# Advice for Graduate Students

September 2011, by Achim Kempf,

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## So you are a new graduate student

**First**, welcome to grad studies! Now, what is going to be different, compared to undergrad studies? Sure, you will continue to take courses and they will be somewhat similar in style to undergraduate courses. But other than that, everything will be a lot different!

I think the main new thing that you need to know is that now you will have to make mistakes, and better plenty of them. What? Yes, I know, for so many years you have been trained, and trained very hard, to avoid making mistakes at all cost. And of course, yes, in every one of our grad courses you are still expected to solve the given problems correctly and elegantly. But I am talking about research, one of your main new occupations. Especially if you are a Ph.D. student then research is your main occupation. You see, nobody can do research without making mistakes along the way. You need to be willing and yes, you need to be happy to make mistakes. Lose your fear of making mistakes. If you have an interesting idea, try it out even if you know very well that there is a good chance that it may not work out at the end. Try out a lot of methods, try out a lot of ideas. In other words, don’t just blindly go full steam ahead in one direction until you either reach a pot of gold or hit a wall, because the latter is more likely. No, take breaks, re-evaluate and allow yourself some playtime with your research topic.

One of the most important skills that a graduate student needs to learn is to be able to estimate how well a particular attempt is going. Is it worthwhile to invest more effort in my current attempt

or should I move on to another idea? You'll have to make such decisions, small ones and larger ones, all the time. The small decisions may be for example about how to try to solve an integral: for example, is it worth to continue trying analytically or is it time to go numerical for that integral? The large ones would be major strategic decisions about how to approach the overall subject of your research: for example, is it wise to continue trying to solve the problem in generality or should I spend time working out doable special cases that could give me intuition about what is going on in the general problem? Having to make small and large strategic decisions all the time can be a little scary and even frustrating at first while you are still not used to thinking on your own. But your successes, small ones and larger ones, will be all the more elating when some ideas start to work out!

Of course, there is always your supervisor to go to for strategic advice whenever needed. But really, grad studies at its best is about you eventually developing the skill to continually assess yourself how things are going and in what direction to go next. By the way, to this end, it is a good idea to keep trying to assess what you are doing from different angles. And, always be your own work's best critic: if something seemingly cannot be done with any methods you tried then try to show that it cannot be done at all. If things seem to go too well, try to show you made a mistake. If there's no mistake, examine how robust your results are under small changes. If you have a nice result, try to find out if it is a special case of something bigger, i.e., something more general and more exciting that you may be about to discover. I know this may all sound daunting. But that's why you are still a student. You are here, in large part, to learn these skills.

Indeed, these skills, along with the technical expertise and the communication skills that you will learn in grad school, are what make a graduate degree valuable, especially a doctorate. These skills, namely the skills to creatively, rationally and strategically think things through on your own, at a high level of sophistication, and with the ability to communicate your thoughts efficiently, are indispensable for a career in academia. And, these skills are also what can help you open the doors to the more fulfilling jobs and the higher echelons in industry. Okay, if you are a Master's student, relax, the expectations in this respect are not as high as those for a doctorate. The minimum achievement for a Master's thesis is that it delivers a professionally written, concise and thorough review of the scientific literature on a particular topic, including the description of a significant effort at critiquing that literature: at a minimum, describe the state of the art, work out examples in detail, and examine what further interesting things could be done in this context. For a Ph.D. thesis, however, it is expected that you are the main author of original results which reach approval by the scientific community, namely by being accepted for publication in respectable scientific journals and by being approved also by the external examiners in the Ph.D. defense.

