I consider myself fortunate to have graduated with a less-painful PhD (2014) from the prestigious Computer Science department at the University of Southern California (USC), specially when I was not even interested in getting a PhD till about three and half years after receiving my bachelor degree. After spending a good long five and half years on my PhD, I decided to publicly share my thoughts/colorful experiences/realizations on various important aspects of ‘getting the PhD’ process. These thoughts are completely my personal viewpoints, although I should mention that most research friends of mine at USC and other universities worldwide, for whom I have high regards and respect, share similar opinions. I also in a sense apologize in advance to all who might feel that some of my comments do not make sense to them or hurts their sentiments.

A WORD OF THANKS

Before sharing my views, I would want to thank Professors Leana Golubchik and Konstantinos Psounis for being excellent advisors over the years and teaching me subtle but important research values. I would also like to thank Professors Stuart Madnick (MIT), Charles Leiserson (MIT), Tomas-Lozano Perez (MIT), David Hsu (NUS), Bernard Levy (UC Davis), Chen-Nee Chuah (UC Davis), Mung Chiang (Princeton), Robert Gallager (MIT), Leonard Adleman (USC), Robert Calderbank (Princeton), late John Nash (Princeton), Pan Hui (HKUST), and Viktor Prasanna (USC), from whom I picked up some invaluable research wisdom from time to time, over my short meets with them - in the case of some of these researchers, I just met them only a few times. Finally I would like to thank my late father (former professor at Indian Institute of Management, Calcutta), who was THE mentor in a set of quite a few, without whose influence and hand-holding guidance I would just be an ordinary undergraduate with no mission in life. It is with the blessings of both God and some of these people, that I embark upon the task of writing this article.

WHY THIS ARTICLE?

Some PhD students might have come across the article, ‘The PhD Grind’, by Philip Guo (currently an assistant professor at U. Rochester), who was a PhD student in the computer science department at Stanford. I really liked Philip’s article and the way he opened up in explaining the tough time he had at Stanford, the reasons behind his struggle, and the lessons a PhD can take out of it. I had already started to think of my article when I first saw Philip’s, around three and a half years ago, but I must admit that his efforts was a good bed-time read, and gave me that added motivation to write mine.

However, my article is different in two ways: ‘The PhD Grind’ is mainly a CS student’s personal account of his PhD journey. Here in this article, I do not intend to be that personal. Added to this is the fact that Philip’s article has a sympathetic tone towards struggling PhD students, and has a negative tone towards PhD beginners and the weak-hearted, whereas my effort here has a non-sympathetic and non-negative tone. Before writing my article, I sampled opinions from multiple PhD students about the ‘The PhD Grind’, and most said that the impression they got was ‘do not do a PhD’. I guess the impression was created due to the illustrious pre-PhD qualifications of Philip (B.S., and M. Eng., both from MIT), and if such a guy goes and has a tough time in the PhD, then students are really going to think that getting a PhD is hard. Giving due credit to Philip, reading his article, I think he acted more like a PhD student rather than a budding motivated researcher, and being the latter is a necessary condition to enjoy your PhD. Well, getting a PhD is not easy, but it is not hard either, even if you do it from the best schools in the world in your research area. After all it is just a PhD - the basic qualification needed to have a research career.

My goal in this article is to precisely touch upon the various important factors that contribute to getting a PhD (in most disciplines), my own experiences and realizations related to them, and more importantly, sharing with readers the inherent logic or philosophy behind the right things to do.

WHAT THIS ARTICLE DOES NOT CONTAIN

First, this article does not talk about the politics, mind-games, and strategy aspects of channeling one’s outcome of his PhD. I sincerely believe they are very important, just that the basic ground work needs to be done very well, and only then (barring exceptions) the above-mentioned non-technical aspects matter. This article is all about doing the ground work right. How a PhD student can become an ‘academic politician’ is generally never disclosed by any student (sometimes not even from faculty to his student) and is considered strictly private information and treated like one’s intellectual property. The politicians (of varying degrees) are either naturally gifted or they learn it through experience. All I can say here is politicians judge/manipulate other politicians just by the words spoken
between them, the eye contacts, and intuitions :), and that is
the same across disciplines. Basically, the right way to play
politics in CS is the same as the right way in Biology. Second,
this article does not talk about how to better one’s technical
abilities that is a pre-requisite to entering a PhD program, i.e.,
good problem solving skills. Third, this article does not talk
about how to prepare for PhD screening and qualifying exams
within a PhD program. The main reason behind this is that
these exam types differ from school to school, and primarily
based on problem solving skills and/or the ground work for
research - as mentioned above, I would not discuss the former,
and the stuff to follow is all about the latter. Finally, and not
the least, even though this article grammar refers only to the
masculine gender, the reader is always welcome to replace the
gents with the fairer sex when applicable :)
potential wise, not in terms of getting marks) tend to select brilliant research advisors - the mental mapping just occurs naturally here.

It is sometimes easy to criticize your advisor for various reasons (and we all do at times, including me), but in the end the student should know that there is something special in his advisor, else the latter could not become a faculty at a top school. Personally, I have always take my advisors’ comments (positive/negative) regarding research very seriously. I do not agree to them at times, but I always try to find a logic in their words, and there always is. It is very easy to get emotional on advisor negative comments but one should remember that he will be the happiest when you are successful so one should take one’s advisor’s comments with respect and submission. Remember, you chose your advisor after good thought seeing your research vision and philosophy, he did not come and ask you to be his student. So do not consider your right to bitch about your advisor, nor did you do him a favor being his student. If you could not match with your advisor, it is in most cases your fault, or lack of academic maturity. Look inside yourself 50 times before pointing fingers at him. One of the qualities of a great student is to understand why an advisor is telling him something (both good and not so good) - it takes a lot of IQ and emotional quotient (EQ) to analyze these non black-white things. I did not have this ‘understanding’ quality on a high scale before I joined USC. I am fortunate that I now do (does not logically imply though that I was a great PhD student :)). On the other hand, one should not also be open about how good/great/mature/popular one’s own advisor is and find fault with other professors. Unfortunately, me and some of my friends have done this time and again and still do. Finally, one should remember that, to the external world (be it in academics or industry) you are the face of your advisor at least for the time you do your PhD and a few years hence as well. So conduct yourself in public accordingly while at the same time maintaining your original personality.

