

“If I were starting over...”

Advice for EE Graduate Students

Department of Electrical Engineering

Stanford University



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Preface

Inspired by the “If I were starting over...” guide published¹ by graduate students in the Department of Physics, we have produced this hopefully useful equivalent for EE students. This guide contains the advice of 35 Electrical Engineering Ph.D. students who kindly took the time to respond to a survey form that solicited contributions in Autumn 2009. We have advice from students in every area of EE, and from students in every year of study from second to seventh, including some graduated students.

This guide also contains some solicited advice from professors, and a set of links to other useful resources.

I would like to thank Debby Bryan and Samar Fahmy for their support of this project and for their help in editing. I would also like to thank all the contributors, named and anonymous.

If you have any comments or suggestions, please feel free to e-mail me at pmcmahon@stanford.edu.

Peter McMahon

Stanford, CA
16 September 2011

¹<http://www.stanford.edu/dept/physics/publications/StartingOverBooklet.pdf>

Letter from the Chair

Future colleagues,

I think you all are very lucky that one of your colleagues has spent a lot of time surveying other students to provide you with this booklet of advice for your graduate student career at Stanford. There is a lot of good advice in it. Like the rest of life, not all of the advice is consistent, so in some places you will need to form your own course. Let me also add some of my own advice:

Startups: Now is a good time to join a startup, but it will also be a good time to join a startup whenever you are ready. When I was a graduate student at Stanford back in the 80's there were many workstation companies that were formed (Sun, SGI, etc.). I thought that I was going to miss my chance, since I was not ready to join a company at that time. But it turns out I was wrong. I did join a startup a decade later, in 1990 (Rambus), and there continue to be opportunities. So do it when you are ready, whether that is after you graduate and work for a company for a while, or during your Ph.D. program.

Advisers: You should always listen to your adviser; but then you should make up your own mind about what to do. If you don't have an adviser, you should get one ASAP. In fact I would advocate getting two (especially if you are doing interdisciplinary research). Remember they are interesting people to talk with, and you don't need to do exactly what they say. I do think you should carefully listen to all the advice that is given to you. You don't need to follow the advice, but don't just ignore it either. Rarely is an adviser or reviewer stupid. If they misunderstood what you were trying to say, then you need to tighten up your arguments – your thinking/paper was not clear enough. You don't need to make the changes that they suggest, but you generally do need to make some changes. Think of it as part of your learning to manage up.

Research: Your research is critical, but there is more to education than your lab, computer and office. Think about it: in graduate school you are being paid and you get to work on stuff you know very little about. When else is this going to happen in your life? You will feel foolish if you don't take advantage of it. Take classes in areas that tickle you fancy, whether they be bio, law, business, music, language, dance/scuba/golf... Listen to Steve Jobs's graduation speech at Stanford². Life has a funny way of leveraging what you know.

Education: You are at Stanford to further your education. But there is more to life than just classes and research. Stanford is in an amazing region and it would be a shame if you did not take the time to notice it. A quick test: if you don't notice how wonderful the weather is around here, you are spending too much time working. Take a hike, go to the beach, mountains.

Believe in yourself: The Stanford faculty are an amazing bunch of people. But honestly you are even more impressive. Many of us joke that we would never be able to make it into Stanford these days. Get to know your fellow students. They are an impressive group now, and will be even more impressive in ten years. You are truly exceptional people. Please take advantage of all Stanford has to offer. Be bold. As Helen Keller said, "The fearful are caught as often as the bold." But please don't be arrogant. Do listen to what others say and consider their opinions.

And of course be nice to the EE office staff. They are the people trying to take care of you.

Prof. Mark Horowitz
Chair
Department of Electrical Engineering

²Transcript (Stanford Commencement, 2005): <http://news.stanford.edu/news/2005/june15/jobs-061505.html>

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1 Graduate Student Responses (by Question)

