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1 Introduction

The general requirements for the degree of Doctor of Philosophy in the Department of Statistics include the preparation of a dissertation that provides evidence of a significant research accomplishment, represents a clear contribution to knowledge, and includes material worthy of publication. The dissertation, and the oral examination supporting it, should demonstrate the candidate’s knowledge and understanding of the particular field of study, originality in solving a problem in the field, and skill in communicating ideas.

Prior to preparing and presenting a dissertation a student must pass the Qualifying Examination. This examination consists of written qualifying examinations, which are usually taken upon completion of the core Ph.D. courses in statistical inference and advanced probability, an oral and written presentation at the culmination of the advanced data analysis course, and a final qualifying process, known as the Proposal. The Proposal, which is usually completed within sixteen months following the written qualifying examinations, is the final step before a student is admitted to Ph.D. candidacy. The Proposal should demonstrate the candidate’s knowledge of previous work in a particular field of study, should present initial research results, and should lay out a plan of research which, if completed, would qualify for the degree of Doctor of Philosophy.

This document provides a set of guidelines for satisfying the requirements of the Proposal, preparing a dissertation, and satisfying the Final Public Oral Examination. It contains both explicit requirements and more general descriptions of what is expected of doctoral candidates. The thesis advisor will assist the student at each step in the process, but it is the student’s responsibility to follow the guidelines and meet all requirements.
2 Thesis Proposal

A student’s thesis proposal is a critical opportunity for the faculty to guide and shape the dissertation research. The proposal process succeeds when it leads the student to a sound and detailed plan for the dissertation. The faculty should provide the student with constructive criticism on proposed methods and approaches, force the student to question assumptions, and challenge the student’s perspective on the problem. The proposal process described below has been devised with this in mind. It has the following steps:

1. The student, in consultation with his or her advisor, prepares a rough draft of the proposal document. Potential thesis committee members are also encouraged to participate in this process, if practical. The body of this text is limited 15 pages, excluding tables and figures.

2. The student assembles a working committee of at least two Statistics faculty members other than the advisor and preferably an additional outside member. (See text below on selection of the committee, in particular the requirement that an abstract be circulated to the full faculty before the working committee is formed.) Working committee members should be given the rough proposal document at least one week before the formal committee meeting.

3. The student meets with the working committee in a formally scheduled, two hour session with the goal of constructively refining the proposed research. The format of this meeting is the following:

   (a) To get the discussion started, the student presents to the committee a brief executive summary of his or her research plans and objectives. This presentation can be formal or informal, from slides or from a short written summary. However, the student’s presentation should not last longer than 5 minutes.

   (b) The student and committee discuss the proposed research in detail.

   (c) The student and committee formulate specific suggestions for changing the document and specific action items. They also decide if further meetings are necessary.

The goal here is to guide rather than test the student, so the discussion should be conducted in that spirit. All those present at the meeting should be fully prepared with the substance of the proposed research prior to the meeting. This includes, but is not limited to, reading the draft document.
4. The student, in consultation with the working committee, revises the proposal document. The rules governing the structure of this document will remain unchanged.

5. Once the student and the document are determined to be ready by the working committee, the revised document is posted on the web in the statistics department private area. The faculty are notified that the document is available for viewing for a two-week review period. Faculty comments should be directed to either the advisor or the student, as appropriate.

6. The student and faculty advisor working with the Director of Graduate Studies then schedule a proposal presentation to which the entire department is invited. Proposal presentations whenever possible will be grouped together on dedicated "proposal days," typically scheduled at the end of the semester or summer.

7. Following the oral presentation, the faculty meets to approve the written proposal and the selection of a final thesis committee, which will typically (though not necessarily) be a strict superset of the working committee. The thesis committee must include a member from outside the department. The Director of Graduate Studies is responsible for certifying and recording that the proposal is approved.

The working committee meeting (step 3) is the key element of the proposal process. This meeting is a formal milestone, to be taken seriously by the student. Both the student and the members of the working committee are expected to be fully prepared. The student should expect thorough questioning, constructive criticism, and other guidance, all geared towards shaping the proposal in specific detail. Other graduate students are not invited to the working committee meeting. It is possible that sufficient progress will not be made in the first working committee meeting. In this case, the working committee should schedule any additional meetings that are necessary. The proposal document is not posted on the web until the working committee is satisfied that the document and the student are ready.