**Second**, what is also quite different from undergraduate studies is that now you actually get paid. If you are not a self-funded student, we guarantee you a minimum income (within a time limit and while in good academic standing) that should cover tuition and the cost of living. For this, you have certain obligations. You are to take part in your supervisor's research program and you have to diligently fulfill certain teaching duties, such as marking or helping out in the tutorial centre. Sometimes, your teaching duties may be more, sometimes less. This depends

on the need for teaching assistants (TAs) in the faculty, on your supervisor's contributions towards your income and on scholarships that you may earn. By the way, all our graduate students are continually being considered for departmental, faculty and university merit scholarships. So to get any one of those you don't need to do any paperwork. Just do well. To get one of the major provincial scholarships (such as OGS) and federal scholarships (NSERC) you have to pursue an application yourself. Only these major scholarships are guaranteed to raise your income and to reduce your teaching duties. But the minor scholarships are also sometimes reducing your teaching obligations and they are always worth listing in your CV. Either way, in the Department of Applied Mathematics, under normal circumstances, no student should do TA duties for more than three courses per academic year. TA duties for one course encompass five hours of work per week for each week of the term, i.e., not only in the teaching period.

## 2. Graduate courses

**Which graduate courses to take?**

Depending on your program (Ph.D. or Masters), you will need to fulfill certain course requirements in order to be able to graduate, e.g., the breadth requirement: You will need to take a certain minimum number of courses out of a particular set of four courses.

- You are responsible for checking that you fulfill all degree requirements. Be informed! For the department of Applied Math, the rules are here: http://www.math.uwaterloo.ca/AM_Dept/grad/
- If in doubt, check with the graduate secretary or the graduate officer.
- Do discuss your remaining choices of graduate courses with your supervisor.
- Better do not enrol in more than 2 courses in one term. You will be very busy already with two courses, research and TAing.

**Plagiarism**

Sorry to bother you with this disclaimer since for most of you that's not a concern at all, of course. But universities have to take this issue very seriously and so I need to point this out: Yes, nowadays it is easy to cut and paste together an essay. But, when this is suspected, it is actually very easy to check for it. Did you know that if you put a few consecutive words of a plagiarized text within quotation marks in a Google search field, the original source will generally pop right up? Essays by your predecessors are usually not on the web, but we have them too to compare with. I wish I wouldn't have to say that.

**Academic integrity**

You are required to fully abide by all of the university's rules concerning academic integrity. Read them here:

http://uwaterloo.ca/academicintegrity/

**How to find good literature ? (for a course essay, or for your research)**

There are specialized search engines for scientific literature, such as Web of Science, available via the university library's web site. But also a Google engine called "Google Scholar" can get you to relevant papers quickly. In Google Scholar, try searching, for example, for a few technical key words along with the words "Review" or "Introduction". Most scientific articles are now available online and the engines will give you links to articles in electronic journals. Most journals require a subscription but the university library usually has it. For the subscription license to be automatically recognized you may need to browse either from a university computer (the domain is what counts) or you log into the library web site from home and go to an electronic journal through the library's electronic journal search engine. Many journal articles are available also on electronic archives such as arxiv.org. If so, you may want to cite the archive address as well, as a service to the reader who can use it to look up the paper also without subscription. Note though that the archive versions are often early versions that do not contain the fixes that went into the refereed journal versions. The scientific search engines also provide citation searches. When you find an interesting paper, use the citation search to find out which other papers have cited it and therefore probably followed up on it. Doing literature research diligently can get you ahead quickly in your research, and it can save you from wasting time duplicating what has been done already.

**What is expected in an essay for a grad course?**

An essay should be a review of existing literature on a given topic. The sources can be textbooks or review articles or original articles or some of each. All and everything that is used must be cited. However, **do not rely on and do not cite Wikipedia, ever**! What you saw in Wikipedia may not be what the instructor sees in there a day later. Wikipedia is useful, of course, and you are encouraged to use it. However, instead of citing Wikipedia, follow up the references to peer-reviewed publications that are hopefully given at the bottom of the Wikipedia article, read these publications, and then cite whichever of them you actually end up using. But don't cite the Wikipedia article itself - you might as well cite an anonymous casual acquaintance that you met on the bus.