II. Masters Degree Before a PhD

My experience in EE and CS related fields suggest that unless you are an exception, and conditioned on the fact that you want to have a research career after your PhD, a Masters degree is usually a necessity nowadays to enter a top PhD program. The reasoning is pretty simple - most research areas are saturated enough to be able to apply knowledge of traditional text book stuff learned in those areas during undergraduate (UG) studies, to churn novel research output. For the new upcoming areas (many times a spin-off of traditional areas), the solution space is primarily interdisciplinary. In this regard, a student needs time to pick up new courses, assimilate them in his ‘blood stream’ through thorough problem solving, and finally try his luck at producing a novel research output. One could argue here and say that a student fresh from UG could get admission to a PhD program directly, take time to learn new courses, and finally produce research output. However, this is hard to achieve in practice because of the following reasons: (i) in top schools the admission system is very competitive and most competitors have at least one good publication in the modern day when they apply for a PhD - most likely this publication comes during a student’s MS study, (ii) faculty find it much easier to directly initiate a student already having an MS degree into his group’s research and therefore more inclined to accept mature students with an MS degree, and (iii) most students who get accepted fresh after UG take a long time to catch up with the students who already have an MS degree with respect to contributing to novel research output, and finally when they do they usually find a motivated student of the latter type way ahead in the number of publications, which in turn demotivates (a factor in losing the mental game) them to compete with their mature and experience-wise senior peers for an academic job. In my experience there have been many cases of such fresh admits (sometimes very good UG students from top schools), and in my personal view, they are wrong admits. I must say here that with respect to (i), many students in different countries of the world now (in the last four to five years) politically churn papers in not a very legal way (I do not want to go into details of what is legal) during UG studies to make their CV look attractive for a direct PhD entry after UG studies. This becomes a screening challenge for schools in the US or anywhere to admit talented students. However, I must say that there are some great fresh UG talents who can jump directly into any top PhD program anywhere in the world and be more productive in terms of both quality and quantity than their peers already having MS degrees.

III. On Choosing an Advisor

It is a very difficult problem indeed to select a PhD advisor. In the worst case, if the only way of support you get during PhD is via research assistantships, and your goal is just to get a PhD, then it is logical to go for an advisor who has funding for you to work on his projects. It may not be the best match (in some cases it really can be), but no doubt a reasonably win-win one. Generally, top schools have fellowships for many PhD students, and it gives them an opportunity to explore research in different groups before finalizing on an advisor. I have a simple rule for doing this: you know yourself (how good/mature you are and what you are interested in). Read recent papers by the faculty you are interested in and approach them. AVOID going to a paper machine (exceptions are discussed later in the article), or student graduating machine, even if you know that the professor’s research matches your research interests. The good thing about such professors is that they are generally blessed with lot of funding, and might in the end help you land up a job. The not so good thing is that you will spend five valuable years but not develop or have knowledge about research acumen/aesthetics to conduct good research in future. Having said that I want to emphasize that such professors are also bound to show results because of the funding they have from different sources, so it is rational of them to “softly exploit” students (e.g., not allowing them to go for external research in summer, not allowing them to work on independent projects, etc.) for their own objective accomplishment. However, not all advisors who have lot of funding will prevent their students from interning, and also interning is not a necessity in many disciplines, e.g., the sciences.

Personally, I would suggest looking for adaptable advisors, who are smart enough to adapt to new topics (sometimes potentially unknown to their research) and can give valuable insights on whatever problem you bring to the table. They should also have a humane side to understand your concerns/problems/constraints not related to academics, and those...
that could play a role in the way you shape your PhD career. Coming across such faculty sometimes require knowing them either through friend recommendations, or through directly taking courses taught by them. If you are thinking of choosing an advisor in view to getting a good industry job in future, believe me, in a top school, each faculty has most likely some contact somewhere in the industry, so you should potentially be safe to end up a good job after PhD. Thus, your main concern should be not to think of getting a job but to learn as much as possible (like an apprentice) from your advisor in the years you spend in your PhD. Finally, do not choose an advisor with whom you might have ego clashes. Might seem surprising, but believe me, ego clashes are quite common in academia. Specially, most faculty have huge egos. Since academics is a soft sphere, egos are not that evident on face. Students with good EQs generally tackle this situation with considerable ease, whereas others just drop out or change advisors.

Personally, I have always shared good academic relationships with lady advisors and mentors since my undergraduate studies. I think I was fortunate to meet them at important phases of my life, hardly ever had an ego problem with any one of them, and always felt they understood me better as a student than a male academic (not that I had problems with males, but somehow a few male academics felt that I was trying to be too smart with them.). The ladies I have worked with are emotionally very smart and sensitive, and understood both the academic and personal side of me. Yes, there were times there were clashes but it got resolved fast due to our mutual understanding. Bottomline - both the advisor and the student should know to press the right buttons and things get along pretty well. Fortunately, I have been lucky in this regard and got many favors from my lady mentors (and also from the male counterparts too).

IV. THE ADVISOR’S ROLE

Simply put, an advisor is your academic parent. In that respect, his primary goal is to just motivate the student to a degree so that he can always think of doing good research and remain focussed. Of course to do this an ideal advisor needs to be ‘strict’ as a parent but also show appropriate affection, care, and support. However, the term, ‘support’ should not be misjudged. It is not the duty of an advisor to spoon feed students with research ideas, or research techniques. However, it is imperative that he has periodic technical discussions with his students, and spends enough effort to make sure that one’s research progress/maturity (judged via a combination of various parameters which an advisor knows about) is on the rise, without forcing students to reach the benchmark. A PhD student in a good school is mature and smart enough (barring exceptions) to know what is good for him, and is expected to do the best he can without much external push. It is his PhD, not the advisor’s. Each advisor should also make sure that the student brain is often kept in an intellectual thinking mode (specially when students are stuck with their thesis progress). One way to do this would be to through limited digressions like making them think of puzzles (need not be mathematical), allowing them to think of solving a small challenging research problem in a different area/sub-area, asking them to do an in-depth review of ground breaking papers in one’s field so that the why’s and the how’s of great ideas can flow through one’s intellectual stream, or even asking them to TA a fundamental course requiring problem solving (could be both on the theory as well as on the experimental front) expertise.

It is true that junior professors need to work very hard for getting tenure, and they should. However, some of them at times tag their students along, make them work in-humanely hard, and exploit student labor. These academics should also know that (a) students are not paper producing slaves, (b) have a life other than research, and (c) good research through students can only come out when students have the space to relax and breathe, and are driven by self-motivation. It is true that students surviving such in-humanely strict professors will end up having many papers (some in top venues as well), but in the end they will learn virtually nothing about the process of doing good research - they would have written quite a few papers but these works would most likely not have that ‘philosophy/learning’, ‘beauty’, and ‘depth’ elements to them. The junior advisor should be bold and fearless - he should just work slow and steady towards doing good research without thinking of tenure and putting pressure on himself, because if he does he might not be able to do good work, and consequently his students would not academically learn much. I know this, i.e., being bold and fearless, is very hard as it has a psychological connotation of the faculty trying to speed towards a settlement (due to a family, or other relevant reasons), and as a reason you see most assistant faculty doing good/above average research during their pre-tenure phase - the outcome is their students fail to know what is great research, and hardly end up in an academic position in a top school. It is also the case that many faculty not taking tenure pressure also get tenure, but it is important to know at the same time that some great researchers we know today did not get tenure in their junior days, but are much more renowned than other faculty, who had tenure success. Personally, as a researcher, I always believe in going up the hardness level from time to time (conditioned on properly judging my IQ levels) in terms of the research problems of my interest. It helps one develop as a researcher and face challenges - not aligned with the common notion of a safe way to get tenure, but definitely aligned with increasing your personal gravity via solving difficult problems. Please note here that I do not intend to say that one need not be prolific in easy publications. What I am saying here is that a faculty should ideally constantly strive for both very high quality (ground breaking types) and quantity at the same time, and not play safe. In the process he may not reach great levels (very few do), but the process would rub off very well on his students aiming for an academic career.