The purpose of the presentation (step 6) is to give students practice at planning and giving talks, to let our students see their colleagues in a professional capacity, and to provide an opportunity for department-wide interaction. It is not an exam. All faculty and students are expected to attend these oral presentations. Student whose proposals have been approved by appropriate working committees and circulated to the faculty for comments will give brief (30 minute) presentations of their proposed research, with questioning from the audience afterwards. This is expected to be a professional-quality talk.

The members of the working committee are selected by an informal process. However, the following desiderata should apply:

1. Any Statistics Department faculty member (visiting or regular) may be a member of the working committee, but the advisor must be a regular faculty member.
2. All faculty within the Statistics department should be invited to serve on the working committee. To this end, while forming the committee, the student should circulate by email to the entire faculty an abstract describing the proposed research. This constitutes an invitation to serve. To maintain an open process, the committee should be formed before the working committee meeting is scheduled.

3. The student and advisor may also encourage particular individuals to serve on the working committee.

4. The student and advisor may also select a member from outside the department, based on his or her expertise in the topic under investigation.

5. Although the working committee is likely to form the core of the dissertation committee, this is not required. As the research progresses, new members can be added or replaced at the committee’s discretion, and members who feel they are no longer of service may excuse themselves. The student is also free to request changes in the committee, either through the advisor or to the committee as a whole.

3 Public Presentation of Proposal

3.1 Proposal Document

A proposal should be organized as follows

1. state the basic problem clearly and succinctly,

2. review relevant literature,

3. provide preliminary results that indicate how solutions to the problem might be developed, and

4. propose specific steps that could be taken to complete the research.

These fundamental elements of a Proposal should be clearly evident in the written document. It is usually most convenient to have section headings that identify these components.

The document should be of quality comparable to that produced by \LaTeX, with an 11 or 12-point font, in a style similar to the \LaTeX\document style Article with single spacing and standard margins. Its length must not exceed 15 pages, together with at most an additional 2–3 pages of references and 5 pages of figures and tables. Citations and the list of references should be done according to the style of a standard statistical journal such as the \textit{Journal of the American Statistical Association}. Derivations
and proofs should be included only as they are necessary to explain the work being proposed. Appendices or further documents may be used for additional derivations or auxiliary results, but the main document should be understandable on its own. The document must be posted on the web at least two weeks before the oral presentation.

3.2 Oral Presentation

The student should give a formal presentation to the entire department on proposal day. The oral presentation should be roughly 30 minutes long (±5 minutes), and should emphasize the central points in the proposal. It is often helpful to include a page of basic definitions and notation as a handout. The student will be interrupted during the presentation for purposes of clarification only.

In preparing the presentation, the student should keep in mind the major elements of a proposal as listed above. The faculty will be trying to understand the ideas underlying the proposal, and they will be trying to get a picture of what the completed thesis might be like. The student should make the presentation helpful in this process, and need not stress the details of his or her accomplishments to date.

Following the oral presentation there will be a question-and-answer period with the faculty having the first opportunity to ask questions.

4 The Committee

It is the student’s responsibility to confer with committee members periodically while working on the dissertation. Progress should be discussed at least every four months, scheduled so that committee members can report to the faculty at student-evaluation meetings, which usually occur in December and May.

5 The Dissertation

Many of the instructions given in Section 7 follow those in the leaflet “Preparing Your Manuscript for Microfilming,” provided by the University Microfilms, Inc. A copy of this leaflet should be obtained from the departmental secretary.

The dissertation must be a document exhibiting the best professional standards. As the original copy of the dissertation will be kept in the library and copied for microfilming and other purposes, the paper and the production must conform to standards of long archival life and clear reproducibility.
5.1 Timetable

Before a dissertation defense can be scheduled, the thesis committee must agree that the thesis is ready for defense. This does not require an official meeting of the committee members. What is required is an agreement from each committee member that the work is likely to be completed in a timely manner. This decision would usually be based upon examining a draft of the thesis. (As a practical matter, a defense date may be reserved prior to this decision, but the defense may not proceed without the full approval of the committee.)