When writing an essay, your task is to show that you have understood and critically reflected upon the material. You show that by creating an original way of presenting the material that you are bringing together. Try to give the material your own angle or spin. Wherever possible, try to put things into a larger context. Sometimes (hopefully very rarely and only for short stretches) it may be necessary to stick quite closely to a source, e.g., when a particular calculation is to be presented and the source does it in a way that is just hard to improve upon. In this case, you can show that you mastered the calculation by filling in a few nontrivial steps in the calculation that the author omitted. In this case, it is important that you point out at that place that you do so. And/or, discuss special cases, or possibilities for generalizations. Whenever you do go beyond a closely followed source, say explicitly that you are closely following that source and do point out when you deviate by filling in steps or by discussing special cases or generalizations. If you do not point this out, the instructor may miss your contribution and not give you credit for it. So do take credit where it is due.

In an essay, no original research results are expected. However, you are encouraged to include educated speculations about interesting things which could be done in this area. You have been a regurgitating undergraduate for a long time. This is an opportunity to show that you still have some creativity left! Show that you are thinking for yourself.

**Typical essay format, if not otherwise specified by the course instructor:**

- Length: 15-20 pages, pdf format
- Format: title+abstract page / motivation / main body / (summary or conclusions or outlook) / bibliography
- It is very important that you cite all your sources and that the bibliographic information is complete. All items in the bibliography must be referred to somewhere in the text. It is expected that you sort your list of sources in the

bibliography, for example, alphabetically by author name, or, e.g., in the same sequence in which you are referring to them in the text. If you look at papers from different journals you will find that there are different ways in which the citations in a bibliography can be formatted. Choose one format and stick with it for all of the bibliography.

## 3. Teaching assistantships ("TAing")

**What constitutes a TA job?**

- Typical tasks are strongly dependent on the course and may include:
    - Marking assignments,
    - Proctoring and marking tests and exams
    - Collecting assignments from drop boxes and distributing them to undergraduate markers
    - Recording marks
    - Holding office hours
    - Working in the Tutorial Centre or a Lab
    - Running tutorials

Let your supervisor know if you have strong preferences regarding TAing: do you prefer marking for advanced undergrad courses or do you prefer running tutorials for first and second year students? There is no guarantee that you can be assigned what you ask for but you improve your chances.

**How much work is one TA job?**

- A total of 80 hours over the full term.
- This means 5 hours/week on average over 16 weeks.
- Expect the work load to be unevenly distributed over the term, with a slow start and with peaks when the midterms and final are to be marked.
- If you feel that a TA job demands significantly more of your time than this, raise your concern with the instructor, your supervisor or with the graduate officer right away.
- If you absolutely have to miss TAing duties for some valid reason, try to find a substitute for those times among your fellow graduate students as early as possible and tell your instructor.

**Feedback:**

Feedback from students is collected on the performance of each TA. Those who come out on top are rewarded with 100$ prizes, and such an award also looks good on one's CV.

**How many TA jobs?**

- In the department of Applied Math, the maximum is normally two TA jobs in one term and a total of three TA jobs per academic year (September to August). You may volunteer to do more to earn extra money.

- Major scholarships (e.g., NSERC and OGS) provide enough funding to free the scholarship holder from TAing duties.

## 4. Developing communication skills

By the time that you first have to present at a professional conference, or for a job in industry, it is probably too late to start learning presentation skills. By that time you must have them. So do exercise your presentation skills as early and as much as possible. Volunteer to give talks in meetings of your group or in a group that works on related subjects, or at student conferences. Any type of talk is valuable, be it a general review, a journal club talk (i.e., a talk reviewing a particular paper), or a talk on your current research. Then, when you feel ready and have results to present, talk with your supervisor about possibilities for going to workshops or conferences. To develop strong presentation skills is not only important for one's career. The process of preparing a talk also often significantly clarifies details as well as the overall picture in one's mind.

Even powerpoint-karaoke, which is normally just for fun, can be useful, namely to overcome stage fright. In case you don't know: in powerpoint-karaoke, in front of a student audience, randomly chosen students present a randomly chosen powerpoint file from the internet for a few minutes, without preparation. It is usually hilarious. (Go ahead, organize a powerpoint-karaoke session with your fellow students. The grad officer will be happy to help you book a seminar room and projector.)

**Here is some general advice on how to prepare an inspiring presentation:**

* Do take presentations very seriously. Excellent or miserable presentations at

conferences and job interviews are known to have contributed significantly to the making and breaking of careers. That's how important it is to be able to communicate. Better use any opportunity to practice this skill!