Generally, an advisor has various types of students interested in a broad set of careers by the time they finish their PhD. No matter where the students want to end up, it is the duty of the advisor to make sure that the PhD is a good PhD. In the process, if the advisor needs to adopt strict measures, then be it. The basic quality of a PhD work should never be compromised. It is true that with the rapid rate of increase in the number of PhD students, it becomes hard to ensure quality theses everytime. Nowadays many PhD students have the wrong reasons to do a PhD, and that needs to be set straight by the advisor. There is a ‘fixed’ structure to any quality PhD theses, and every advisor needs to follow that (and this would decrease the PhD entry and completion rate). Even though most people have the
right to education, the PhD should only be meant for the elite academic, else the degree is going to be devalued over time. Specially, at USC I have seen that faculty (or administrators) do not standardize, market, or advertise PhD research that strongly for the quality school it is (US top 15 in EE/CS), and the outgoing best students suffer in terms of getting academic jobs. One reason I feel is the increase in number of PhDs offered with not so good PhDs being the majority. As a result, the external image of USC EECS as a research den is very good but not great.

V. THE RESEARCH PROBLEM

As a very basic requirement, one should always read a lot (papers by eminent researchers, state of the art research topic documents, magazines, newspapers, etc.), keep eyes and ears open, and try to select problems that have some considerable practical value. Of course, this comment is especially relevant in the fields of computer science and electrical engineering. Practical problems of good impact are where both popularity and funding lie. These problems are also most likely to give you an academic job after your PhD. This statement does not necessarily imply that pure theory is not cool, just that it is very hard, and you need to be a problem solving star already to have the confidence to both, start your PhD in pure theory on a well-known hard problem and complete it as well. The term ‘well-known’ is important here as without solving a well-known pure theory problem, you will not get the basic recognition levels to make a career in pure theory. As a matter of fact the so called ‘geniuses’ by popular consensus in the CS/EE/Math fields are pure theorists, and such researchers are very rare. Theory applied to practice is the best win-win approach to selecting a research problem - you get the best of both worlds. By this I mean problems where you ask questions whose answers could have a good impact on current industry trends and people’s lives, and at the same time the solution is based on a sound theoretical principle. However, my last comment might seem more philosophical and in reality it is easier said than done.

A necessary step before choosing your research problem is to analyze your theory/experimentation/system implementation capabilities. In this regard, finding a good problem (theory or experimental) that matches your interests, skill sets, is hot and trendy, and whose solution is based on a sound theoretical principle, is horrendously difficult. As a consequence, it is unwise to select an experimental (theory) topic (be it hot or cold) requiring advanced coding (math) expertise when your system development (mathematical) skills are average. On the other hand, doing a good job on a problem requiring average skills will not get you much research value. Thus, the tradeoff decision here is quite important for the researcher who aims to have a research career in the future. To exemplify the difficulty of this decision, most students I have seen (USC and elsewhere) hardly give any sound thought towards the dimensionality of their PhD problem. Most are happy to work on some problem related to their interests and just get a PhD (either they do an average job on a hot topic, or they do an ok job on a cold topic, or even worse, just do an average job on a cold topic). This is where your advisor can really help you to find a good problem (if you cannot find one yourself), one that you will be proud of solving in the future, with your abilities. Working on age-old topics like adhoc networks, certain aspects of P2P/sensor networks, and routing protocols in wireless networks for your PhD is extremely boring, incremental, and will fetch you no future value, i.e., it will be hard to get publications in top venues, which is a necessary condition to get a research job in future. The job market (be it industry or academia) always work on current trendy topics and it is best advised that a student (a) chooses problems from hot topics (unless you are the next genius round the corner solving long-standing issues in an area), and (b) target a solid problem within the hot topic area. On a very high level, there are two ways to form your research problem - either you fix an open problem in a given area and solve that problem (using theory, experiments, etc.), or you design a methodology that solves multiple problems in possibly different application spaces (most likely valid in the case of an engineering PhD). In the former case it is advisable that the open problem is a decently well known problem and is open for at least three to five years. In the case of the latter, no matter what methodology you develop or reuse (from existing works), the application space, and subsequent research questions in that space needs to be very trendy. If you cannot meet these two requirements for a PhD problem, you could still get a PhD but the market value of that PhD may not be that high. A current trend in the CS domain, with the increase in industry funding, is the rise of a community doing experimental systems PhD research without a sound theoretical/fundamental principle. Personally, I do not think one needs to be a PhD to do such sort of research, at best one needs great engineering skills to make a system work, for which the best degree should be D.Eng (or M.Eng) rather than Ph.D. I do not see any philosophy or intellectual value coming out of such research but unfortunately there is too much industry backing for this community to flourish.

I selected a topic for my PhD (the role of cyber-insurance in increasing network security) which I thought was cool, some industry people thought was cool, and a few researchers (including my advisors) thought was cool. However, there are so many open interdisciplinary and implementation challenges to my topic that hardly any paper gets published on it, even by eminent researchers in the community. Neither are some assumptions that make some problems on my topic easier to solve, accepted by the community due to the socio-economic nature of my thesis topic. But the funny thing is that most security researchers and US government officials think that my PhD topic can have a big positive impact on tomorrow’s global network security - just that no one knows how to implement it in practice in a feasible way. Thus, I landed up in a situation where the topic is really trendy but the problems are very difficult. I was always trying my best to make some contributions (need not be that practically easy to implement) to the topic and finally I did with a lot of push, patience, and hard work, but a lesson for me (even though I thoroughly enjoyed research on my PhD topic) is that I should deal with technologies implementable in the near future, i.e., in three to five years from now. An important thing I learnt from an industry visit in 2013 is that it is very hard to find a problem that is intellectually great and at the same time has a huge industry importance. Such problems come once in a decade. Solutions to such problems result in big CS awards. So if one is desperately trying to look
for such problems (actually very few students today dare to take up the challenge to solve such problems) and not getting them, it is normal. Only a famous advisor who has contacts with lot of industries can give you such problems, or it just might be an open problem famous in the EECS community, and of course you should be lucky enough to be in the right place at the right moment to come across such problems in your research path and become famous in future :) I am still waiting for my moment :)

VI. MENTAL QUALITIES

Remember, we are to be PhDs. It is not a 100m race like UG or MS studies, it is a marathon. Stamina, mental toughness, emotional IQ, and energy are the most important personal characteristics for getting such a degree AND doing very well in it (potentially holds true for achieving anything good in life, in all spheres.). Intelligence and knowledge come a close second. I REPEAT - INTELLIGENCE AND KNOWLEDGE ARE SOMEWHAT SECONDARY !!. The average (also includes non-Phd, but good students) guy feels great with what he is doing initially, for a short while, then he gets tired or distracted after some time when barriers of all kinds (e.g., difficulty in solving a research problem, difficulty in having publications, failures in the publication process, personal issues, etc.) come (inevitable), and then gives up hope, and finally quits - what a loser despite having talent !!. The “good” ones feel great initially, if they do happen to get tired or stuck, then they mentally raise their activity standards by sheer determination, motivation, patience, and purpose, to feel great again. You may be brilliant as an UG or MS student, but if you do not get through the PhD process, you just showed that you could not run far and will not gain that much respect. Period !!! (unless you are a future Bill Gates or a Steve Jobs or show some sustaining potential to be like such figures). One could say things like “I am satisfied with what I have and that is all that is important”, yes true, but then you will always have it in your mind, somewhere within, that you could not push hard enough when it was required. One can show a false image to others but can never lie to oneself!! I know quite a few friends of mine from UG who very very good students in the pre-PhD phase, but did not do a PhD just because they felt it was not necessary for them. Now, after several years when I speak with them they say that they wish they had done a PhD, and wish someone had guided them before. Well, people always existed to guide them, but they did not listen when they should have. After having an experience with life, they realized themselves what was good for them.