1.1 If you were to start over, what would you do differently?

- Get involved in a startup: don't worry about making it big, just be involved in the process. There are classes you can take (MSE 273, for example) if you don't find a company on your own. This is one of the few places in the world with this level of exposure to startups. That is what is truly unique about Stanford. Even if you have no desire to start a company, you will gain a huge amount of experience in technology, business, and life. I focused a little too much on academics/research at the beginning, but I came around eventually.
- Since I came to Stanford with a SGF, I should've started looking for an adviser immediately instead of getting engrossed in coursework. After passing the quals, I had only one year to look for an adviser.
- I would try to plan better for my career after Stanford. It's easy to get absorbed in the bubble of graduate school and lose sight of the fact that you won't be here forever. It will make the transition to real life that much easier if you spend some time planning how your goals in research relate to your career goals after graduation (be they in industry or academia).
- I would do as many internships as possible (I recommend three for international students). Internships give a perspective on many different fields. The field you think you like may not be as fun when you see it up close. And a different field you didn't think about before may open new possibilities. Always do internships!
- Look around different labs more aggressively and try to see what projects they have.
- I think things actually worked out pretty well – the key is to start talking to professors before you even come to Stanford. It shows initiative and interest in the group more so than when you show up on campus. I also didn't know about group meetings – most research groups meet once per week to discuss the current research in the group. It is good to ask a professor if you can sit in on the discussion and becomes a way for you to find out more about the group before committing to it.
- I would have started doing research from my first quarter.
- Talk to everyone you see; shake hands with anyone. There are so many interesting people walking around campus. Take lab classes to meet as many professors as possible at the start of your graduate school career.
- I would approach more professors earlier rather than working with one at a time. If you do that and realize that they're not a very good match, then you just wasted a lot of time and there might be no space in the research group you're interested in. Also, you might miss out on an adviser who would be a good match just because they aren't one of the first people you thought of.
- I may have tried rotating in other labs before trying the one I was most interested in at first. Because I rotated in the lab that I was most interested in at first, I ended up sticking with it instead of trying other labs. This requires time and somewhat conflicts with the quals schedule. You will need about a quarter's time in order to figure out if a group/adviser is right for you... yet, trying more than one lab will require more than one quarter's time. It is difficult to secure an adviser before taking quals (in your first year) and to try out different labs at the same time.
- I would probably take more initiative in pursuing research directions, instead of asking professors for projects. I would also keep in mind that working on a Ph.D. is actually a series of small steps and a cumulation of ideas, rather than being composed of one big idea – even if the thesis ends up looking like a single unified result.
- I would try to do independent study as early as possible. I would definitely not take so many introductory classes, as they are dry, and it is difficult to meet the professors. I would knock on more doors, and if a professor is unwilling to chat, I wouldn't take it personally.

- I'm pretty happy with the way things have gone. Perhaps I would have taken more CS classes, since knowing more about programming and algorithms is always an asset to a scientist/engineer.
- I think one major thing I would change is to not worry too much about publications in the first year. It is unlikely (not impossible) to have good publications when you have barely begun. So worrying about them is a waste of time. Instead that time is better spent building upon the ideas you already have.
- Take more math-related courses. They will help build strong foundations for whatever you do in ISL.
- During my M.S., I would have focused on what it is that I really want to do (not quals, and not even on research until I was sure I knew what I like). Then, I would seriously think about whether I want to get a Ph.D. right away or after a few years of work experience.
- I would try to pursue a joint degree program right from the onset (M.S./Ph.D. with an M.B.A. or M.D. or J.D.). I believe Stanford is one of the best places for interdisciplinary education and a lot of schools and departments here seem to support cross-disciplinary course enrollment.
- Be more involved with graduate bodies and clubs like the GSC, Sierra Club, etc. Also, would take a lot more fun classes like languages, archery, etc.
- Finish classes earlier, rather than take it slow the first couple years.
- 1. Take athletics classes to help you relax through any busy quarter.
 2. Interact extensively with international students and learn about their habits and work ethics. I believe there's a lot to learn from other students as well.
 3. Put in 40 hrs a week on school. You don't need to kill yourself. You will still do fine.
 4. Spend summers doing internships.
 5. Take part in club sports and other activities on campus. I have thoroughly enjoyed my experience with them.
- I would have started doing more of my work on Stanford's clusters earlier on. They aren't publicized too well, so lots of people don't even know how to connect to them, but the latest cluster (corn.stanford.edu) consists of 30 Sun Blade X6240 machines. Each machine has two quad-core processors and 32 GB of RAM. Yeah, what does your PC have? Maybe a dual core and 2GB of RAM? It makes a difference.
- I wanted to keep my GPA high, so that I didn't take classes aggressively, meaning that I took classes that I felt comfortable taking. However, in the end, GPA does not matter (*Ed.*: so long as you meet the departmental GPA requirements!) and classes with big challenges would give you skills that you don't have.
- Single out the possible research areas and summarize them at the end of class from each class I took. It gets a bit too much to explore papers when you start on Ph.D and the classes you took would have given a good direction if you have done this activity earlier.
- Spend more time doing background/lit searches early in the research. Even before selecting a project.
- I would not take 3 EE courses plus TA during my first quarter. I would try harder to find friends to work on problem sets with during my first quarter. I would have gone home during at least part of the Christmas break of my first year instead of holding myself captive here.
- Be very persistent with the professors. Don't be intimidated by them.

