

# A Fancy Thesis Proposal Title

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**Abstract**—Define the research area (which particular area are we focusing?); A statement of the problem and why it should be solved; Reference to and comments upon relevant work by others on the same or similar problems; The candidate's ideas and insights for solving the problem and any preliminary results he may have obtained; A statement or characterisation of what sort of solution is being sought; A plan of action for the remainder of the research;

**Index Terms**—Latex, Thesis, Template, Proposal

## I. INTRODUCTION

The introduction should lead the reader to the work you've done and you're planning to do. You should start with general statements and then get close to the core (zoom in). Every computer scientist should be able to understand what is paper is about. The introduction should follow the same structure as the abstract; but this time you should spend one paragraph for each item.

A statement of the problem and why it should be solved. Exactly focus and identify the problem. Identify both: the particular problem and the foundational/global issue (area). Identify the fundamental theoretical and methodical principles. Show the context. Why should someone care? Identify the rough objectives. Exactly identify the assumptions. Formulate theses. Why should the issue be solved? Are there real examples?

Motivation: broadly, what is the problem area, why it is important? Open up the subject (the subject will be electromagnetic fields in cylindrical dielectric geometrics, adaptive arrays in packet radio, or whatever.) Introduce problem, outline the solution; the statement of the problem should include a clear statement why the problem is important (or interesting). Avoid stock and cliché phrases such as "recent advances in XYZ" or anything alluding to the growth of the Internet. Be sure that the introduction lets the reader know what this paper is about, not just how important your general area of research is. Readers won't stick with you for three pages to find out what you are talking about. The introduction must motivate your work by pinpointing the problem you are addressing and then give an overview of your approach and/ or contributions (and perhaps even a general description of your results). In this way, the intro sets up my expectations for the rest of your paper – it provides the context, and a preview. Repeating the abstract in the introduction is a waste of space.

Why is it interesting and important? Why is it hard? (e.g., why do naive approaches fail?) Narrow down: what is problem you specifically consider? Describe the problem addressed in this paper.

Survey past work relevant to this paper. Why hasn't it been solved before (related work)? Or, what's wrong with previous proposed solutions? How does mine differ? Reference to and comments upon relevant work by others on the same or similar problems.

Describe the assumptions made in general terms, and state what results have been obtained. This gives the reader an initial overview of what problem is addressed in the paper and what has been achieved. The candidate's ideas and insights for solving the problem and any preliminary results he may have obtained.

What are the key components of my approach and results? Also include any specific limitations. "In the thesis, we ...": most crucial paragraph, tell your elevator pitch: How is it different/better/relates to other work? What are the key components of my approach and results? Also include any specific limitations.

A plan of action for the remainder of the research.

The main contributions of this thesis will be...(to help the reviewer to get the scientific surplus value between all the motivation and basics).

The remainder of this proposal is structured as follows (based on [1]): In Sec. II the particular and the fundamental problem is identified in detail. Subsequently, the historical development of the subject, relevant work by others, the most important stances in the literature, and a summary of the gap in the field are given in Sec. III. Based on this knowledge in Sec. IV both the approaches and considered methods for solving the problem are discussed. The preliminary results, a short summary of results that are expected from the research and the characterization of what sort of solution is being thought are given in Sec. V. Furthermore, in Sec. VI a plan of actions for the remainder of the research, the major milestones, and the planned publications are given. Finally, in Sec. VII a rough outline of the thesis itself, in terms of the expected solution to the problem, is shown.

## II. PROBLEM STATEMENT

The first obvious thing which a thesis proposal should contain is a statement of the problem to be considered, in both specific and general terms. The specific statement

must deal with the very specific issues in which the candidate is interested, for example, the optimization of tables of LAIR parsers. The general statement should relate the problem to the larger context of the science and show why it is worth solving. The problem statement in the thesis proposal should be directed to an audience of intelligent scientists who have no specific interest in the problem but who are interested in knowing what the candidate is doing. It should not be directed to the candidate's supervisors and/or to people with similar research interests.

To prepare the proposal for their benefit is to make a very common mistake. Such a proposal is filled with jargon which is private to that local group. It fails to state important constraints and frequently does not provide enough background. Sometimes the candidate assumes that his supervisors know as much about the specific area of the thesis as he does something which makes it difficult for the department and the examiners to evaluate the research on its merits. The candidate is then exposed to the very real danger that he and supervisors may have been working very happily in their own microcosm, only to find that at the end of three years he has no results which justify a Ph.D. degree.

### III. RELATED WORK

In order to present the problem to the wider audience, and in order to justify proceeding with the work, it is necessary for the candidate to present the background to the problem and to survey related work by others. This is the second component of a thesis proposal; and in some cases, it may be included directly in the thesis. It may take any of several forms—for example, annotated bibliography or a comprehensive summary, explanation, and analysis of existing results. It may be necessary or desirable for the candidate to include his own critical comments. For example, if the thesis is to present a new technique for solving a class of numerical problems, then this section of the proposal should review existing techniques and analyze their inadequacies.

