

## Generic Template for Research Proposals

### What to Address in a Research Proposal for CS/EIE/MS

Ekow J. Otso

#### 1 Generic Structure of a Research Proposal

1. Abstract	1. Abstract
2. Introduction	2. Introduction
3. Background (or Literature Survey)	3. Methodology - Overview of the main approaches to accomplish research work
4. Methodology - Overview of the main approaches to accomplish research work	4. Analytic Results to be used
5. Analytic Results to be used	5. Experimental Setup and Computational Model
6. Experimental Setup and Computational Model	6. Preliminary Results
7. Preliminary Results	7. Explanation of the Rest of the Work to be Accomplished
8. Explanation of the Rest of the Work to be Accomplished	8. Methods for Validations of Expected Results and Exceptions
9. Methods for Validations of Expected Results and Exceptions	9. Risk Management
10. Risk Management	10. Literature Review (Literature Survey)
11. Schedule and Time-line	11. Schedule and Time-line
12. Summary of Proposal and Planned Additional Work to Complete	12. Summary of Proposal and Planned Additional Work to Complete
13. References	13. References
14. Appendix (If Any)	14. Appendix (If Any)

## 2 Abstract

- Motivation for the problem
- Problem statement
- Significance/Relevance of the problem and its proposed solution.
- Applications of problem solution to other domains
- Known earlier results from the literature if any
- Main results and contributions being made to the field of study
- Limitations and scope of the proposed solution and/or contributions

## 3 Introduction

Expanded information contained in the abstract plus detailed background of the problem plus report organisation, i.e., outline of the rest of the proposal. Content of the introduction should elaborate on:

- Motivation for the problem
- Clear problem statement or research hypothesis
- Significance/Relevance of the problem solution to CS, EEE or MS.
- Application of problem solutions to other domains. Expand on the similarity and equivalence of the problems as it applies to other disciplines.
- Known earlier results from the literature if any.
- Main results and contribution being made to the field. Emphasise the novelty of the solution, concepts and techniques being used, the results being advanced and any known limitations
- Organisation of the rest of the proposal

## 4 Background/Literature Survey

This Section/Chapter may be placed after the results and validation Section or Chapter.

- Discussion of earlier know related results if any, with citations.
- Discussion on how these earlier results differ from the expected or actual results of the current proposal.
- Differences in the methodology used, compared to the approaches used to obtain earlier results.
- Impact of current environment or availability of resources, e.g., new significant data, more accurate instrumentation and data capturing techniques, compared to the environment used in the related earlier work.
- New analytic results, or algorithms with citations, being used as a bases for the current work

## 5 Methodology

The content here may be split into 2 key subsections: Methodology-I and Methodology-II.

### 5.1 Methodology-I

- Overview of the basic ideas or concepts being espoused in the current work.
- Detailed explanations of concepts from the literature to be applied
- Statements of known dependent lemmas, propositions, theorems and sketch of proofs?
- Well formatted algorithms in pseudo-code (e.g., using `algorithm2e.sty` or `clrscode.sty`)

### 5.2 Methodology-II

- Definitions of new concepts to be advanced in the current work.
- Contrast with previous work
- Limitations and possible exceptions
- New developed algorithms in pseudo-code

## 6 Analytic Results and Derivations

You may consider moving detailed proofs to the Appendixes

- Statements of resultant lemmas, propositions, theorems and their derivations.
- Explanations of the consequences of propositions, theorems,
- Any resulting corollaries and interpretations.

## 7 Experimental Setup, Computational Model and Validation

Main objective is to conduct experiments and give sufficient information for independent reproducibility and confirmation.

- Computational Environment:
  - Experimental environment: the hardware specification - CPU, GPGPU, memory, network card and bandwidth used
  - Computational model used: serial, multi-threaded, MICs, Shared-Memory, Distributed Memory, Hybrid, PGAS, MPI, etc.
  - Software and versions: OS; compilers; special libraries and tools, e.g., Matlab, Octave, R; statistical and graphics libraries; simulation tools and packages, etc.
- Data sources, or data generation methods. Alternatively, specify methods and input parameters for data generation and values of parameters used in the experiments.
- Software Engineering Practice and Public Accessibility:
  - Use of software engineering techniques and best practice in code development
  - Composing source code in a revision control environment - SVN, GIT, Mercurial, etc.
  - Open or limited public access to source code, documentation, etc.
  - Source code should be accessible to be recompiled and run under the same conditions of the experiments to reproduce results.

