FRIENDLY ADVICE ON GRADUATE SCHOOL APPLICATIONS FOR DOCTORAL ADMISSIONS

> **Disclaimer.** The contents of this document are compiled purely for academic purposes and intended to help graduate school applicants seeking doctoral admissions. Nothing written here is "correct" in any absolute sense and is based on my experiences as an applicant.

Contents

I. CURRICULUM VITAE - CV

Your CV represents your accomplishments and experience as an academic and helps to establish your professional image. Most importantly, *follow the conventions of your field!* Different academic disciplines have different standards and expectations, especially in the order of categories. Check out CVs from recent graduates of your department, and others in your field, to ensure you are following your field's norms.

1. There is no single best format. Refer to samples for ideas, but craft your CV to best reflect you and your unique accomplishments.

2. As far as text-styling is concerned, do not use more than **three** colors in the entire document, a rule-of-thumb is : one for the general body, one for tag texts/thematic phrase texts which require subtle attention like venues, institute names etc. and lastly one for links.

3. Stick to a common font, such as Times New Roman, using a font size of 10 to 12 pt. Use highlighting judiciously, favoring bold, ALL CAPS, and white space to create a crisp professional style. Avoid text boxes, underlining and shading; italics may be used in moderation.

4. The resultant CV should not look cramped with information. A good practice which often proves to be very helpful is to first make a master Resume with all the informations and details included, with proper styles/formatting. And then edit it to get it trimmed to the appropriate size version.

5. Keep locations, dates and less important information on the right side of the page. The left side should have important details like university, degree, job title, etc.

6. Be strategic in how you order and entitle your categories. The most important information should be on the first page. Within each category, list items in reverse chronological order.

7. A CV created using LaTeX, almost in all cases, appears more professional than the same CV made using any other text formatting software. Overleaf has an abundant collection of tex templates of CVs, but for applicants in STEM (especially for math majors) it is recommended to come up with personal tex projects. The .tex preambles in this repository might come handy!

8. It is okay if you do not have significant projects and experiences to fill up your CV, but do not fill it with irrelevant information or out-of-context jargon. Do not include any material in your CV which is untrue! Furthermore, it is equally important to not put any experience or information which cannot be verified or has absolutely no robust documentation. Your CV may get no more than thirty seconds of the reader's attention, thus it is not prudent to present points leaving the reader with no option other than believing you at face value.

9. Although it is not official, most academic committees use an algorithmic setup to cut CVs and resumes to two pages per document. To be on a safer side, do not make your CV to be of more than 2 pages. Pair this point with point 4. mentioned above.

10. A pattern which I have seen in almost all the professional CVs is the mention of relevant referees along with their contact details. It is an unwritten non-negotiable in academia to compose resumes.

11. Do not use personal pronouns (such as I) and avoid full sentences. Abbreviate in a sensible manner and use appropriate action verbs while lisiting details. Most importantly, use a narrative style of writing

Tip. Personalisation of the details presented in your CV with respect to the 1. position you are applying for; 2. the lab/research group you intend to join; 3. the researcher or the professor you wish to work under, is a subtle yet effective advantage you can have. Do a background check of the department you are applying to and craft your CV accordingly. The point to be noted is that, your CV should subtly answer *why the department/ the research group or the professor should hire you?* Tailor your resume to the type of position you are seeking. This does not mean that all of your experiences must relate directly, but your CV should refect the types of skills the employer would value.

Sample. The full-professional resume/the master CV, which I have looks like [this pdf], and can only be accessed if someone visits my webpage. It is meant for a general audience in the internet. However, one of the targeted CVs which I used during my grad school applications back in 2025 is [this pdf]. Please feel free to compare them and take a note of the all the differences they have.

II. STATEMENT OF PURPOSE - SoP

Your Academic Statement of Purpose or SOP is a writing sample and a part of the screening process. By putting your best foot forward, you can increase your chances of being interviewed. A good way to create a response-producing SOP is to highlight your skills or experiences that

are most applicable to the job or industry and to tailor the letter to the specific organization to which you are applying.

Note that each document in your application should stand alone, telling the same story in a different way. For example, the CV lists all of your academic accomplishments, while the cover letter will emphasize the most important and relevant parts of your background. The letter should not read as a CV in prose, and should summarize and encapsulate the points you expand upon in your research statement and teaching statement. Allow your professional voice to shine through in your writing to express your sincere enthusiasm for your work and the confidence that you are the best candidate for the particular position, department, or institution.

1. First and foremost, write like a child and edit like a scientist! Begin with telling the story/fact about your academic journey which you otherwise are afraid of sharing. At this stage, do not bother about the size the content volume.

2. Continuing from the above, edit your essay with keeping the most precise and the most creative outlook in your mind. *An essay devoid of grammatical, punctuation and spelling errors is the bare minimum!*

3. Although it is not official, but most of the academic committees have algorithmic setup to cut SOPs and Cover Letters to 2 pages of a single document which follows a 11pt font size or above. To be on a safer side, do not make your SOP to be of more than two pages and use at least an 11pt font size. Use a standard font prevelant for official purposes - **do not** use Comic Sans!

