (vector spaces and linear operators, not just matrices) and "advanced calculus".

To get some idea, and also for (3) above), I'd recommend you look at standard advanced UG textbooks such as

author = {Mary L. Boas},
title = {Mathematical Methods in the Physical Sciences},
publisher = {Wiley},
year = 1982}

This is very clear, with good problems and solutions, so very well suited for self−study. Mastering the subject matter in this one book would probably take you a long way! If this seems too hard at first glance, the Schaum Outline series has some excellent problem books on differential equations and linear algebra which are old but (usually) not so old that

they use hopelessly outdated terminology.

OTH, IMO Dover books are generally to be avoided, with a handful of exceptions, since these are often so old (typically, reprints of books first published around 1930−1950) that their terminology/focus will only mislead you about what you'll encounter in a contemporary classroom. To forestall people who complain whenever I say this, it is true that one of the very best Dover books in the area of PDEs was first published in the 19th century, and is still one of the best introductions to the material it covers, and there are other counterexamples to my claim that most Dover books are not good first books for a contemporary student. But as I see it, right now you want books which will quickly prepare you to fit right into an early 21st century classroom.

Good luck!

"T. Essel" (hiding somewhere in cyberspace)