One important advice on image portrayal on being a research student I always got from many great academics is to “shut up, just work, keep ears and eyes open, and exude wisdom”. So does it mean “Not speak ??” - No, aim to be a brilliant speaker/casual talker/chatter/blogger, but at times when it matters (generally quite a significant fraction of your PhD), do not distribute and waste your energy in frivolous social talking activities. Being an Indian, I specifically see this problem in my countrymen (not necessarily researchers), - they do something not even that significant and then goes a post on “Facebook” of their “hollow” achievement with 100s of likes - they feel that is marketing, but in my opinion it is not. You may become a hero to your mediocre friends, or sell your ideas and opinions, but to many other wise people you just showed how dumb, idea hollow, and low ambitious you are, and this mental quality of being ecstatic on small achievements is a big negative in achieving a good PhD, and a potential research career after that. As an example, many MS and PhD students post tons of photos on social sites when they are conferred upon with a degree. I do not understand the need to do these things and I am not a social recluse to make such a comment. It is OK to put up photos of receiving an award along with your degree, but the way they portray the conferral of solely a degree, sometimes it seems that they achieved the greatest thing in their lives, when the reality is that life just started.

VII. THE WORK ETHIC

Work ethic in my opinion is the single most important thing that separates the achievers from the non-achievers. In my life, as a student, I have seen good talent bite the dust with a very lazy and laid back work ethic, and at the same time seen ordinary students reach great heights with sheer hard work and determination. I was always told by wise academics and by my late father that many street loafers are IQ wise more intelligent than some students in the top universities of the world, but the reason they do not make it to the top is primarily because of (a) poor work ethics, (b) not being at the right place at the right time, and (c) of course in many cases a lack of opportunity due to multiple factors such as family background, financial status, etc. Assuming (c) is not within one’s control and we cannot do much about it leaves us with (a) and (b) to deal with. In this regard, being smart is no excuse to have a poor work ethic because there is always someone smarter than you who is working harder and will have an edge over you. In addition, I can assure you (through multiple instances I have seen) that a good work ethic will eventually put you in the right place at the right time. At USC EE/CS, most PhD students come from the best undergraduate schools in their own country. So most have good talent. However, many of them just them give it up after joining USC (due to distractions, lack of mental toughness, etc...). The same is true for schools like MIT and Stanford as well. As a result, after their PhD most students (all of whom had it in them to do great things in future) end up in positions, which are for the common man - a waste of talent!!! To give an example, around 400 students graduate every year from the EE and/or CS department of the top 20 schools. Only 20 of the students (avg. one per university) out of the 400 directly become faculty in top 20 schools, around 60 students go to research positions in industry or academic labs, and approximately the rest (around 80%) end up in common man positions. Of course there is an element of luck, and everyone cannot make it to academic and research positions, but the ground truth is that most PhD students in top schools just do not have that “need it badly” or killer instinct that would reduce the percentage of students taking up common man positions, for which one need not have a PhD in the first place. Most students after spending five years in the PhD program are quite tired and just want to get settled in life with money, family, etc.. without targeting an academic peak point. Of course you could always settle down as well as keep your ambitions intact, just that very few people know how to do it, and these are the ones who most likely end up in academic and research positions.
As a PhD student, one’s ideal work ethic is giving time to research on average 14 hours per day for 6 days a week (an doing the relevant things to progress research) during one’s peak PhD phase - the phase where one should be THINKING ONLY ABOUT ONE’S Ph.D. One should sacrifice one’s hobbies and tastes at that time, and JUST THINK OF ONE’S Ph.D PROBLEM from wake up time till sleep time (I am assuming here that the PhD problem is a solid problem - something I am seeing students are avoiding nowadays in the hope that they would safely get a PhD). Yes, it seems very painful, but that is why it is an ideal and only the very best are able to put in such efforts, and precisely these best students get the best jobs after their PhD. Generally a peak PhD phase for a good student should range from one to one and a half years. I think I have spoken a lot !!!! At this juncture I feel the need to ask the question - what did I do ??, else it would really be unfair to give advice. **As a matter of fact, by citing my work ethic as an answer to the question, I wish to convey to people what is possible for even an average PhD student if he is really hard working and sincere.**

My answer - I just did not do enough for my PhD that I could, with my capabilities. This is what my advisors said and that is what I somewhat feel too. I used to be frequently scolded by one of my advisors to reduce my fun activities and put more effort in research. The average number of hours I put in to research per day ranged from four to six (with really solid focus) - thus, in a week a maximum of 36 hours. I used to lie (in fear) to my advisors that it was 60 hours (I only did those 60 hour weeks during one year of my peak, should not even call it a peak) and still one of them used to say that is clearly not enough and that I should push towards 80 hours (in peak) if I had any hope of graduating. Well, I did graduate but I do not know what would happen if I said I only put 36 hours a week on average in my entire PhD :) My advisor from Stanford told me that in his peak, he gave 90 hours (I seriously doubt his focus level here still today :). I believe it is just not possible - may be tried to push me !!) per week, and that excluded a Sunday when he used to go out with his wife (then fiancee). For a guy whose first love is surfing and second love research/family, even a fake 90 hours is a sacrifice, and for that pain, here he is, a faculty in a top engineering school. Bottomline, my net weekly work hours during PhD was very similar to what a graduate Masters student puts in; at USC I know they put in much more than that. Now why is this ‘hour log’ information relevant to anyone? Simply because with the effort I put in, I got faculty interview calls from three top 15 schools in the USA (I only applied to top 20 schools with a bias towards California as I am just addicted to the place) directly after my PhD. Of course lot of factors matter in getting a faculty call (great letters, top papers, luck, etc..), but the point I want to drive home here is this - if I can get three top university faculty calls with my work ethic, just imagine what someone, putting in twice that effort, be able to achieve. Of course, I should mention here that one of the top schools that called me for an interview did say that their main reason to call me was because one of my PhD papers was a solution to an open problem I solved (and subsequently the paper appeared on Wikipedia) - but the main point here is that with luck (here, by ‘luck’, I mean the the research problem you are solving should be solid, hot, and trendy, and you need some luck to be a part of such a problem) and a good work ethic, most people can solve multiple open problems, and subsequently get multiple faculty calls. There are always good open problems round the corner. At USC EE/CS, what I cannot figure out is the reason that despite most PhD students putting in quite a bit of an effort (much more than 50 hours per week), they still are not that productive - most likely their focus levels are not that high during those hours.