* Good speakers give the impression of pursuing their craft effortlessly. It is the same with good violinists. Both require a lot of practice. You wouldn't want to be on stage with a violin without having practised. You shouldn't be on stage with a powerpoint file without having practised either.

* Maybe the most important advice is the following. Begin preparing your talk by asking yourself what three or four messages your audience should take away from your talk. Let's say someone missed your talk and then asks an audience member: "I missed the talk, what did the speaker say?". Then, what should the audience member reply? Is "Um ah, I guess it had to do with some kind of flow" good enough? No, you need to think beforehand about which three or four key messages your talk absolutely must convey. Then, once you know what these are, design your talk to be a vehicle to convey these messages. For example, the key messages could be of the form: 1. In the field of --- an interesting/important problem is --- because if we can solve that, then ---. 2. In this context, my/our approach is inspired by --- and consists of trying ---. 3. Using --- methods my/our key finds have been that --- and ---, overcoming the problem of ---. 4. This shows that --- is the case and it also indicates that trying --- would be very interesting because then --- could be achieved. The sole purpose of your talk is to make sure that the audience takes away your key messages. Design your talk accordingly. Some more concrete tips are further below.

* But first, I need to remind you that when you exercise your talk in the days before your presentation, also make absolutely sure that you can finish it in the allotted time! If you go over, this reduces your question time - and going over time is likely to annoy at least some in the audience. At a conference, talks usually get cut off beyond a certain time limit since else you would be taking away from somebody else's time.

* I would strongly recommended that, if possible, you repeatedly practice your talk in front of someone who will give you honest feedback. Even if they are not from the field they may be able to give you important feedback, for example about whether your voice is too monotone or whether your slides are too crowded.

* Keep in mind that good presentations are not about dazzling the audience with fancy powerpoint tricks and important-sounding acronyms. In fact, it is generally better to cut back on distracting gimmicks. Also, do not expect the audience to know or learn acronyms and jargon. Instead, good presentations impress the audience by engagingly communicating interesting ideas, problems and solutions. Don't hesitate to consult your supervisor regarding the best strategy or concept for your talk.

*Here is some more concrete advice:*

* You can usually assume that some audience members are not completely familiar with your particular topic. Therefore, always start your presentation with a brief sketch of the big picture in your field, explaining where, how and why your particular research problem arises. Also make sure that your terminology is clear. As mentioned before, don't ask your audience to learn jargon and acronyms. Keep it simple. Keep the focus on communicating the main messages.

* Don’t give a boring talk, engage the audience. To this end, structure your talk so that you create interest and anticipation in the audience. If at all possible, build some suspense. For example, you may ask a question and answer it, ask the next logical question and answer it, etc. Or, if your topic permits it, even ask a big question at the beginning, then remind the audience of the question every now and then, while building up to the answer (which may not be complete of course) at the end. Keep in mind that any audience will be much more receptive to an answer if they've heard the question first!

* Again, get your messages across! Whenever an argument has been carried to the end and you arrive at a conclusion: take a deep breath and do - spell - out - the - conclusion! Do not expect the audience to connect the dots in their minds. Remember that you should decide beforehand what you want the audience to take away from your talk. Remember, say someone arrives so late to your talk that all they hear is the applause at the end. Then that person may ask an audience member: what did I miss? Think ahead of time what you want this audience member to be able to say. The audience member should be able to quickly list a few key messages of your talk. If your talk is to be any good, you must succeed in getting at least these few messages across. So these key messages, when they come up in your talk, must be highlighted. To this end, when appropriate, feel free to use in your talk phrases like “if you want to take away one thing from this talk, it should be this: … …” Or, use a phrase like “ So finally, we arrive at ….. A key message of this talk is therefore that … …”. Do explicitly tell the audience repeatedly what you believe are the important bits to take away from your talk - and of course always tell them why these are the important bits. Your audience will greatly appreciate any such sign posting.