1.2 On choosing a research adviser

- Advisers can differ greatly in style. Some are very attentive and really care about their students. Others are away from campus most of the time, and rarely speak to their students. Some people like being micro-managed, and some students like being given a big idea and sent off to work without any further guidance for the next year. Figure out which advising style you prefer, and take it into consideration when you pick an adviser. You have to work with your adviser for many years, so it's critical to ensure that you're at least somewhat personally compatible – having compatible research interests alone is not enough.
- Work with a professor before joining their group and make sure you like their working style. Things to remember:
 1. Do you need funding? Do they have funding?
 2. How often do you want to meet with him/her? How often does s/he want to meet with you?
 3. Do you prefer to be micro-managed? (Some people do!) Does s/he want to micro-manage?
 4. Do you like working alone or in a group? Do they have projects which involve a group of people or does everyone in their group work on a separate project?
 5. Check out the group dynamics. Do grad students help each other or are they too competitive?
- It's hard figuring out what you like (in fact, that's the hardest part). Don't be afraid to tell your adviser that you want to work on something. If you don't like it, don't be afraid to tell them that as well.
- Make sure that it's someone who you can converse with well, even if your research interests don't coincide 100%. A friendly adviser will help you find a different adviser if it doesn't pan out.
- When choosing an adviser pay attention to the following qualities:
 1. Works in an area you like (duh!)
 2. Nice
 3. Gives time to students
 4. Smartin that order.
- Sometimes, the adviser can be more important than your initial project. I've had advice from a professor at another university that the adviser is the most important part of a student's graduate school experience. The adviser is the one who will guide you through research, prepare you and help you during exit procedures, and build your network after you graduate. Make sure you mesh well with your adviser. You don't need to rely on courses to find an adviser; most will meet with you just to talk about the group/research.
- Don't think all advisers are alike and that it won't influence your work; it will! Choose someone you trust, you like personally, and you can take as role model. Choose someone who gets you excited about research!
- Talk to people in the adviser's lab to get an idea of what he / she is like. Discuss the project in detail to understand expectations. Do some homework to check for feasibility of the project before engaging in it. Many ideas seem good in PowerPoint, but can be quickly proven infeasible with some back-of-the-envelope calculations or some careful thought about long-term applications. Young advisers are generally very proactive in supporting their students, while older advisers are hands-off. Factor that in when you choose someone to work for.
- Choose one in part based on your future career intentions. Are you interested in academia or industry?
- Pick your path, and pick it early. Evaluate your interests and what's important to you. Pick your area of research, evaluate the professors in that area of research, and then get yourself into that professor's research group. Research isn't something you can try out half-heartedly and expect it to feel right – you need to dedicate yourself to it fully. Pick your research, pick your adviser, and throw yourself into the research. After some time has passed, reevaluate whether or not it's the right path for you.

- Don't listen solely to people's "advice" or hearsay about any professor. Meet the person and work with them yourself before making judgements.
- Perseverance is the key. If you don't have luck finding a research adviser in the EE department (especially if you need funding), look in other departments.