This summary/survey/overview is not without its traps. If most of the references cited and most of the work mentioned are from within the candidate's own department (or in one other department with whom we are very "chummy") then there are serious grounds for questioning his breadth of knowledge and background for pursuing his problem. The danger is that people who limit their horizons to their own local environments produce very inbred research, narrow attitudes, and unacceptable theses. They tend to reinvent ideas already known elsewhere; they fail to apply techniques which could simplify their problems considerably; they often attach too much importance to minor results and do not recognize major ones worth reporting; and they write incomprehensible theses and papers which make no effective contribution to knowledge. In inbred environments, the work of other organizations is often dismissed as irrelevant or unimportant characteristic

of a disease called NIH (Not Invented Here). It is extremely important for the thesis proposal to indicate that the candidate knows about the complete work.

The literature survey is a broad and shallow account of the field, which helps to place the contribution of the paper in context. It is part of the motivation of the paper, because it helps to identify the gap that this work is trying to fill, and explain why it is important to fill this gap. Rather than a list of disconnected accounts of other people's work, you should try to organise it into a story: What are the rival approaches? What are the drawbacks of each? How has the battle between different approaches progressed? What are the major outstanding problems? (This is where you come in.)

Summary:

- Show the historical development of the subject
- Reference to and comments upon relevant work by others on the same or similar problems
- Reference only a few key papers - a summary of the gap in the field you have identified.
- Was the same issue examined before (other PhD theses)?
- What are the most important stances in the literature?

### IV. OWN APPROACH AND CONSIDERED METHODS

It is hard enough to schedule 'invention' when one has some good ideas for solving a problem. It is almost impossible when he does not. Thus the Ph.D. student, who is working to a tight and very emotionally constraining timetable, needs to have some insight, some ideas, some preliminary results before he commits himself to discover more. These should be described in the third section of the thesis proposal. If he has none of significance, then his proposal is premature. For he would have no indication that the problem can capture his attention for as long as it takes to solve it and write the thesis. He would have no assurance that he is heading in the right direction, that he is capable of finding a solution.

By implication, then, the candidate must have done some successful work in the area, perhaps in collaboration with others, before the thesis proposal. This may be something like the discovery of an interesting algorithm, representation, or relation while working on one of his pre-thesis projects. He recognized this as a tip of the iceberg, the introduction to a new problem area which eventually becomes his thesis research. For example, a student simulating a well-known paging algorithm stumbles across a phenomenon quite different from that which was expected or generally accepted. This result and his subsequent explanation for it form the basis of his thesis proposal and thesis research in memory management. They form the seed of the methods which he develops to specify and solve his problem. Without such results, a plan to investigate the area would have seemed like hot air, and his efforts would have lacked direction. But with them, the

success of his research is assured and the timely completion of his thesis is much more likely.

A common situation occurs when a student proposes what seems to be a good problem to investigate, involving brand new broad, general models or theories. But when he is pressed, he has only some ideas about a very small, special case or example. He might not even have explored these ideas fully because he regards that example as uninteresting in the context of the overall problem and those ideas as having no apparent generalization. Some students will be able to discover the necessary general ideas, develop them and defend them. But such theses are few and far between, and their authors are typically awarded Nobel prizes and other very high distinctions. Ordinary mortals with good first class honours degrees have no such luck and often get stuck, unable to find any other examples, applications or ideas which are substantially different from the ones they know already.

At this point, it is time to go back and look at the problem statement again. As often as not, that "uninteresting" example may be the foundation for an interesting and valuable thesis problem in its own right. If so, it is probably a better investment of the candidate's energy to solve it, finish his thesis, and then devote his life's work to the general problem in a more relaxed fashion.

Summary:

- Your ideas and insights for solving the problem and any preliminary results he may have obtained
- You need to have some insights first - otherwise this proposal is premature.
- Which methods do exist? What are they assets and drawbacks?
- The way in which you are going to solve the issue (mathematical theory, model, simulation tool, ...)
- What, how and why to use a specific method for which sub problem?
- In general you'll not solve a general problem but an interesting example.
- Show theses and hypotheses .
- Describe the theoretical basis.

## V. EXPECTED SOLUTION

The most important part of the thesis proposal is a statement of what kind of solution to the problem is expected, i.e., a characterization of the stopping condition of the project. This, more than anything else, will help the candidate estimate the value of his efforts to separate the chaff from the wheat, to allocate his time. Without such a characterization, the candidate has no good way of knowing when to stop and submit. He cannot measure how far towards his goal of a Ph.D. degree he has progressed. He might even discover a satisfactory solution to his problem and not perceive that he has. With a characterization, he will know where he stands during his research, and he will be able to argue convincingly at the appropriate time that he has done what he set out to do.