**VIII. The Detachment Process**

This section, in my opinion, can be best structured if I first ask the following question: Why was I inefficient? To answer this question, let me first tell you that I was OK some what in the first year and was good in the second year. However, from the third year I went a bit astray in my vision, and started thinking of (a) multiple problems at a time to cover risk of being stuck in the same problem for years (note that I did solve a difficult problem in my PhD, but that was only in the later parts - I was struggling on a mathematical proof for nearly one and a half years) and (b) thinking of multiple careers (a bit due to some family issues but it was mainly my wavering mind at some tough times. Now combine (a) and (b) with ambition - your biggest friend, but also your biggest enemy. The above experiences mentioned in this section are sufficient enough for me to motivate the concept of detachment in research - in my opinion, the MOST IMPORTANT QUALITY ONE COULD HAVE.

(a) comes from fear of failure, and is your single most powerful enemy in your pursuit of academic excellence, only a handful of wise researchers have escaped that, but with the current publication requirements for a good job, the number will soon converge to zero. Most of us are attached to the consequences of academic failure, and when tough times arise (in a good PhD it will definitely come), we all run for cover and try to save the day by having some quick publications. All I can say (even though it is much easier said than done) is to try to relax in such situations (I am not going to discuss the methods of doing that, but there exist methods) and focus on the existing hard problem (the problem should really be perceived to be a hard problem in the community) without thinking of the output of the solving process. I am not going against publishing on other easier problems (you anyway need to do this to have an academic career), just that it should not be at times when you are having issues with a difficult problem. Face the problem boldly, maintain focus, and be patient. I know of an EE student at Caltech, who published few incremental papers on his PhD topic till year 4 of his PhD and finally had a big paper which was his main result on an open problem. The student is now a faculty at UIUC, one of the best schools in Electrical Engineering. It has to be said here that he had a very famous advisor for his PhD who always pushed him to focus on one hard problem throughout his entire PhD. He could afford to be risk-loving because of a famous advisor and his strong IQ - most other students would probably be risk-averse and solve multiple problems at the same time when facing difficulty, which is fine - my main message here is do not overdo it. Solving at most two problems in parallel at one point of time is good enough. (b) is the notion of attachment to the consequences of materialistic failure that also arises from fear but primarily the fear factor here is instilled from a family
upbringing and societal point of view (in the Indian context, the tendency to finish everything super early in life without paying heed to the quality of a future career and the satisfaction it would provide). One needs to be as far as possible from (a) and (b) to have a successful research career, and prevent mediocrity. The PhD tenure is the best place in this regard to make mistakes and learn because later in your research career the scope for making mistakes will be much lesser. Ambition is good - it helps you aim far and high, it is your best friend when things are going your way, but it can be a very bad enemy (e.g., when paper gets rejected multiple times), and forces you to take crazy steps to turn the tide in your favor (e.g., change research topic, change Ph.D advisors, look for faults within, etc.). It is here one needs to be mentally strong and sift till the rough wind settles down. Probably a break from research is ideal at this point of time to recalibrate your ambitions and gather energy to start fighting again.

Philosophical Wisdom - I conclude this section with two important philosophical concepts from the holy Bhagavad Gita, and relate it to the PhD process. (i) Barriers to one’s goal is mother nature acting on an individual. The ignorant try the impossible to tame or escape mother nature (divert focus to other problems, careers), and fail (to complete a good PhD). The wise just experience mother nature in a detached manner (stay calm, patient, and persevering on facing research progress barriers) and reach the shores (complete a good PhD). The lucky get steered by God from the path followed by the ignorant to the path followed by the wise. (ii) one’s goal is to just work towards one goal (his PhD problem) without thinking of or expecting the outcome (whether he will be able to solve the problem). The outcome is only decided by God and is a function of one’s body (physical fitness), his mind (detached, non-detached), the instruments he uses (his action, efforts), the method he adopts (fair, unfair), and divine grace (luck, fate). The wise just happily act on the problem at all times as it is the only thing totally under their control, without thinking they are responsible for the outcome. The ignorant think they alone are responsible for the outcome and try to tame mother nature.

IX. Publication Philosophy

So how much should you publish? Where to publish? How to publish? In my opinion for your PhD work in CS, the ideal mix is 2-3 top tier CS conferences, 2 journal publications on your conference work, and a few (1 or 2) workshop papers in top conferences. Any thing more than these is a bonus. Even though most popularly, CS students only publish in conferences and workshops. If you are in EE, journals count mostly, and 2 journal papers in top venues (e.g., IEEE Transactions) should suffice to get a good PhD degree. In the field of natural sciences, the top publications venues are journals (e.g., Nature, Science) and 2 good journals should again be enough to get a good PhD. However, if your hopes are to join research and academia in the future, you better be a publication machine to prove to people that you can publish at will. Both, quality and quantity matter here and should be balanced appropriately. It is also good to publish some papers on your internship experiences (applicable primarily to EE and CS fields due to its virtual laboratory culture). It helps to show people that you can work on varied topics (I am assuming here that during your internship, one would work on topics different from their PhD topic) and most importantly get letters of recommendation. For any academic job, one needs three or more letters of recommendation, and it is best that your letter writers write about your research abilities. It is important that you just do not publish any where for the sake of having papers in your PhD. To put it simply, quantity does not count at all if quality is not there, and simply quality without quantity will not suffice either (unless you solved a very big problem). One unique good thing with quantity is that it helps you get in touch with multiple topics in various areas/domains and broadens your research vision, which is very important when you apply for faculty interviews and also when you write proposals. Especially, in a faculty interview, they often ask you the question “How do you see yourself five years from now?”, and you need a significantly broad research vision to answer this question convincingly. With regard to publications, it is also important to note the order in which you become involved in the author list of a paper. For most of CS and EE domains (apart from CS theory, where the list of authors are traditionally in alphabetical order), the first author in a paper is the most important, and indicates the person doing most of the work in the paper including him having the main idea. Being a second author in a paper is also useful at times depending on the nature of the work. However, being third author and beyond does not give you much benefits. The thing good about being a second, third,... author is that you prove yourself to be a team player, something which is very important in most jobs you take up.

X. Writing, Speaking, Marketing

Technical writing and speaking are the two most important strengths one should have as a PhD student if you want to enter academia or research industry (actually does not exist anymore) after your PhD. The equation is simple - if you do not write well, no matter even if your work is deserving of an international award, people will not understand it clearly to appreciate its value, and the work will be rejected in conferences, journals, etc. Generally, most advisors in your first writing draft absolutely demoralize you with millions of comments to the point that you feel as if you do not even know how to write at such a level. The good thing is that you are not alone, so there is no need to feel bad, and the advisor is just helping you out to become a good writer. The bad thing is that you might have to spend significant effort in improving your writing, apart from doing good research. Separate from you dealing with writing issues with your advisor, it is often advised to cross check your writing draft with your lab mates for comments and suggestions.