1.3 On choosing a thesis topic

- It's not as hard as you think. Don't freak out, you'll think of something.
- It is better to choose a topic where things are well defined, otherwise you can end up spending a large amount of time just finding a problem to work on.
- In reality, you don't explicitly choose a thesis topic – you do research and in the end you make a cohesive story. You will migrate to things you are more interested in within your research group (which of course limits the topics you choose) naturally, so don't stress about it.
- Some topics are more likely to lead to high impact papers than others. If you want to stay in academia, you should care about publishing papers. If you plan to go to industry, you can get away with working on a project that is less likely to yield a string of important papers, but that does let you learn and exercise many skills that people in industry care about. Choose your topic (and research group) accordingly.
- If you don't have an interest from previous encounters, then the best way to find an interesting and current topic is to talk with a professor in your area. They have the most knowledge about the general field and specific interesting topics. Also, Stanford sometimes holds conferences and often has seminars that can help stimulate ideas.
- Make sure you're really interested in what you're working on; you need to be excited about at least some aspect of your research area. Try to find out quickly if something is uninteresting, so that you can switch topics. I've found that it was very hard to work day in and day out on something I didn't really care about – and that is definitely not sustainable through the many years it takes to finish a Ph.D.
- Spend a year or so poking around, and try to publish a paper before you settle on a topic. Tailor your thesis to the work you have done, rather than the other way around.
- Find a topic you are very passionate about. If you think it is important, you will be able to convince others that it is. Don't pick something simply because it is "hot" right now. Which areas are hot are constantly changing; building tools to work on a variety of problems is more important.
- I would not obsess too much over how grand the topic sounds. I would focus more on the skills one uses and sharpens on a daily basis, the opportunity to contribute/publish in the space or the extent of prior work done in the field and job opportunities after graduation.
- Pick one based on your long term goals. If you want to go to industry, pick one that has a shot at being applied to a product within the 5 – 8 years you spend on your Ph.D. If you want to go to academia, pick one that has long term scope so you can continue working on it as a professor. Make sure you pick a project you enjoy as your life will center around that project for at least 3 – 5 years. If you don't like it, you probably won't make much progress on it.
- This entirely depends on the field and the funding sources for your adviser. Very often the topic is decided by the projects that get funded for the group. This can be tricky. All I have to say is be flexible and approach any problem with an open mind. Things that you will learn in solving any problem could be a wonderful experience.

- Take advice from your adviser and senior group members. Your adviser will likely tell you at some point “This topic here is your thesis topic”. Balance this advice with your own interests and perception of your abilities. Formulate your own perception of your thesis topic and bring this back to your adviser to flesh out the details and make sure you’re on the same page. Nothing too surprising here, just the standard back and forth of getting advice on any important matter.

If you make it a few years in and have no idea what your thesis topic is, then ask your adviser about it. Or formulate an idea for one and bring it up. It’s fine to work on multiple side projects related to your thesis topic. Publish papers on them if you can.

1.4 Other general academic advice

- Quit school. Get out now. There are so many great high paying jobs out there. Don’t stick around unless your heart is in it. Getting your Ph.D. will be extremely rewarding. However, it’s the process that is rewarding, not the piece of paper and the title. So, if you’re not enjoying yourself here, don’t waste your time.
- A lot of interesting work happens outside the United States. Try to read conference proceedings and a few of the top journals every month to keep up with what is happening. If you just rely on seminar talks on campus and U.S.-based conferences to learn about new work, you’ll miss out on a lot of the good stuff happening in faraway lands.
- Many of you will come in from undergrad with 3.8+ GPAs and other stellar academic merits. Remember that if you are a Ph.D.-track student, very few people care about your GPA after you graduate. Priorities will change in graduate school, and if you are like me, you will rather work on research or maintain your social life much more than work on problem sets. The only people who care about your GPA/transcript are Stanford (which requires easy-to-achieve grades for graduation and to take quals the second year you are here) and your mother. Personally, I’m more afraid of the latter, but she is fairly easy to please and will forget about all of it when I get her flowers on Mother’s Day.
- Don’t be afraid to approach professors just to chat about random ideas. There are many who are approachable and love to talk to students, and it also gives them the opportunity to hear something fresh. Even seemingly small ideas can turn into major results.
- Stanford has plenty of resources (CTL for oral presentation; public speaking classes; CDC to review your CV; Hume Center to proofread what you write); use them! It’s tough to do classes *and* research. Focus on classes the first two years, and set yourself limited goals for research (readings, projects with well-defined scope and short-term goals). Go full speed on research once you’re done with heavy classes!
- If you are writing papers, make sure you get feedback from anybody willing to review the paper. Apply for funds, write the proposal yourself if you have to, talk to your adviser so you can both apply for funds.
- Make friends with your peers, because they are going to be really important and useful later in your life.
- Take classes in other departments too. Grades aren’t everything. Stanford has diverse and extremely capable faculty in various schools and departments. Learn as much as you can.
- The truth is grades can still make a difference, but the influence is indirect. Learning new material and making progress on your research are the most important things, no doubt, but you’re fooling yourself if you think a mix of C’s, B’s and A’s is as good as a string of A’s. Your adviser knows your grades, and, consciously or not, that knowledge will influence his perception of your focus and abilities.

