How to write a grant proposal

How to enjoy writing a grant proposal

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The main points

- You have already written successful proposals (or you wouldn't be here! :)
- Writing a grant proposal is an opportunity to focus on your goals, get your thoughts organized, and put your work in context. It can substantially help you move forward.
- Use it as a chance to communicate with your supervisor.
- It is not that different from preparing a talk or writing an introduction to your thesis or paper, but is more comprehensive.
- It is about mathematics; not about you.

Good writing in general

- **Overall structure**
  - Imagine your audience.
  - Think carefully of the goals.
  - Keep it organized: Sections, subsections, subsubsections, paragraphs.
  - Each paragraph explains one idea (or a collection of very closely related ones).
  - Decide what is important to say.
- **The writing itself**
  - Do not start sentences with a mathematical symbol.
  - Common problem: sentences are too long. Any new thought merits a new sentence.
  - Italicize the terms you are about to define.
  - Avoid *more* `than` one kind of *emphasis*, and do not overuse it.

Credits:

- Francis Edward Su (president of MAA at the time) “Some Guidelines for Good Mathematical Writing”.
- My Ph.D. supervisor, Thomas C. Hales.

The timeline

This is actually an absolute "last-nimute" timeline!

1. Months in advance: Think of your mathematics. Read about the context. Ask questions. Enjoy! Get a template for the proposal (preferably from a faculty member, not a peer).
2. $\geq$ 2 months before the deadline: Start the file, state precisely the main result(s) you aim for. Discuss with the supervisor.
3. $\geq$ 1.5 months before the deadline: Have a complete draft, and run it by the character count. Discuss with the supervisor. Try the website and make sure you can get through the obstacles in it.
4. $\geq$ 1 month before the deadline: Complete and polish the draft, give it to your friend (?), then to your supervisor for feedback.
5. Expect that there will be lots of changes needed, maybe complete restructuring.
6. the last week before the deadline: Polish.
7. A couple days before the deadline: submit. Do not leave till the last hour!

What happens if you start late? – You will enjoy it much less. You will probably still succeed. Your supervisor might be upset. None of it is the end of the world. Do not punish yourself.

The sources of panic

- CCV (Canadian Common CV). Cannot even start p.2 of it because it doesn't know that UBC exists: drop-down menus. Many phone calls and emails later, one discovers that it is The University of British Columbia.
- Character count on NSERC pages doesn't agree with most online character counts. Leave room for error in your drafts.
- It doesn't tell you but it has line limits in many text-input windows.
- Be clever about notation – sometimes the input is text-only.
- The margins!!
- The time zones: sometimes if you leave it till midnight, it turns out the deadline was midnight in Europe...

Your audience

- Write for the reader who does not want to read it. Your goal is to make them want to read it.
- Assume your reader is unfriendly, and will challenge every sentence.
- The first paragraph or two is for mathematicians far from your research area, to help them get a sense of what you do.
- Assume that there is at least one expert on the panel who knows a lot about your area and more than you do about your problem.
- Even so, they do not know your thoughts and are not familiar with your notation; assume the expert has not been thinking about this type of question for at least 10 years. Remind them.
- Many mathematicians read till the first error. Be precise and do not say things you do not understand.

Organization

- Appreciate the character count! It forces you to decide what is important to say, and organize.
- What is your main (proposed) theorem?
- What is the minimal set of things you need to define to state it?
- What was known before your theorem?
- What are the possible/known applications of your theorem?
- What are the open questions?
- Why do we care about this theorem?
- What is the main difficulty in proving it?
- What are the your special tools you expect to try to use to overcome the difficulty?
- Be clear about: what was known before, what you just proved, what you propose to prove.

Do's and Don't s

- Do give a brief overview if possible (often required) for a mathematician outside the area. This helps the experts pick the proposals to review.
- Do not insult the reader:
  Avoid "Number theory is an extraordinarily important area of mathematics, going back to Pythagoras, and with such seminal achievements as the proof of Fermat's last theorem by the genius of Andrew Wiles. My proposal will advance Number Theory...".
  Something like "Proposed research aims to contribute to our understanding of diophantine equations using the tools of algebraic number theory..." is likely to suffice.
- Do make a clear list of goals early on. Do not be afraid to use bullet points, numbered lists, etc.

Choosing words

- Be mathematically precise; you might not be able to include full detail, but do have theorems, definitions, open questions, etc. stated precisely.
- Think carefully about notation: use simple clear notation that helps make the document shorter and more readable. Avoid too many subscripts, superscripts and technicalities, but do not compromise the truth.
- Be honest: if the theorem is not in its final form, call the statement 'approximate', 'projected' or something, but make sure you indicate that you do not yet know what the correct assumptions are (e.g., "for p large enough, though we have not yet optimized the lower bound on p").
- Avoid non-mathematical judgemental adjectives such as 'seminal', 'important', 'stunning', etc. If you are referring to someone else's work that laid the foundation for the area, say 'foundational' or 'classical'. If you need to comment on someone's ingenious proof, say just that, and apply the adjective to the proof, not the person.
- Avoid judging your own work or proposal within it, e.g. say 'we propose to prove the following theorem, and develop its applications to X, Y, Z" rather than "we propose to prove the following important theorem". 'The importance of the result lies in ...' is fine.

The biggest obstacle

P R O C R A S T I N A T I O N / feeling stuck

Quiz: why do I procrastinate

(a) I am a lazy person

(b) I am terrible at doing things I do not like

(c) This grant is just stupid paperwork, I'd rather be doing math

(d) The right answer: We are human, and have emotions! Just recognizing it helps a lot. Do not punish yourself! Instead, recognize that the prospect of being evaluated triggers complex emotions. This is normal. Remind yourself that these emotions are OK but for now you have to just start organizing your thoughts about the proposal.

- **Bad news**
  - Humans are terrible at evaluating themselves.
  - Imposter syndrome (very contagious, increases with every success)
    - "this time they will see I am just faking it"
    - "My friend started working on it 2 months ago! He/she is a real mathematician, I am not".
  - Insecurity
    - No-one cares about my project, why would they fund it?
    - X, Y, Z are applying too, and their research is much better than mine.
    - etc.
- **Good news**. You do NOT need to evaluate your grant proposal. Leave it to the panel!

How to support each other

An imaginary dialogue:
– You look awful!
– Stayed up all night writing my NSERC proposal, I am in a panic.
– And did you finish it?
– Not even close, I am having a hard time just figuring out the structure.
– OMG, poor you! I got mine done last week. Do you want to see it to help you?

Do you agree that the variations on the last line is the response we sometimes get but it is the opposite of helpful? I think we need to make sure we do not do this (even though well-intentioned). If someone does this to you, give them feedback “This was not very helpful". A much more helpful response:
– I have a few minutes right now. Do you want to tell me about your main result to help you organize your thoughts?
The point: distract the person from the abyss of anxiety, coax them back to thinking of the math.