* Sign posting is especially useful before you are about to enter into a stretch with technical detail. If the technical details are hard to follow, the audience often doesn’t know what to do. They will wonder, should they make the effort of trying to follow the details, at the risk of the technical details not being important at the end. Or should they just use this time for an open-eyes nap? Most will opt for the second. So if you are about to show technical detail, what can you do? Easy: tell the audience beforehand why you are going to show the technical details. Is it the case that the details don’t really matter

and you just want to convey the flavor of the calculations? If so then say so before you start with the technical details and the audience will pay attention with the right attitude. If you show technical details because there is some technical issue that is a key to it all and that just has to be explained to understand the why, what and how of the matter, then say so beforehand and the audience will try to follow you.

* Colors can be a great visual aid but don't overdo it. Keep in mind that a significant percentage of males have trouble distinguishing red and green. Also, don't use too many fonts, i.e., avoid the "ransom note" look. The key purpose of the visual tools is to guide the audience' eyes so as to make the logical structure of each page and its message clear. Make sure that each page clearly *corresponds to* what you are saying at that moment.

* In fact, here is an often-overlooked but important point: Your talk's audio and visual should NOT complement another. Instead, the content of what you say and what you show should be the same. Why? Else, the audience would continually have to decide if they want to pay attention to what you say or to what you show. They would continually have to decide if they should listed or read. Nobody can do both at the same time. Quickly switching back and forth between the two is tiring and less than one in a million audience members enjoys this rapid switching.

* Avoid writing full sentences. Why? Again, reading them would distract from paying attention to what you say. In any case, full sentences are better said than read because the intonation that comes with the voice significantly helps one in getting the logical structure of a sentence across.

* Wherever possible, use graphs, tables, pictures, images or demonstrations. They can be very efficient ways of getting a point across.

* Try to make sure that there are never more than 12 lines per page (better fewer), counting equations too. If you know ahead of time that the room is large and that there will be people far from the screen, use a larger font and fewer lines per page. It sounds little, but more lines than that usually make a page look too crowded.

* Avoid speaking in a monotonous manner, obviously. At the same time, keep colloquial expressions to a minimum, i.e., expression such as "like", “you know”, "pretty much", “sort of”, “kind of”, or "anyway". They serve no purpose and only make the speaker sound insecure and/or unprofessional. While it is important to avoid using such terms, this can be a little difficult at first. The reason is that one easily uses these terms in talks without even registering that one does. That’s because, in presentations, these words tend to slip out as fillers which buy you time while your mind is busy trying to find the right words to explain something. The cure is to diligently exercise one’s talk beforehand in order to make sure that one has all the right formulations ready for one’s explanations. Remember that if a great speaker’s talk comes across as effortlessly

excellent, it’s likely for the same reason that a violin player’s performance may come across as effortlessly excellent: they probably practiced a whole lot!

Equipment:

* Chalk-on-blackboard presentations are okay in informal settings but you cannot do this at conferences or in a business setting, because of the short time available. You'll need to learn using electronic means for presentations at some point anyway, so better start early than late. Powerpoint is better for graphics and LaTeX/Beamer is better for equations.

* If you plan to use your own laptop, best make sure that minutes before your talk you have your laptop all fired up, the presentation software running etc, so that it is a mere plug and play with the data projector. At conferences, I've seen speakers waste time arguing with their computer and eventually being cut short by the chairperson, with the effect that at the end they were not able to get their message across. That's too bad. If you have to use a provided laptop, it is usually best to export your presentation in pdf format with the fonts included. Else, you run the risk that the provided laptop’s software installation formats your slides differently, and may not even have the fonts for equations that you use.

## 5. Lecturing

Our Ph.D. students in Applied Mathematics normally teach one course, usually calculus. If you are a Ph.D. student, discuss with your supervisor in which term you would like to do this.

## 6. Collaborations

Most of the time, students collaborate with their supervisors, often with the supervisor providing project ideas and technical advice and with the student doing the heavy lifting in the form of lengthy calculations and or coding. While this traditional setup tends to be productive, more advanced students, and especially Ph.D. students, are encouraged to take on increasingly creative and proactive roles.