1.5 Qualls advice

- Practice with your study group members and friends. That helps a lot managing time and organizing thoughts in the real exam. Don't be intimidated by the indifferent or scary looks of the examiners. They just want to be fair to everybody. Forget about the previous exams and focus on the ones that are coming.
- It's not the end of the world. Go home for Christmas. Don't stay here to study; your mom misses you. Study the professors as much as you study the material – it's all about who you get.
- Make sure to get the basics for your field down solid. It's unlikely that you would be able to “study” for anything beyond the basics, so spend your time on the basics and practice talking. Qual givers often look for whether students are reasoning efficiently, so make sure you get plenty of practice saying your thoughts aloud. The worst thing you can do is to get nervous at a challenging question and clam up.
- I think the best preparation is to simulate 10 minute interviews during your study group meetings. Every student should try to come with their own questions (not from the quals booklet) and ask each other these questions under time pressure. The sooner you start doing it, the better it is. Make sure you don't convert your quals study sessions into quals moaning sessions. Everyone knows that it sucks; rather moan about it when you are done with it!
- Unless language or other circumstances are a problem, I would recommend taking quals in your first year. Generally you don't have to worry about research, so it is easier to focus on studying for quals. Some professors won't even talk to you if you have not passed while others don't care – so giving it a shot right away gives you a better chance of talking with a larger pool of professors. Also, in the devices area, make sure you really understand the fundamental physical processes behind everything – it will help you answer a lot of questions.
- If you know your stuff and are prepared, the quals are really random. If you're not prepared, they're not as random, and you will do poorly. (i.e. There are a lot of false negatives, but not a huge number of false positives.) Unfortunately for most students that means giving up the winter break. After you pass, though, the effort is worth it. Another thing to keep in mind is that while the data says that you have a better chance of passing the second time, that includes people who appealed a second failure with their research adviser. In many previous years, your odds were worse. So try to do research before taking the quals a second time so you at least have the option of appealing.
- When studying, be sure to learn your fundamentals. When I took it the first time, I spent too much time trying to game the questions and didn't do very well. For my second attempt, I made sure I understood how things were derived and the basics of why things were true. This made it easier to handle tricky questions, so that during the exam, I was able to clearly elaborate what I knew and then map out what I needed to figure out.
- If you have already been admitted to a research group, then forget about the quals (of course, you should also listen to what your professor says). If you have not, then focus completely on studying for quals, and make sure you pass as soon as possible.
- The students who do best are invariably the ones who literally have fun with the test. And the test should be fun. You're probably a nerd to some extent, and you like intellectual technical challenges. This is a chance to relax, have fun, and do some one-on-one chats with professors.
- 1. Please do not panic. It's like any other competitive exam you have faced.
 2. Think out loud.
 3. Choose faculty on your preference list wisely. Friendly faculty members are good for your confidence. Passing the quals with friendly professors is the same as passing them with hard professors. You ultimately pass.

4. Pick your quals group carefully. Like minded people preferably.

- The advice given to me by my adviser, paraphrased: Just think of the quals as an opportunity to have a conversation with ten Stanford professors. That's how a question should feel to you: a conversation between you and the questioner. And when else will you have the opportunity to have sit-down one-on-one conversations with ten different Stanford professors in one day?
- Be sincere and work hard on the first two areas. You should aim for high scores on these areas if you want to clear the cutoff. Get first-hand rapport with some professors so that you are not nervous in meeting them on the day of the exam.
- Study hard. Be confident. Don't be afraid to say, "I don't know." And be strategic in selecting subjects as well as professors – easy doesn't mean that a subject/prof is a good choice!
- The Qualls are mainly a test of determination. It will test if you really want the Ph.D. badly enough, and make you question why you want the Ph.D., which is not necessarily a bad thing. In addition to learning about EE, you will learn a lot about yourself through the process.