Occasionally, a research student will say, "I know precisely what problem I want to solve. I have no idea of what the solution will be, but I will certainly recognize it when I've got it. After all, this is research. So how can I possibly give a characterization of the solution beforehand?" That is, he thinks he is an exception, but if he cannot characterize his expected solution, how can he recognize it? More likely, he has not specified his problem sufficiently precisely, or he has not yet done enough preliminary work and obtained some preliminary results in the area of the problem. In either case, he must do more legwork before presenting his thesis proposal. Sometimes it is easy to characterize the solution, particularly in the light of preliminary results. For example, a candidate developing a new analytical model to describe message traffic among communicating machines would expect to prove some theorems about the model, validate it empirically against some existing systems, construct some algorithms based on it for calculating the performance of similar systems with different parameters, and argue by example that they are useful in the design and understanding of future systems. At other times, it is much harder to be so specific about a stopping condition. It may also be necessary to change it as the research progresses. However, a moving target is better than no target at all (providing that it is not moving so fast that the candidate cannot catch it.)

Summary:

- Any preliminary results that may have obtained;
- Short summary of results that are expected from the research.
- Characterization of what sort of solution is being sought;
- Define a criteria for success – establish exactly the criteria by which you intend to judge the success of the work.
- A statement or characterization of what kind of solution is being sought
- What type of solution to the problem is expected? Stopping condition.

## VI. PLAN OF WORK

The first two points which a thesis proposal should address are almost, but not quite, afterthoughts. After the candidate knows what he wants to do, has some background to allow him to do it, has done a little bit, and has some idea where it will take him, he had better draw up a plan of action. This section of the thesis proposal is like a road map and timetable of how he will travel during the remainder of his research. If it is carefully and realistically prepared, it will expose to him any hazard of trying to do more than he reasonably can before he runs out of steam. Obviously this plan, like everything else in the proposal, is subject to change as new results are obtained and new ideas gained. But some plan is better than no plan.

So this is a plan of action for the remainder of the research - a roadmap / a timetable of how to travel through

the research. This is just an example:

**Milestone 1 (06/2011):**

Final thesis topic and content definition. To validate the planned strategy one or more talks are given.

**Milestone 2 (09/2011):**

Exhaustive analysis of the related work and the research gap. Results will be discussed within an introductory talk and published in form of an overview paper.

**Milestone 3 (01/2012):**

Detailed specification of the assumptions, objectives and scope of the own approach. First model and scheduling algorithms with initial evaluation results. The outcomes are presented in the second intermediate talks and published.

**Milestone 4 (04/2012):**

Sophisticated model and evaluation results based on real application data. A third intermediate talk is given and the results are published.

**Milestone 5 (09/2012):**

As well all open issues as all odds and ends are identified and closed. A final talk presents the key contributions.

## VII. THESIS OUTLINE

Finally, it is always useful when doing research to keep in mind how it is to be reported, what issues will be emphasized, and what will be de-emphasized. Thus, the thesis proposal should contain a rough outline of the thesis itself, preferably in terms of the expected solution to the problem. This will have at least a small impact on the shape of the research, and it will provide a set of good guidelines when the candidate decides that it is time to "write it all up".

A rough outline of the thesis itself, in terms of expected solutions to the problem, is given below:

**Introduction (4 p.):**

Introduction to lead the reader into the research area and create an awareness of the problem and its importance. Give a brief overview of the context of work and expose the own contributions to the research. Sketch the most important validation results and give an outline of the thesis.

**Related Work and Research Gaps (40 p.):**

Essential fundamentals for the reader. Identification of the research gap by referencing to and comments upon relevant work by others on the same or similar problems. The most important stances in the literature will be exposed and a historical development of the subject will be given.

**Assumptions, Objectives and Scope (20 p.):**

Clear definition and dissociation of the thesis' scope. Description of the assumed presuppositions and overview of the limits of the research. Explanation of the objectives in a more formal manner.

**Main Part (40 p.):** Assets and drawbacks of existing strategies to solve the problem are discussed and the own ideas, insights, and ways for solving are defined and implemented; in terms of an analytical model and simulation environment.

**Influence on Scheduling Performance (30 p.):**

Exhaustive analysis of the own approach and comparison with other existing solutions. Interpretation of the results and recapitulation of the achieved contribution to the research; if possible based on data from existing applications.

**Conclusions, Discussions, Future Work (4 p.):**

Synopsis of the work done in the thesis. Identification of the key contributions and discussion about further research in this area.

## REFERENCES

- [1] H. C. Lauer, "Discussion: on Ph. D. thesis proposals in computing science," *The Computer Journal*, vol. 18, no. 3, pp. 279–281, 1975. [cited at page 1]
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- [3] D. Waitzman, "RFC 1149, Standard for the Transmission of IP Datagrams on Avian Carriers," *Internet Engineering Task Force*, 1990. [cited at page ]