Each candidate is expected to have a complete version of the dissertation in the hands of his or her Ph.D. Committee at least two weeks before the thesis defense. Additional copies should be made available to other faculty. The student should allow adequate time for further revisions of the thesis after the defense, prior to the awarding of the degree.

The thesis defense must be held no later than 21 days before the date of the awarding of the degree. The candidate is responsible for scheduling the thesis defense so that all Committee members and a majority of the regular faculty can attend. The departmental secretary will assist the student in scheduling a room. The defense date, time, and location should be determined at least four weeks prior to the defense.

5.2 Certification

The Department Head is responsible for certifying the PhD candidate for graduation. The deadline for certification for Spring, Summer and Winter graduations are respectively, May 1, September 15 and January 15. To obtain certification the PhD candidate completes the following steps.

- After the thesis defense, the thesis advisor compiles a list of required dissertation revisions from the comments of the thesis committee and the faculty members who have either read the thesis or attended the oral defense. The dissertation advisor presents the official revision list to the Ph.D. candidate, the director of graduate studies, and the department head. In addition, committee members and other faculty may give the candidate lists of typographical errors and other minor changes to be made in the document.

- When the revisions have been successfully implemented, the Ph.D. candidate presents the thesis to the departmental secretary for binding. He or she also petitions the department head for certification. The departmental secretary posts certification on the HUB.

- If the student does not obtain certification by the deadline listed above then he or she cannot graduate at that time. Furthermore, no student will be allowed to participate in the graduation ceremony without official certification.
6 Dissertation Document

6.1 Number of Copies

Following approval by the Committee, but not later than 10 days before the date of the award of the degree, a sufficient number of copies must be prepared and deposited as follows:

- Original, or copy of good reproducible quality (to be used for microfilming at Hunt Library) to departmental secretary.
- One copy to the Advisor
- One copy to the Department. Members of the Committee usually receive courtesy copies. More copies may be made for distribution, as required. The preparation of the original and copies is the student's responsibility.

The department will also maintain a repository of dissertations on the web. Placement of dissertations in this electronic repository is optional.

6.2 Microfilm

Carnegie Mellon University, like most universities, has an agreement with the University Microfilms, Inc., Ann Arbor, Michigan to copy and preserve Ph.D. dissertations on microfilm for easy availability and retrievability to anyone who might want to obtain a copy. The Ph.D. candidate is required to sign a form, giving University Microfilms the right for microfilming. A copy of the thesis and the appropriate form will then be taken to the Reference Service Supervisor in Hunt Library. The author is responsible for paying the extra copyright fee.

University Microfilms requires each dissertation to be accompanied by an abstract of not more than 350 words. Such an abstract must be provided with the thesis. If the candidate chooses, two abstracts may be submitted: one, not to exceed 350 words, for microfilming and one, not to exceed 1,000 words, as part of the dissertation.

6.3 General Form

Except as specifically superseded by directions from the Microfilms booklet, the general rules with respect to form shall follow those set forth by K.L. Turabian, *A Manual for Writers of Term Papers, Theses and Dissertations*, 4th Edition (University of Chicago Press, Chicago, Illinois 60637). For details that may be particularly relevant in statistics consult the style guide in the *Journal of the American Statistical Association*. 
6.4 Cover Page, Title Page and Abstract

The first page of each dissertation must be a cover page in the general form, and bearing the same information as the sample attached. Upon successful completion of the final oral examination, the original cover page must be signed by the Advisor, the Department Head and the Dean of H&SS. The copies need not contain the cover page.

The cover page should be followed by a title page. The title page of the dissertation should follow the format shown on the sample attached. If a variation of format is used, be sure that all the information shown on the sample page is included.

The abstract must not exceed 350 words. It should be double-spaced, have the paper title, your name and university, year, number of pages, and your advisor’s name as the heading.

6.5 Preparation of the Manuscript: Production

6.5.1 Paper

The paper must have good archival qualities and have high opacity so that the typing or printing on the following page will not show through unduly. The original should be on 20-pound, smooth-finished bond paper of 50% cotton fiber. The copies must be on 13-pound or heavier bond or xerographic paper.