1.6 Grad student life advice

- Live in Rains. Eat on Castro street. Party in the City (that's San Francisco). Summer in Yosemite, winter in Tahoe.
- If you ever want to eat off-campus and don't know where to go, Castro Street in Mountain View is a great place. It's right next to the Caltrain station, so you could even ride your bike to the Palo Alto station, hop on with your bike and get off at Mountain View.
- You can light an open bonfire between 10th and 13th Street on the beach in Carmel-by-the-Sea. This is the only place around here that I know of where you can do that. It's the perfect way to finish a nice hike at Point Lobos, or after kayaking in Monterey!
- For guys: we all know that meeting girls in EE is difficult, but you don't have to go all the way over to the other side of campus to find nice ladies: 38% of Civil and Environmental Engineering graduate students are female, as are 40% of Bioengineering grad students. Only 13% of Computer Science graduate students are women, so stay away from Gates unless you like a challenge. Electrical Engineering is 21% female, so you're better off prowling any other Engineering department, besides CS and Aero Astro (17%). For girls: to find socially awkward men, hang out in Gates and Durand.
- Learn to cook. You'll save a lot of money over eating out and develop a valuable skill. Better yet, cook with roommates or friends. If you don't have a car, during the school year there's the Shopping Express bus, and Safeway also delivers.
- Life? What life? Remember there are lots of people around here who are just like you. US students will find plenty of people with similar interests (e.g. college football, outdoors, sports, drinking). International students will also typically find plenty of people who share their interests. There are also plenty of groups and organizations. Remember to meet people quickly in the beginning of the year before everyone starts forming their cliques and stops showing up to large social events. Balance things as best as possible... life, research, schoolwork, and sleep. Also, never ask another Ph.D. student when they think they are going to graduate.
- Make sure to walk around and enjoy the pretty campus. Stanford spends a lot of money on the landscaping and upkeep (using your tuition dollars!), so you might as well take advantage of that. One of the many great places for a walk or run is The Dish. But also spend some time outside the Stanford bubble and get to know people off campus. It is very easy to lose perspective on why you're here and how you're doing when all you see are other Stanford people all the time.

- Get a car right away. Participate in GSPB events, or even organize some yourself. GSPB will give you up to \$20 per person to take a small group out to whatever you feel like. *cf.* <http://gspb.stanford.edu>
- Being a student gives you a lot of flexibility with your schedule, so take advantage of that! (You're being badly paid, you work a lot, you deserve it!). It doesn't mean you'll work less. It just means that you won't be productive at all if you don't take time off regularly.
- Spend time outside, lots of time outside.
- Enjoy your time at Stanford. Can you imagine any other place on earth that has excellent weather, smart people, budding entrepreneurs, and multi-millionaires all at a same place? (Berkeley? – *Ed.*) Often when you are sitting in a cafe you might not even realize that you are sitting in the company of Nobel Laureates. So make the most of your time. This means not just academically but beyond academics. Learn a new language, develop a new hobby, or work on old ones; watch some great movies (see the collection at the Green Library), listen to a nice symphony, watch a Shakespeare play, or listen to heads of state give talks on campus.
- There is lots of free food on campus – take advantage of it! :-)
- Participate in Intramural sports, and take PE courses.
- 1. Get yourself out of your own comfort zone and try new things: random classes, sports, dance
2. Have dinner at the *University Cafe* on University Ave :-)
- Go out. There are a lot of activities going on at Stanford. A good place to start is the Grad Events mailing list and the GSC website.
- Go to football games and lots of sporting events. Especially if your undergrad institution was not a big sports school. Even if you're not a huge sports fan, the environment at games is a lot of fun.
- Best restaurants: 1. Evvia 2. Tamarine 3. Flea St. Cafe.
Best coffee: 1. Cafe Del Doge 2. Philz Coffee 3. Coupa 4. Borrone's.
There's not much else to know!
- During job hunting season you can easily get 5 – 10 free meals a week.
If you don't have a car, Zipcars are not a bad deal because for \$8/hour you get the car, gas, and insurance. However, before signing up find someone else who already has a membership because if you use a referral the two of you can split \$50 driving credit.

2 Advice for M.S.-only Students

- You're not going to be here very long so make sure you take time to enjoy the other things that Stanford has to offer beyond your immediate department.
- If you really want to continue as a Ph.D. student, it is possible but you'll need to dedicate yourself to it, and get involved in research as soon as possible. Go for it with no regrets!
- Think about whether or not you want to get a Ph.D. Do not do it to prove yourself. If you really want to get a Ph.D., then find an adviser, and do not worry about the quals yet.
- Take classes you think will be useful for you. Don't feel hindered by the course requirements, you can get around them. (*Ed.:* Make sure you check with your academic adviser and/or the departmental programs administrator to make sure that your plans can be accommodated.)
- Take classes that give you math and coding skills. Those are big currency in the job market.