Indeed, highly ambitious students may eventually want to consider publishing also without the supervisor as a collaborator. Especially a single-author publication, while not necessary, can be quite helpful for one’s career, if the paper is good. There is a very high risk though that you may underestimate the difficulty or the amount of time it takes to finish a project alone. So if you feel that you have a fresh idea that you can bring to fruition on your own then you are encouraged to pursue it. However, if you want to embark on such a project, do let your supervisor know right away. On one hand your supervisor needs to know what you spend significant time on - because your supervisor has a responsibility to see you succeed and graduate in due time. On

the other hand, your supervisor can advise you as to the feasibility of your project and about strategic issues such as which journal to aim for, what that journal is looking for, and how to communicate with editors and referees.

**Give credit where it is due!**

Assume you are in the process of writing a paper, either alone or with others. Then, what do you do if you receive an unexpected informal contribution to your paper? Say you talk about your paper before you publish it, e.g., over coffee in the lounge or in a group-internal seminar, and someone in the audience makes a good point that improves the future paper. If the point is major, say it shows and fixes a major flaw in your work, or it answers a key question that you were struggling to answer, then you should invite that person to become a co-author. If that person's contribution to your subject is an important observation but you won't actually follow up on that observation in your paper, then you can proceed like this: within the body of your paper, mention the observation while giving honest, i.e., unambiguous, credit for it to that person, and then cite them in the bibliography as "[23] A. Name, private communication".

Proceed similarly if someone makes a contribution that is minor. In your paper, give explicit credit for the point in question to that person, citing them in the form "[12] J. Doe, private communication".

Finally, if you benefited from general advice regarding your paper, for example, if someone pointed out a valuable reference, it is good style to express thanks in the Acknowledgments.

## 7. Thesis writing

Try to keep a typed-up log of your research progress. This will help you later when writing up your thesis. Also, and perhaps more importantly, the process of putting results in a clearly written form forces one to rethink, and this can inspire significant progress. Once you start writing up your thesis, show early versions to your supervisor. Supervisors don't help in the writing but are to check that things are on track. Also, it is important that Ph.D. students are not distracted too much while writing up their thesis. For this reason, there is competitively-allocated funding to free Ph.D. students from teaching duties in one of their last two terms. If you are a Ph.D. student, keep this in mind and consider applying for this funding in time.

## 8. Advice and Counsel

**In case of serious problems:**

If you have any concerns, questions, suggestions or problems that could impact your success in your graduate studies, better do not let them linger. Ask your supervisor or the grad officer

for advice early on. Also, the university has a counseling office in Needles Hall (phone extension: 32655) for all matters academic and non-academic. Inquiries are of course treated confidentially.

**In case of language problems:**

Renison College (which is right here on Campus) offers very valuable English language courses for foreign graduate students. The courses ESL601 and ESL602 are free for UW graduate students. Don't let a language barrier unnecessarily hold you back!

**In case of computer problems:**

The machine on your desk is probably maintained by the Math Faculty Computing Facility MFCF (or CSCF) which has a help desk on the third floor of the MC building.

Things to do with the internet and software licenses tend to be managed by a central unit of the university, which is called "Information Systems and Technology" (IST). The IST has an office in the basement of the MC building.

Obviously, do not misuse your computer and internet connection for significant non-academic matters or even illegal matters. For example, we have seen copyright lawyers threatening students and don't want to see that again. Also, the MFCF and IST are automatically monitoring internet traffic and they sometimes notice that a user's computer is virus infected before the user notices it. If you have a PC on your desk, do keep it updated and clean.

**In case of time pressure:**

To avoid running into time pressure, try early on to develop good time management skills. They will serve you well throughout your career. In principle, it is simple: make rough schedules for various time scales and make sure they are realistic. The hard part, of course, is sticking to one's plan. On a deeper level, notice that there two different kinds of tasks that require your attention and balancing the two kinds is a difficult task. One kind of task is the "urgent task". For example, an urgent task could be having to mark and hand in a pile of midterm exams by tomorrow at 1pm, buying food, or getting news from a friend. And then, there is the other kind of task that require your attention: the "important tasks". An important task would be, for example, to find out, as part of your research, what is known about the discrete Legendre transform in the scientific literature, because you have a hunch that something in this area may be known that could help you with a numerical part of your research. Now a common pattern is that people (not just students) are continually busy doing urgent tasks, while neglecting the important tasks. The important tasks thereby get further and further postponed. What to do about it? Be aware of the problem and then schedule time for the important tasks too - and stick with it.