Technical speaking is equally important (after you have done a good job in selling your written work to a peer committee). If you do not speak well in your job interview, you will not get the academic job. I am fortunate that both of my advisors maintain the highest standards for writing and speaking, and I have gone through the grind with them, which made me good in both writing and speaking, even though I am always improving. To give you an example, how hard my advisors trained me, for a research talk I had to give at a company quite
a few years ago, I had to revise my slides 10 times after a decent first draft, and prepare my talk 4-5 times. The moral of my experience is “practice, practice, practice”. Give talks to your lab mates, to your advisors, friends, etc. Till date, I have not fared badly in the speaking events. There are a few great articles on the Internet on how to speak (and write) well as a PhD student (and even beyond) which students can have access to. However, the most important thing to remember is to match thinking speed with speaking speed. You must make sure that your thinking speed is at least as fast as your speaking speed, because otherwise, there is always a very clever guy in your audience who can stump you with a question, and you get stuck. It happens to most researchers anyway but the goal should be to minimize such stumpings :) On a personal note, I have been stumped a few times at some talks and faculty interviews, and the experience is not that great I can tell you. In many cases, an audience is pretty aggressive and might ask lot of questions, which might take away your speaking time. It is always advisable here to say “We can discuss this offline”, and continue with your talk. Note here that through your talk anywhere, the audience is judging whether you can control people, apart from obviously testing your technical/scientific mettle.

Marketing is something the academic community has a divided opinion on. Some do not put much of emphasis on it whilst others are very serious on marketing their work to the greatest extent possible. I think marketing is a very important component, specially if your research has practical and social impact. Think of it in this way: you do not lose anything in marketing, probably some organization takes interest in your work and you get benefitted academically or otherwise, but if you do not, you cannot expect to have some additional advantage. Marketing your research can be in any form, be it personal webpages, news articles, magazine articles, etc., but since most of us not are doing groundbreaking work that overnight changes the world, it is wise to market your work whenever possible, for your own benefit.

XI. LABORATORY WORK CULTURE

One’s research lab is the place to do research other than his home. Of course, for experimental research, a laboratory might be the only place. On the other hand, for paper and pencil theorists (like me), be air, road, or under water, any place is a valid place. At USC, in general I have found the lab presence to be good, i.e., people turn up in the labs, but what is missing is meaningful interactions. As a personal experience, I was very bad in studying in the labs of my advisors as a PhD student. I used to mainly be in the lab for chatting with friends, who were great fun. Very few students in the lab used to study in the lab so I would assume that most felt like me about coming to the lab, or had just given up about the idea of studying in the lab because of characters such as me :) who could make a lab lively but break the concentration of people most times. I guess our being more like a theory lab and in the age of the fast speed Internet, it is not necessary to physically work in the lab. But I would like to make a point here - I think I missed out on a valuable learning and collaborating experience. It is a very good idea to work in the lab. The work could be anything from discussing research ideas with friends to collaboratively doing research. At home, at least myself would mostly feel relaxed and laid back and this would not always give me the best concentration levels (apart from certain times), even though it gave me solitude, quite a bit of intuition, and problem solving insight. For people like me whose concentration levels gets affected on getting cozy at home, it is better to spend significant amount of time in the lab to force focus on oneself knowing that the environment is distracting (non-cozy), and this in turn would help develop higher concentration levels.

XII. ON HAVING ACADEMIC IDOLS

Many PhD students keep academic idols whom they look up to and get inspired. This is an excellent concept to perceive, but there is a problem. Academics is not an open field like entertainment or sports where one could watch one’s idol train or perform live and then pick up a thing or two. Academics is a closed field where people are hardly talking to other people about their research strategies. The only thing visible is the output (in terms of publications, etc..). Unless, your idol is your advisor, it is very hard to learn from the idol about how he goes about his research process. Personally, I do not believe in having academic idols. I simply believe in the concept of a researcher stretching limits and improving oneself by observing people around him, taking their good qualities, and above all taking all the advice and knowledge from their advisors. I once saw a professor lay down some guidelines before his PhD students of having an academic idol and striving to get close on him for one’s own betterment. Well, I have a clear cut thought process on this. As mentioned above, if the idol is someone famous in academia, and you are not in contact with that person on a mentorship relation, you would not know how the person worked daily to become famous, (until there is a very well written book on him - does not happen in academics that much) so apart from being a fan, there is nothing you can learn from him. Now if the person is not a famous academic superstar, why would you want him to be your idol? Who knows, you might become even better than him, and philosophically an idol is an epitome standard that cannot be bettered. The only exception is, if you yourself are working under a superstar (e.g., like a Turing Awardee, Nobel laureate), you would get somewhat divine mentorship, but then you have to be a star yourself (unless you are very lucky) to be the person’s student. What are the odds of that happening? Not much. So keeping an academic idol is not something which I vouch for. On the other side, I am more inclined towards getting inspired how great people (or even ordinary researchers) overcome adversity to achieve something in life. This inspiration drives to develop fighting characteristics in me that helps me to face tough situations. Since, I am not brilliant in the sense of the term, I prefer to take inspiration from people who faced hardships in life, trained and worked very hard, fought back brilliantly from failures, and ultimately achieved excellence by world standards. Whether such people are inherently brilliant or not, does not matter to me. In fact, a few years ago (during the final year of my PhD), I came across a beautiful and decently smart girl, quite a few years junior to me, who used to give me certain advice at times (my mini-advisor ;)), which I thought were valuable enough to adopt. As a matter of fact, the reason I am in academics even today is mostly because of some of my interactions with her.
She was just a new-coming PhD student but she spoke sense, and that is all that matters to a receptive individual. The term ‘beauty’ is not important here with respect to academics :) , but let it stay.

XIII. Peer Talents, Complexes, and the IIT System

The wise people say “Never compete with others, but compete with yourself”. No doubt this statement is true, but quite idealistic. In a competitive world, we are bound to compete (even if subconsciously) with others for positions. In my experience, students feel competition in two ways: (i) amongst peers in the same department, and (ii) peers in other schools.

With respect to (i), I have generally observed that students do not say much but actually really get pumped up inside when they get to know that their lab mate or department mate is doing well. I have myself as a student and lab prankster tried to play mind games with my lab mates to see what was going in their head when they heard someone doing well - either they said that the achievement was not substantial, or they were happy about the achievement and themselves increased their research efforts for a short period time. This is the good side of competition. As an example of good competition, I was once told by Shanghua Teng (the two-time Godel award winning great theorist at USC) that Jon Kleinberg (the famous theorist at Cornell CS) got the added motivation to complete his PhD from MIT in four years, when at a party during his third year, he heard that Dan Spielman (also a two-time Godel awardee), his one year senior at MIT finished his PhD in three years. When Jon heard that news, he was not on track to finish his PhD in four years. He worked immensely hard in his fourth year, churned out around nine top publications in a year, finished his PhD, and joined Cornell CS directly as assistant faculty. The bad side of competition is when you deny to help or even take help from someone out of jealousy, ego, etc., just because the latter was going ahead of you, even if temporarily. Jealousy, as a personal opinion, has never helped anyone and never will. I have mostly never hesitated to take advice from either my junior or my senior whether or not they were smarter than me. I can safely say that I have benefitted as a researcher due to this.