- If you have funding, don't rush it – Stanford has so many interesting courses that you might as well try to see if you can take more courses (and even get a second M.S. degree in a different department such as MS&E). If you don't have funding, try to TA to give yourself more time and options.
- Find funding; don't pay for your M.S. There are lots of groups that have ready made slots for M.S.-only students to come in as an RA for 1-2 years and then go. Talk to your friends and find out where they are.
- Try to do internships as much as possible – industry experience is your best friend if you are doing an M.S. and then going directly to industry.
- Try to take advantage of all Stanford has to offer and don't try to get out too fast.
- There is no point looking for RAs in EE. Students who are willing to commit to a Ph.D. clearly have an advantage and a more genuine need for financial support (unless you plan to (re)apply to the Ph.D. program). Definitely intern over the summer. One-and-a-half to two years is hardly any time to get anything serious done in research. Be more pragmatic and gain work experience.
- Since you don't have to worry about quals, make sure the classes you're taking are interesting to you. It's not necessarily the best idea to take the large quals-prep classes if they're not on topics you're interested in. Also, remember that this might be your last chance to take classes full-time or for a significant amount of time before you embark on your professional quest to make millions – try to take at least one fun or interesting class that you'll never take otherwise.
- If you want to get into the Ph.D. program, take small classes in your first year. If you only care for the M.S., try to do at least some research.

3 Survey Summary

3.1 Estimated Time to Graduation

Survey respondents were asked to estimate how long it takes for a student in their group to complete the M.S. and Ph.D. at Stanford. The average estimate was 6.04 ± 0.54 years (one s.d.). The median estimate was 6 years. Figure 1 shows a histogram of the data collected.

3.2 Estimated Time to Graduation by Area

Due to the small number of respondents in many areas (in addition to sample bias), this data may not be particularly useful, but we've included it in case you're curious. Times are given in years.

Area:	Number of Respondents:	Average (one s.d.):	Median:
Devices	9	6.11 ± 0.70	6.5
Information Systems	8	6.00 ± 0.71	6
Integrated Circuits	6	6.00 ± 0.00	6
Radio Science	3	6.00 ± 0.00	6
Telecommunications	2	5.50 ± 0.71	5.5
Computer Hardware	2	6.25 ± 0.35	6.25
Computer Software	1	6.5	6.5

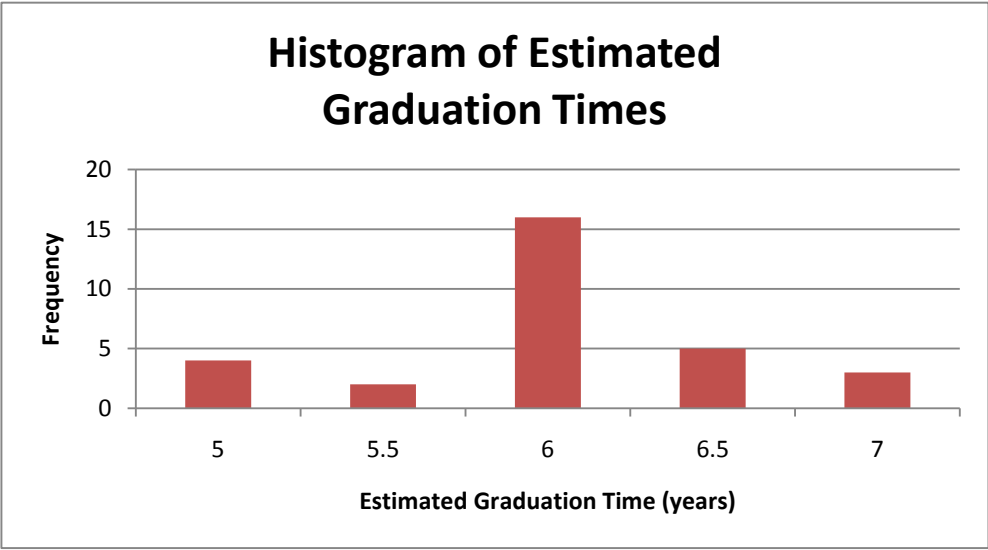


Figure 1: Histogram of survey respondents' estimates of graduation times in their groups.