6.5.2 Text Processing

Typed matter must be double-spaced, clearly legible and free of typographical error. Footnotes and long quotations may be single-spaced. The text should fill an area not larger than six inches by nine inches on one side of an 8½ by 11 inch sheet, allowing a minimum margin of one and one-half inches on the left for binding and one inch on the other three sides. Font size should be 11-point. It is recommended that \LaTeX with book document style be used.

In general, for computer-generated text and figures, clarity of production should be the guide for both text and figures. The font size should remain 11-point for all legends and lettering on figures. Data and computer programs may be shown as direct computer output, provided the general rules with respect to clarity, size, and margins are followed.

6.5.3 Equations, Charts, Graphs, Tables, Figures

Formulas and equations should be neatly formatted. Drawings should be kept within the bounds of a six-inch by nine-inch rectangle aligned as described above.

Lines on graphs or illustrations should be identified by labels or symbols rather than colors. Shaded areas should use cross-hatching, and not color, for contrast. Data should be presented, where possible, in numbered, titled tables.
Numbering of equations and references to equations in the text should follow the form used in a standard professional journal such as the *Journal of the American Statistical Association* or *The Annals of Statistics*.

Charts, graphs, maps and tables that are larger than the standard page size might have to be used in the dissertation. It is recommended that such pages be avoided unless absolutely necessary. Try a different layout for the chart or table to see if it can be placed on a standard page, or use a photograph or xerographic reduction of the material.

### 6.5.4 Photographs

Ideally, each photograph should have a full range of contrast from true black to pure white. Photos with limited contrast will reproduce satisfactorily on positive microfilm but they will be unclear in xerographic copies made from microfilm. Color photos should not be used in the dissertation. If necessary, contact a photographer about having color photos reprinted in black and white. Rubber cement and glue are acceptable means of affixing photos, but dry-mounting tissue provides the neatest and most permanent method.

### 6.6 Binding

The copy for Hunt Library should not be permanently bound (to aid microfilming) but other copies may be permanently bound by a professional binder. The Department will have three copies permanently bound: one complimentary copy for the student, one for the adviser and one for the Department. There will be a charge for any other copies ordered.

### 6.7 Preparation of the Manuscript:

#### 6.7.1 Form

**Title** A dissertation can be a valuable source for other scholars only if it can be located easily. Modern retrieval systems use the words in the title and sometimes a few other descriptive words to locate a dissertation. It is essential that the title be a meaningful description of the content of the dissertation. Avoid oblique reference, and be sure to use word substitutes for formulas, symbols, superscripts, subscripts, Greek letters, and so on.

**Format** Dissertations typically have three main parts: preliminaries, text, and references which may be followed by appendices.
6.8 Usual Order and Content

6.8.1 Preliminaries

a. Title page, followed by the copyright notice if statutory copyright in the dissertation has been or is to be claimed. For microfilming, the copyright notice is placed before the title page. Essential components of the copyright notice are: copyright symbol, full legal name of author, year in which copyright is secured by publication. The copyright notice may appear as follows:

Copyright by John Arthur Brown 19-
   All Rights Reserved

b. Preface, including acknowledgments

c. Table of Contents, with page references

d. List of Tables, with titles and page references

e. List of Illustrations, with titles and page references

6.8.2 Text

a. Introduction

b. Main body, with larger divisions and more important minor divisions indicated by suitable, consistent headings

6.8.3 References

Appendices (if needed)

6.8.4 Page Numbering

Each page in a dissertation, except the blank page following the title page, should be assigned a number.

The following plan of page numbering generally is accepted:

1. For the preliminaries, use small Roman numerals (i, ii, iii, iv, etc.). The numbering begins with ii; the title page counts as page i, but the number does not appear.

2. For the remainder of the dissertation—including the text, illustrations, references and appendices—use Arabic numerals (1, 2, 3, 4, etc.). Each page must be numbered. Try to avoid use of letter suffixes such as 10a, 10b. The numbering begins
with 1 and runs consecutively to the end of the dissertation. On pages carrying a major heading—such as the first page of a chapter—the page number should be placed at the center top. If the description of an illustration is too long to be placed on the same page, it should be placed on the previous page, not on an unnumbered page.