With respect to (ii), many a time, many students are in awe of someone doing PhD in top three schools. As a matter of fact, it is very psychological of us to say “he/she is doing a PhD at MIT, Berkeley, Caltech, etc.” and mentally allowing them to be ahead of us in competition for positions. I have a very clear cut view on this topic. If IQ is the metric of judgement, there are exceptional students in most top schools but they only form 1% of the student population. Everyone from say an MIT or a Stanford, or any top school is not gifted. Out of 100 PhD students may be 2 or 3 are. It is true that such students cannot be touched. You just see them and admire their intellectual beauty. I am fortunate to have seen a few of them in my life. However, the rest 99% anywhere are no doubt really good, but CAN BE TOUCHED AND BEATEN. Just the right discipline is required. So there is absolutely nothing to think too high of PhD students in better schools than yours. In most cases, the admissions to a PhD program in a top 20 school is very random - a student getting into UC Berkeley could well have received admission from USC, and vice-versa.

I feel internally pissed of when students make comments like “He/She is from big school X….. so must be really good man !!!” I am like “Why do you think he is really good?? F**k him !!! Has he done something substantial??, Yes, I respect him for being a student in X (might have done something good in UG - may have excellent grades, must be really hard working and focussed, AND was lucky to get the admission draw in his favor), but show me something he has done after entering X that would let me look up to him. Just do not take the name of the school and think he is really good. If he has done a very good PhD, cool, else he is just a normal student in a top school." The average US undergraduate from a top school or entering a top school for PhD after UG in a good US school is not someone to be in awe of. Personally, I have taken courses with such students and beat them by quite some margins in marks (not a good metric in general to judge talent, but for intellectual courses, is some measure), and even in intellectual thoughts, I felt I was quite a bit ahead (exceptions excluded). I just felt “Man, just if I were a UG in the US”, nothing more. So when these students go to a top school under a big advisor for a PhD, I am just “OK you are lucky and destined due to some good work you did in your past lives”. Today if I were doing UG in US, with my abilities and right direction, I could have, with a very high probability, worked with a Turing awardee on my PhD. As a matter of fact, I have respected all my colleagues at schools ranked higher than USC, but hardly have I ever felt that I was in anyway less than them.

For and Against the IIT System: Here is a lesson for Indian educationists. We often say that the top IITians (e.g., the top 50 AIRs) are brilliant!!! Yes, they are. When we compare them to US UG students at MIT or a Caltech, they are there at par. However, most of these top 50 IITians lose out in the marathon (some were PhD colleagues of mine at USC) either during or after PhD, and become unknown entities in the academic world, whereas the above average MIT and Caltech guy goes on to become a Professor in a top 5 school, the great ones sometime become a Turing awardee. Why?? Just because the road to an IIT in India is made so troubling, over-hyped, and stringent that students get tired by the time the marathon is even half way. Our population, social structure, and basic illiteracy is to blame here, but the bottom line is that the IIT exam is NOT The RIGHT WAY TO HONE TALENT. It’s JUST ONE WAY TO PROVE ONE HAS TALENT, BUT THERE ARE WAYS TO PROVE AND HONE TALENT TOGETHER!!! The IIT exam structure is not the gold standard to screen talent!! Yes, it screens the best students, but lot of very very good students miss out as well, AND THERE ARE OTHER GOOD SCHOOLS TOO!!, and some of the students from these schools have a very bright research career in the US, and elsewhere. Just that in our country with respect to education, it is always negatively portrayed to the outside world that there is IIT in engineering and there is nothing else. What is the outcome? - In some top US schools, the only Indians who get PhD admit are IITians, whereas students from top 10 Chinese schools are uniformly seen in top US schools and doing very well. One IIT President’s Gold medalist friend of mine (my high school mate) in MIT told me once “Ranjan, I do not know why the IIT exam is in place. I think just if I had learned (which he did) how to score well in school and board exams, and entered a good engineering school, I would
have still managed an MIT education with flying colors." I did not get his statement then, now I do. As a matter of fact, I did not aim for an IIT education because I wanted to be a mathematician. Thus, I appeared for the toughest exam in India (in the absolute scale) for UG entrance, and cleared it to get an entry to the top math school in the country. However, societal facets forced me into an engineering college to study computer science for a safer career. However, I do not think my talent was any less than an IITian within rank 100 in the IIT entrance examination. I did not get a good rank at IIT just because I did not focus on the preparation game which is quite intense and all-rounded. I just focussed on doing mathematics well without paying heed to physics and chemistry that form an integral part of the IIT entrance exam. On the society front in India, it is mainly like “Son which IIT you graduated from ??”, “My son/daughter went to this IIT” . A parent is also typically like “X scored 95/100. How much did you score”. India is all about mediocre goals and fake useless competition with next door neighbor’s son/daughters, not about achieving excellence without focussing on competition. It is all about faking brand names and showing off standard to the world and in India. Fortunately, the American free system of education at the school level allows students to distribute their energy at the right time in the right manner to achieve excellence in the long run. So, being an Indian and non-IITian, or even an IITian, the next time you see a Harvardian or MITian on the street, just think “Yes, you may be very good, but some of you are lucky also due to being born in America (not that you should not proud of being born in India, but one cannot neglect the faulty and corrupt education system) - with a bit of hard work, dedication, and luck I can catch up with you too !!!"

XIV. THE TEACHING ASSISTANTSHIP JOB

If you want to be a professor in a good school, TAing is a MUST. I have seen many PhD students crib about being a TA, and even worst, some professors discourage students doing TA ships, considering it a waste of time. Let me get one thing straight here - if as a TA you are only grading scripts and holding office hours for HWs, then it is of no use, and unfortunately most TAs do that. In that case, it is better a student does not do TA as it results in zero utility. Any top school needs to give responsibility to their TAs to TEACH CLASSES, FRAME EXAM and HOMEWORK QUESTIONS, AND GRADE EXAMS, apart from holding office hours. An effective TA experience (at least 2 semesters) increases the teaching confidence of the TA, allows him to get a firm grasp of the subject by repeated interaction with the class students and tackling their doubts, and above all improves his communication skills. Even the great Richard Feynman (a great teacher himself) took love and pride in teaching and openly admitted the fact that when things were not going great with him in research, teaching was his most loved act. I am sorry that I cannot assume here that students who crib at TAing, and the professors that discourage their students to do TA, are intellectually more capable than Feynman.