4 Faculty Advice

4.1 Full Responses

<i>Name:</i>	Prof. Christos Kozyrakis
<i>Research Area:</i>	Computer Hardware
<i>Number of Ph.D. Students Graduated:</i>	10
What is the biggest mistake that you commonly see graduate students make?	
Not taking initiative in their research. Worrying about taking quals. Not starting research immediately upon arrival.	
On choosing a research adviser:	
Talk to several advisers and find some way to know them first hand (class project, independent study, work for them for a quarter).	
On choosing a thesis topic:	
Choosing the question is actually more interesting than coming up with the answer. Don't worry about defining a thesis topic on your first day on campus.	
Advice specifically for students in this research area:	
Start research immediately. Don't be afraid to tackle big HW or SW systems that you don't have experience with already.	
Advice on thesis writing:	
Writing a thesis takes time. Plan for it.	
What is the most exciting development in your research area that students outside your area generally don't know about?	
Interdisciplinary work (hw+sw, systems+optimizations, systems+ML).	

<i>Name:</i>	Prof. Shan Wang
<i>Research Area:</i>	Devices and Photonics
<i>Number of Ph.D. Students Graduated:</i>	18
What is the biggest mistake that you commonly see graduate students make?	
At one extreme a student may be too slow to adjust their experimental designs to navigate unexpected difficulties in research and do creative work; at the other extreme, a student may be too quick to give up when facing even small challenges.	
On choosing a research adviser:	
You must love the dissertation topic and the adviser's style and drive. This choice is probably the most important decision in graduate school.	
On choosing a thesis topic:	
Have an open mind, and be willing to get out of your comfort zone.	
Advice specifically for students in this research area:	
My research area is interdisciplinary, so to be successful one has to be willing to learn (and also hopefully create) new knowledge in EE, Materials Science, Physics, Chemistry, and Biomedicine.	
Advice on thesis writing:	
Publish papers as early as possible, but do save great ideas/data for top journals before publishing prematurely. Organize and back up your data! Get the bulk of your dissertation done before looking for a job.	
What is the most exciting development in your research area that students outside your area generally don't know about?	
Nanotechnology-based biochips, cancer diagnostics, spin electronics, and efficient energy conversion.	

4.2 Faculty and Staff Advice Snippets

- Always feel free to change research groups - be part of the group you feel most passionate about. Your adviser will understand. If you switch groups, your adviser will be upset for 24 hours. If you don't, you will regret it for the rest of your career.
- Take 1 – 2 classes on technical writing; even if you are good at it; even if English is your first language. We can all improve our writing, always.

– *Prof. Nick McKeown*

- Treat your graduate experience like a job – that is, to the extent possible, keep regular hours and stay focused while there. Learning good time management skills in graduate school will help you throughout life.

– *Prof. Audrey Ellerbee*

- Be proactive about seeking advice on course selection and on interesting avenues of research from your assigned adviser. Too often a student will settle for just a signature from their adviser on their forms. Advice at this stage of your life is very important. Be persistent about setting up a meeting with your adviser several times a year. If you are unsuccessful, move on to another adviser.

– *Denise Murphy*

5 Other Resources

5.1 Quals

- William Wu's Quals Guide. <http://www.ocf.berkeley.edu/~wwu/quals/advice.shtml>
- Robert Chen's Quals Guide. <http://www.stanford.edu/~rc3534/quals.html>

5.2 General

- EE Graduate Handbook (recommended by former Vice Chair, Prof. Robert Gray): http://ee.stanford.edu/gradhandbook/Main_Page
- Principles of Effective Research: <http://www.qinfo.org/people/nielsen/blog/archive/000120.html>
- Prof. Christos Kozyrakis: How to Have a Bad Career as a Graduate Student. <http://csl.stanford.edu/~christos/publications/BadCareer.pdf>
- Cosmic Variance: Unsolicited Advice on How to be a Good Graduate Student. <http://blogs.discovermagazine.com/cosmicvariance/2007/09/26/unsolicited-advice-iv-how-to-be-a-good-graduate-student/>
- Prof. Terry Tao: Career Advice. <http://terrytao.wordpress.com/career-advice/>
- Dr Richard Hamming: You and Your Research. <http://magic.aladdin.cs.cmu.edu/2005/07/26/you-and-your-research/>
- UCSD VLSI Collection of Advice: <http://vlsicad.ucsd.edu/Research/Advice/>
- Prof. Stephen Stearns: Some Modest Advice for Graduate Students. <http://www.eeb.yale.edu/stearns/advice.htm>