4. Try to use a narrative style of writing tailored for the research group you are intending to join. Include graceful transitions between paragraphs, something that is often difficult to achieve.

5. Put yourself in the reader's shoes. What can you write that will convince the reader that you are ready and able to do the job? Do not use repetitive words.

6. Reference skills or experiences from the research descriptions of your target research group/lab and professor. Additionally, draw connections to your credentials mentioned in your CV.

7. While you may be tempted to use a generative AI tool to compose your letter, be deliberate and specifc with your prompts. Remember to edit the results carefully and add your own voice/style to the letter. It is notable that contemporary generative AI systems exhibit a poor balance in word usage, in particular, words like 'complex' and 'creative' will directly imply that you have used AI *mindlessly*, even in cases when you have not! *That is sad, but true.*

Tip. One of the most underrated facts in general as a student is that, it is not just your strengths which give shape to your academic identity. Rather, it is the unique blend of your strengths and weaknesses which makes your identity standout. A feature of advantage is to include and describe how you manage when your academic/ research plans go south. *how do you overcome your limitations in situations of adversity?*

Sample. One of the academic SOPs which I used during my grad school applications back in 2025 is provided next. Kindly note that, the document was made using LaTeX preamble from this repository, and the format specifications were: `font size - 11pt`, `margins - left=1.7cm, right=1.7cm, top=1.7cm, bottom=1.7cm`.

III. SAMPLE SOP - Mathematics PhD application 2025

> **Disclaimer.** Although shared exactly as the actual document, with some minute changes in proper nouns, the intent is to guide. It is highly recommended that the reader absorbs the salient features and learns from this sample to improve their skills rather re-produce the exact writing style.

SHUBHAJIT DEY
Academic Statement of Purpose

September, 2025

Dear Member of the Admissions Committee,

I am applying for a PhD position in the Department of Mathematics and Statistics at Princeton University. I recently served as a Teaching Fellow (Head) in the Computer Science Department at Ashoka University, New Delhi, and I completed my BS-MS dual degree in Mathematics at IISER[1] Bhopal, with a minor in Data Science and Engineering.

Throughout my academic journey, I have embraced the conviction that mathematics is not merely a discipline but the universal language uniting all sciences. From securing admission at IISER[1] Bhopal through a competitive nationwide examination to completing my Master's thesis titled "Theoretical and computational considerations of Sturm-Liouville systems", I have steadily pursued mathematics as my long-term career path. Looking back, I recognize that it was not a single defining event but a series of transformative moments that shaped my trajectory. One such turning point was the Real Analysis course in the fall of 2021, which transformed how I engaged with mathematics, moving from a mechanical problem-solving approach to one that welcomed abstraction. Inspired by this shift, I undertook a research internship out of sheer curiosity, which explored theoretical aspects of Taylor series alongside their computational applications. This early exposure to approximation theory, at the intersection of analysis and computation, sparked a lasting curiosity in the mathematics behind numerical methods and their impact in practice.

Subsequent projects allowed me to deepen this interest and broaden my skills. I was particularly drawn to the advances in approximation theory through the perspectives of topology and geometry. The targeted design of projects I did, prepared me to get trained and make meaningful contributions through the best of both disciplines, theoretical and computational mathematics. By the time I was beginning the final year of my degree, I had chosen my master's thesis to be based on rigorous analysis on a certain class of differential operators, chosen for their frequent appearance in modelling physical phenomena. As my intuition matured, I turned towards the analytical theories that underpin state-of-the-art numerical methods for ordinary and partial differential equations, with a focus on spectral and pseudo-spectral techniques. This project ultimately became a natural extension of my earlier explorations, while also laying a foundation for future directions. One such prospective line of research is to investigate the role of the eigenvalue spectrum of the Helmholtz eqn in $\mathbb{R}^3$ in shaping the convergence analysis of spectral methods used to solve it. My thesis was commended by my supervisors at IISER Bhopal and was awarded the highest grade (A) for the same.

Having said these, I also firmly believe that a blend of both, my set of strengths and my set of weaknesses, carves me out as a unique individual pursuing academics. For instance,

despite extensive training, I could never approach algebra with the same artistic sensibility I bring to analysis. Interestingly, this trait proved beneficial during my MITACS GRI project at UQAM[2]. The project demanded the use of algebraic geometry to address problems in optimization under uncertainty. Instead of exploring algebra aesthetically, I applied it pragmatically during the project and hence could successfully study links between two distinct areas : computational algebraic geometry and optimisation under uncertainty. Due to my inherent drive of curiosity and perseverance, I was able to overcome the subtle knowledge gaps and thus could meet the necessary interdisciplinary demands of the project. My contributions laid the theoretical foundations of the approach we pursued, and the work is expected to lead to a scientific publication soon.