Still, in practice, many students are under time pressure at some point, for example before an exam or when writing up their thesis. This is where, often, coffee comes in. Maybe, in a time

pressure “emergency”, you may want to use coffee to temporarily beat sleepiness. But if so, be aware that you could easily blunt that weapon by overusing it. In fact there are very good reasons not to make a high caffeine intake a regular habit. Your body adjusts within days to weeks to your caffeine intake (by increasing the number of certain receptors that the caffeine blocks). Once the body has adjusted to your regular caffeine intake, your normal caffeine intake will then no longer do your alertness any good whatsoever. Your regular caffeine intake then only restores you to your normal level of alertness that you would have if you never used caffeine. Sure, as soon as you reduce your caffeine intake, your body will start to recalibrate its neurotransmitters to the normal state. Therefore, in the longer term, probably no harm is done. However, it takes your body a week or two to recalibrate its neurotransmitters to the normal state, during which time you can feel rather miserable. Many don’t know that caffeine withdrawal can be rather bad and that for example getting tension headaches is just one of the symptoms. That’s because through regular caffeine intake your body becomes tuned to perform normally when it has caffeine, i.e., it is tuned to under-perform without it. In other words, the popular idea that mathematicians are machines that turn coffee into theorems is an unfortunate myth. Caffeine just doesn’t help in the long run. It’s just an addiction. Here is a recent scientific study which shows that there are no two ways about it:

http://www.nature.com/npp/journal/v35/n9/full/npp201071a.html

So again: caffeine intake only restores your alertness to the level that you would have if you never took caffeine in the first place. Besides, plants produce caffeine for a reason and it is not pretty: plants only produce caffeine because it is a natural pesticide. If you wish to help your concentration, better do something healthy that actually helps, perhaps eating nuts, performing sports or trying mindfulness meditation - all of which are available on campus.

## Finally, when you are about to graduate...

UW’s Career Services offers advice and runs information sessions about how to apply:

http://www.careerservices.uwaterloo.ca/

### Duration of grad studies and academic careers versus careers in industry

Is it advisable to try to go through graduate studies as fast as possible? That depends. If you are heading for a career in industry, then yes. Employers prefer fast students since they assume that once employed they will probably work fast too. So if you are heading to industry you may want to go through grad studies fast. This means that if you want to earn a Ph.D. before going to industry you may try to transfer after one year of Master’s studies directly into the Ph.D. program. If you pass the transfer exam, the first year of Master’s studies will retroactively count as the first year of Ph.D. studies. In this way you may be able to earn a Ph.D. as early as four

years after the Bachelor's.

Now if you are trying for an academic career then you need to know that a Ph.D. will be necessary and, importantly, that the exact number of years you spent in graduate school will not matter much (within limits, of course). What matters to hiring committees in academia is what you published. And in order to build up an impressive publication record it is advisable to allow oneself some time. So you may want to use the normal two years of Masters studies and the normal four years of PhD studies. If it turns out that you can achieve your research goals faster then you can always speed up graduation.

Also, notice that while industry may hire you at any time in the year, universities (in the northern hemisphere) tend to run competitions for postdoctoral and professorial appointments mostly from November to March. These academic jobs usually have start dates half a year later, mostly between the following August and October (i.e. the deadlines and start times are pretty much like those for grad school applications). So if you are a Ph.D. student trying for an academic career, you need to plan ahead. The ideal schedule is to apply for a postdoctoral job in the fall, graduate in the following summer and hopefully start a postdoctoral research job at the end of that summer. Also, look out early for the deadlines for postdoctoral fellowship applications. They can be all over the year.