## 8 Preliminary Results

In a proposal, it is normally expected that some preliminary results would have been obtained to show the feasibility of the approach being advanced.

- Provision of some preliminary results under limited conditions
- Discussion of the preliminary results
- Approach on how the preliminary results will be extended to achieve the final results.

## 9 Explanation of the Rest of the Work to be Accomplished

It normally:

- Describes the limitations of the preliminary results
- Suggests how the current results obtained will be extended in the future;

## 14 Essential Latex Packages and Discipline Specific Macros

These packages can be found in any installation of the new texlive 2012/2013, if you are on Linux or pdfTeX (MikTeX + TeXnicCenter + Ghostscript) if you are on Microsoft Windows. Alternatively, you can download them individually from CTAN Websites.

Package Name	Description
algorithm2e	an environment for writing algorithms in L <sup>A</sup> T <sub>E</sub> X2 <sub>ε</sub>
amsmath, amssymb, amsthm	L <sup>A</sup> T <sub>E</sub> X2 <sub>ε</sub> document classes developed for the American Mathematical Society
amsthm	provides an enhanced version of L <sup>A</sup> T <sub>E</sub> X's \newtheorem command
booktabs	package for nice tables
fancyhdr	for customizing headers and footers in the L <sup>A</sup> T <sub>E</sub> X document
geometry	Required for page layout
graphics, graphicsx	For introducing graphics in documents
hyperref	enables typesetting of hyperlinks, when the resulting format is PDF
ragg	To check for obsolete syntax
subfig	generalised interface for bibliographic style files
memoir	contains package functions mainly related to document design and layout
microtype	General appearance of the document
pgfplots	draws high-quality function plots in normal or logarithmic scale
quotchap	redefines the \chapter and \chapter* commands to create fancy chapter head pages
siunits	A comprehensive (SI) units package
subfigure	provides support for the inclusion of small, "sub", figures and tables.
TikZ/PGF	a tandem of languages for producing vector graphics from a geometric/algebraic description.
color, xcolor	for setting the color of the font of the text, and also the background color of the page.
<b>Typesetting Biology in L<sup>A</sup>T<sub>E</sub>X</b>	
TeXshade	package provides an ideal solution for displaying the key changes in DNA
TeXsgp	shaded membrane protein topology plots in L <sup>A</sup> T <sub>E</sub> X2 <sub>ε</sub> .
<b>Typesetting Chemistry in L<sup>A</sup>T<sub>E</sub>X</b>	
mhchem	for typesetting a single chemical formula. e.g., $\text{Zn}^{2+} \xrightleftharpoons[\text{+ 2H}^+]{\text{+ 1OH}^-} \text{Zn(OH)}_2 \downarrow \xrightleftharpoons[\text{+ 2H}^+]{\text{+ 1OH}^-} [\text{Zn(OH)}_4]^{2-}$ amphoteric hydroxide      hydroxozincate
chemfig	package for drawing molecules using the tikz package.
chemstyle	provides two packages: chemstyle and chemscheme. The bundle intended to help chemists create floating graphics of chemical schemes.
XyMTeX	a macro package for T <sub>E</sub> X, written by Fujita Shinsaku for rendering high quality chemical structures, e.g.



Table 1: Essential Latex Packages

## 10 Validation of Results

- Production of respectable graphs and equations for preliminary results
- Explanations of results
- Validation with analytic results or known practical observations
- Discussion of observed exceptions

## 11 Risk Management

This section addresses:

- Possible issues that could contribute to the failure of accomplishing the stated solutions or completing the research objectives.
- Some examples of risks: - lack of required skill; timeliness of access to appropriate hardware and software; non-availability of data sources; etc.
- Statement of plan on how to mitigate the identified possible risks.