My teaching experience has been equally formative in shaping my academic development. Over an academic year as a Teaching Fellow in the Computer Science Department at Ashoka University, I conducted tutorials, held office hours, and prepared and graded assignments and examinations. In the Monsoon 2024 semester, I supported the QRMT course, which introduced freshmen to abstract mathematics through set theory, propositional logic, and sequences-series. In the Spring 2025 semester, I was appointed Head Teaching Fellow for 'Discrete Mathematics', taken by sophomores pursuing Computer Science majors or minors. Although offered through the Computer Science Department, the course emphasized core mathematical foundations, including theory and applications of predicate logic, proof methodologies, discrete probability, graph theory, and combinatorics. The experience reinforced for me that effective teaching combines clarity with accessibility, and that inclusive pedagogy is vital for a thriving academic environment.

After the Spring 2025 semester, I was offered the position of Head Teaching Fellow for the graduate-level 'Programming Languages and Translations' course. While I valued this opportunity, I chose instead to take a sabbatical from teaching in order to consolidate my mathematical foundations and align my efforts with long-term research goals. During this period, I undertook a structured self-study of 'Linear Partial Differential Equations: Analysis and Numerics' course (MIT OpenCourseWare), which provided rigorous exposure to both theory and numerical methods for solving PDEs. Building on insights from my Master's thesis, I further explored spectral methods, particularly the use of orthogonal expansions in designing stable and efficient numerical schemes. I subsequently completed 'Numerical Methods for Partial Differential Equations' graduate-course (MIT OpenCourseWare), which clarified the role of approximation theory in scientific computing. The following directions form a basis for my current research interests:

1. [**Analysis on ODEs/PDEs for their computational/numerical solutions**] Based on my background, I have grown interests towards functional analysis on ODEs and PDEs which are fruitful for developing numerical algorithms and computational schemes for solving them. In particular I have an inclination towards spectral Fourier-Chebyshev methods and convergence theory of adaptive mixed finite element methods.

2. [**Continuous optimisation**] Also, motivated from the concepts involved during my MITACS project and my formal training for my minor, I have started to explore the field of optimisation over continuous domains which are crucial from the perspective of deep learning. In particular, I have dedicated my attention towards optimisation over manifolds and their applications in developing better gradient descent optimisers.

3. [**Approximation theory**] Theory of convergence of orthogonal exapansions crucial for developing efficient numerical/computational schemes for solving differential equations.

Mentioning lexicographically, I believe that my current research interests align well with that of Dr. Albert Einstein and Dr. Kurt Gödel. Over and above the aforementioned directions of research, I would also like to participate in some of the advanced graduate courseworks at Princeton before finalising a topic.

What draws me towards the Mathematics and Statistics Department at Princeton is its strong focus on research in applied mathematics, particularly in areas which blend theoretical mathematical analysis with advanced computational methodologies. Additionally, I am also motivated by the prospect of joining Montréal's vibrant and distinguished academic culture, which I first experienced during my internship. My academic journey from Bhopal-Montréal-New Delhi has fostered productive partnerships across academic cultures. I see the doctoral program at Princeton as a unique opportunity to engage and contribute further to the Canadian research culture, building lasting collaborations. I am excited about the research, teaching and learning prospects at Princeton. Thank you for your time and consideration.

Sincerely,
Shubhajit Dey, BS-MS
Mathematics major · Data Science & Engineering minor
Indian Institute of Science Education and Research, Bhopal
[Short CV] — [Homepage]

Tip. Avoid flowery language. Remember that, despite several parts and requirements in an application, your SOP remains to be a very important part of it. Often times, it is the first and the single chance for you to present your academic self to the recruiting entity. *You never get a second chance to make a first impression!*

IV. LETTER OF RECOMMENDATION - LOR

1. The crux of any LOR is to support your candidacy and provide clarity on your ability to undertake advanced studies in the intended area of interest. It is not prudent to aim that your referee writes things about which can be fetched from your other documents like transcripts. For example, you would not want an LOR mentioning you did/do your assignments and homeworks on time OR you performed well in a particular course in college. Ideally, your referee must be able to describe your intrinsic academic qualities/details which cannot be fetched otherwise. For example, how you tackle challenging problems, or the quality of research aptitude in general. **Hence, you should prioritise referees who have supervised you in projects, thesis or multiple thematic elective yet relevant courseworks instead of just a single madatory course from the curriculum.**

2. The requirement of LORs is an inevitable component of your grad school applications. Furthermore, in many places LORs are considered to be an important criteria of compentancy, rather than a minimum eligibility criteria. I have personal experience of referees being unprofessional while writing LORs, even when situations where dire for me. **Hence, use all your discretion before selecting your referees, and not after the job is done.**

3. You might consider describing the project/programme or the works of target research group to your referees in order to aid them. **However, do not share your exact SOP for this purpose.**

4. It is your responsibility, and yours alone, to keep track of application deadlines. Without the minimum number of LORs submitted within the appropriate deadlines, your application would be considered incomplete and won't be processed. **Hence, reach out to your referees well before deadlines, giving them sufficient time to write fruitful LORs.**

V. Additional Resources

Over and above the contents presented so far, please consider refering the following resources to get further help!

1. Undergraduate Resource Series, Mignone Center for Career Success, Harvard University Faculty of Arts & Sciences. [pdf].

2. Graduate Student Information Services, Office of Career Services, Harvard University. [pdf].