In my case, I did not like to do a TA the first time it was given to me, but I had to do it to support myself, and also because I was considered very good by the theory faculty at USC, and so wanted to take up the challenge. I was thrown the duties to manage 150 students in a fundamental and hard subject like algorithms, create homeworks and questions, and hold office hours. The experience did not start well for me as I was excessively harsh, tough, and strict with the graduate students. Several students were crying and complaining about the difficulty of the course, and some students even cursed me in emails. The professor had several heated discussions with me on student handling (not on the difficulty of the course, he was very open to it) but I stuck to my task. Even the department chair and my own advisor called upon me to be asked me to be relaxed with students. I tried my best to be relaxed as possible but it was not good enough for the students. In my inner self, I knew that I was benefitting students, so I was stubborn on making students tough. My only problem was I did not express my political and diplomatic side in the first semester of me being a TA. I used to think that these traits are to be played in industry. I was wrong. The main learning (and I learned very fast) from my first semester as a TA was that in the USA, the academic system is different from India, and diplomacy, wit, and tact are one of the most important personal characteristics to become popular and rise in power. In India, diplomacy is not considered important (strange that we had in Gandhi one of the best diplomats the world has ever seen) and student complaints are not taken seriously. In the US it is. However, I made some of my best friends in that class, who are still my good friends after three years. After me doing three semesters of TAing, I became a lot better in conveying my ideas to students, improved my own knowledge of algorithms, and above all became a better communicator, both in the sense of technical content as well as in nontechnical conversations with students. I played all the good politics I could, with the instructor and the department, kept the graders under my control, but at the same time kept instilling the fear and respect in students. I had so much freedom and power at one time that there were comments floating that “Ranjjan is more powerful than the instructor”. The graders used to follow my orders in manipulating grades (for the betterment of students) without the instructor having any idea. They were great graders and great friends of mine. The GOOD thing was EACH AND EVERYONE (INCLUDING THE INSTRUCTOR) had just one goal. How to make students learn algorithms in the best way possible. Sometimes I did not get along well with the instructor BUT he knew what I was doing and why I was doing. He respected me.

From the 4th semester of my TAship, I started to have my own designed ‘discussion sessions’ (approved by the course instructor) and it became an instant hit. Around 100 students flooded to my sessions, and I became some sort of a “superstar” in the CS department, and enjoyed a celebrity status amongst the huge MS student population and some UG students in the frat and sorority houses. It was not that I was not popular in the first three semesters, but from the 4th TAing semester my popularity scale took a different dimension. Inspite of all the controversies, I got cited to be one of the best TAs in the both the CS department and the entire Viterbi school, for my efforts. In addition, I enjoyed quite a bit of attention on the social front from few MS students, details of which I do not want to comment on here :) It also happened that one student went to the graduate advisor for CS students once with an algorithms book, and she asked her “Are you in that section where the TA is like the Pied Piper of Hamlin”. When the
student narrated me the story I laughed, but internally I knew that I had power, great power and respect. I should not say I did not ever misuse my power at times, it just happens, but I always got away with it, thanks to some lovely and caring CS admin staff, who always knew how much effort I was putting in behind student welfare :) I realized that in the US academic system, one needs to have only three things to have power and success, (i) lot of confidence, (ii) a little bit of knowledge (I know two to three students at USC with probably better knowledge of algorithms than me, but no one knows them), and (iii) good speaking abilities with emphasis on tact, wit, and manipulation - anything more is just a bonus. The last point also holds when you give talks for jobs.

Overall, I just loved being a TA. OK, I was controversial, but who cares as long as you make news. !!!, and I constantly made news as a TA for three years, and learnt quite a bit of academic politics. Not many people can do that :) I thank the CS department, specially Lizsl, the graduate advisor for CS students, for letting me be a TA for algorithms for three years at a stretch - out of all controversies, I might have been very good to have kept getting the job :) The speaking confidence I got from my TAship rubbed on my research talks as well that I gave at various places around the world. FOR STUDENTS WHO CRIB AT BEING A TA AND CONSIDERING IT A WASTE OF TIME, I PUBLISHED 20 PAPERS (MANY OF THEM GOOD QUALITY PAPERS IN MY OWN EYES) IN MY PHD, BEING A TA FOR 3 YEARS NON-STOP!!

XV. THE WORLD OF PROPOSALS

Initially, I had thought of not including this section in the article as it is not an integral part of everyone’s PhD. However, I finally changed my mind because of the future importance of being able to write proposals starting from being a PhD student, if one wants to stick to academia. Well, many things during the PhD have future importance, but nothing like learning the art of writing a well written proposal. First, let me state the importance of proposals - at least in the United States, writing proposals and getting them accepted is a necessary condition for a future in academia. You might have publications without grant money, and end up not getting tenure (almost surely). You might have lot of grant money, and not many publications, and still get tenure (with a low probability) - of course you will not be termed as a good researcher in the community without many publications, but might have a permanent job nonetheless. Having grant money from proposals implies that you will independently be able to hire (like a manager) PhD students (who would do the work for you) and run your research group in a stable manner. A proposal is all about the big vision regarding an idea you have, and the goal here is to sell your vision convincingly, without doing the research, to a committee of people, some of whom have no idea of your area of research. Note the two important aspects of the previous statement, the word ‘convincing’, and the phrase ‘without doing research’. You need to convince the experts in your review committee with a set of meaningful clearly cut-out questions (and a potential 10,000 ft. view of your solutions) you want to address based on a model of your vision, but at the same time reach out to a set of non-experts in your domain to make them believe that what you say you will do is important. Add to this, the difficulty of selling your vision without doing much or any research on your idea. Clearly, a very tough proposition, not intellectually, but from the viewpoint of marketing. The acceptance levels of national level proposals, e.g., NSF, NIH, etc., are very low (approx 5%-10%). Thus, you need to make multiple attempts. So it is a good exercise to start writing proposals from your PhD studies. In most cases you will not get them accepted as a student, but the main aim is to start loving the task of writing proposals. My personal experience in this regard has not been great. As a problem solver, who mainly cherishes the moments when a problem gets solved, I did not like the task of selling something which I did not even start doing - I always thought that I was building castles in the air without any confidence. Thus, it took me a long time to appreciate the job of writing proposals. Well, I still do not like it a lot, but I think I am getting to the ‘love’ phase in a slow and steady manner.

XVI. THE NON-ACADEMIC LIFE

All work and no play makes Jack a dull boy - a well known proverb and true indeed!! I never wanted to be that Jack. Add to that the fact I am a Bengali (a social class in India), so, luxury, elitism, food, wine, and entertainment are all part of my upbringing. Los Angeles (LA) was a perfect platform to living my life-style and doing research at the same time. Clubs, bars, pubs, night clubs, beaches, mountains, casinos, movie trips, and most importantly the daily Starbucks evenings with some of my best friends at USC - I had a piece of everything, I like LA so much that I hardly ever want to leave this place. Apart from my outings in LA, I got a lot of freedom from my advisors and mentors to go around many countries in the world where I had great fun. These fun times and moments are what got me energized in times of boredom or when research was not going well. Yes, at times I overdid it, but its OK - I am not a robot. Thanks to all my lab mates (the brilliant discussion group in my lab that discussed everything apart from academics :) ) and MS friends at USC, and all other friends in Europe and Princeton with whom I had a fabulous time (especially on weekends), and who made my 5 years very memorable. I could have finished my PhD in 4 years without these moments, but I did not need a PhD in 4 years - I preferred a varied and interesting PhD life which I had to the fullest. A million thanks again to everyone from the bottom of my heart!!

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