## 12 Schedule and Time-Line for Completion

This section gives the general idea of how the project is broken into phases. An estimate of the time to complete each phase is specified in a schedule. Most often a Gantt chart is provided for the schedule.

## 13 Summary and Future Work

It is generally recommended that the subtitle "Summary" be used for Proposals and "Conclusion" be used for final Papers, Thesis, Dissertations and Reports. Summary should emphasise:

- What the problem statement is
- What solution (novel result), is intended to be achieved
- A brief statement of justification for the expected improvement (new and better solution) to be achieved over earlier known results
- Applicability of new results to other similar related problems
- Possible options for future work as a result of:
  - Other approaches not addressed in the current work
  - New computing architecture and supporting system's software
  - New algorithms and computational models
  - Anticipated new instrumentation and accessibility to new data sources

For bibliography references use the Harvard style for citations.

Example of citations are (Roberts 1994).

Another alternative is Roberts & Cronin (1996).

A second alternative is (Roberts & Cronin 1996)

## References

Roberts, A. J. (1994), 'The importance of beings fractal', *Australasian Science* p. 23.

Roberts, A. J. & Cronin, A. (1996), 'Unbiased estimation of multi-fractal dimensions of finite data sets', *Physica A* 233, 867-878.



Package Name	Description
<b>Typesetting Physics in L<sup>A</sup>T<sub>E</sub>X</b>	
aa, natex physics	The American Astronomical Society makes typesetting equations for physics simpler, faster, and more human readable.
<b>L<sup>A</sup>T<sub>E</sub>X Editors</b>	
TeXshop	for Mac OS
TeXStudio, TeXMaker, L <sup>A</sup> T <sub>E</sub> X	for Windows and Linux
TeXnicCenter, ProTeXi	for Windows
<b>Making Presentations in L<sup>A</sup>T<sub>E</sub>X</b>	
Beamer	a L <sup>A</sup> T <sub>E</sub> X class for creating slides for presentations
Beamerposter	an extension of the L <sup>A</sup> T <sub>E</sub> X beamer and the alposter classes to create L <sup>A</sup> T <sub>E</sub> X posters
l <sup>A</sup> T <sub>E</sub> X templates, Conference Posters	L <sup>A</sup> T <sub>E</sub> X normal document and can be customized to create beautiful poster layouts in portrait or landscape.
Powerdot	a presentation class for L <sup>A</sup> T <sub>E</sub> X that allows for the quick and easy development of professional presentations
Proper	a L <sup>A</sup> T <sub>E</sub> X class aiming at offering an environment for writing high-quality slides for both printing and displaying
TEXPower	a bundle of style and class files for creating dynamic online presentations with L <sup>A</sup> T <sub>E</sub> X written by Stephan Lehnke
<b>Making Graphics for L<sup>A</sup>T<sub>E</sub>X Documents</b>	
gnuplot	A portable (command-line driven) interactive data and function plotting utility.
Matlab / Octave	high-level programming language, primarily intended for numerical computations
Maple	the world's most advanced symbolic computation technologies, powerful, thread-aware programming language, and advanced numeric solvers
LabView	a software that is ideal for any measurement or control system
TikZ/PGF	Graphic systems for T <sub>E</sub> X Web Site
PGFPLOTS	draws high-quality function plots in normal or logarithmic scaling with a user-friendly interface directly in T <sub>E</sub> X
Asymptote	a powerful descriptive vector graphics language that provides a natural coordinate-based framework for technical drawing
CRAN-R Packages and Utilities: ggplot2, vswave, flexchart	a freely available language and environment for statistical computing and graphics
Blender	An integrated 3d suite for modelling, animation, rendering, post-production, interactive creation and playback
<b>Drawing and Image Manipulation Packages for L<sup>A</sup>T<sub>E</sub>X Documents</b>	
Inkscape	an open source vector graphics editor using the W3C standard Scalable Vector Graphics (SVG) file format
Xfig	an interactive drawing tool which runs under X Window System
GIMP	the GNU Image Manipulation Program
<b>Software and Document Versioning Tools</b>	
Git	a free and open source distributed version control system
mercurial	a free, distributed source control management tool

Table 2: Miscellaneous Packages for L<sup>A</sup>T<sub>E</sub>X