3. If there are more volumes than one, each volume should contain a title page duplicating the title page of the first volume. If the volumes are separate entities it would be well to identify them further as Volume I, II, etc. In any case, the numbering may follow consecutively from one volume to another, or begin with Arabic I at each new title page.

6.8.5 Footnotes

Footnotes should be avoided. If necessary, footnotes should be placed at the bottom of the page in a style similar to that used by LATEX. Footnotes should be numbered consecutively throughout each chapter.

6.8.6 Reproduction of Data

Data used in the dissertation should be made accessible to the reader in substantially complete form. Generally, this means that raw data should be reproduced in a convenient manner in one or more appendices to the main document. In the case of data gathered from readily available published sources, specific detailed citations will suffice, provided that a minimum of one set of the raw data used in the dissertation, complete in all respects, is presented with the original copy submitted to the Library. Deviations from a procedure of full disclosure, e.g., in connection with large-scale computer data bases, must be specifically approved by the Dissertation Committee and explained fully in the dissertation.

As author, you must certify (by signing the University Microfilms International agreement form) that any copyrighted material in your dissertation, beyond brief excerpts, is used with the written permission of the copyright owner, and that you will save and hold harmless University Microfilms International from any damages which may arise from copyright violations. Copies of permission letters should be attached to the agreement form.

6.8.7 Computation-Based Results

In the case of computer calculations essential to the central arguments of the research, these must be fully and clearly explained. If the computer programs which provide the basis for these calculations are originated by the student, the student is required to provide a program listing and minimal documentation on the program in the thesis.
The program listing and documentation would normally be included in a separate appendix to the thesis. However, in the case of extensive computer work considered by the student and his advisor to be too long to include in the dissertation, presentation in the form of tables elucidating important components is acceptable. In this case, the student is advised to submit a separate internal report giving further details. Standard subroutines or packaged programs which routinely are included as software support to a computer installation and which can be readily obtained are exempted from this requirement, but these should be clearly cited and the source of these programs made apparent in the thesis. In every case the student should comply with the standards described in “The reporting of computation-based results in statistics” by D.C. Hoaglin and D.F. Andrews in *The American Statistician*, Vol. 29, No. 3, pp. 122-126 (1975).

6.8.8 References

Citations of the professional literature should be standardized throughout the dissertation. The form of citation should be consistent with the form used in a standard professional journal such as the *Journal of the American Statistical Association* or *The Annals of Statistics*.

6.9 Thesis Timetable Summary

1. **Completion of Written Thesis**—not more than seven years after being admitted to candidacy.

2. **Scheduling of Defense**—at least four weeks prior to defense.

3. **Submission of Dissertation to Committee**—at least two weeks before the defense.

4. **Thesis Defense**—at least twenty one days before the date on which the degree is to be awarded.

5. **Thesis Certification** must be obtained by May 1 (September 15, January 15) to graduate in the Spring (Summer, Winter).
6.10 Sample Title Page

CARNEGIE MELLON UNIVERSITY

TITLE OF THE THESIS IN ALL CAPITAL LETTERS

A DISSERTATION SUBMITTED TO THE GRADUATE SCHOOL IN PARTIAL
FULFILLMENT OF THE REQUIREMENTS

for the degree

DOCTOR OF PHILOSOPHY

In

STATISTICS

by

(FULL NAME OF AUTHOR)

Department of Statistics
Carnegie Mellon University
Pittsburgh, Pennsylvania 15213

Month, Year
7 Final Public Oral Examination

The student should schedule the oral examination when a majority of the regular faculty can be present. Each semester the Department Head will set a standard time for such presentation to occur. Any alternative day or time must be approved by the Department Head. **The date and time of the oral examination must be publicly announced at least four weeks prior to the date.**

The formal presentation should be roughly 30 minutes long (±5 minutes), and should emphasize the central points in the dissertation. It is often helpful to include a page of basic definitions and notation as a handout. The student will be interrupted during the presentation for purposes of clarification only.

In preparing the presentation, the student should keep in mind that the faculty will be trying to understand the main ideas underlying the dissertation and the major results. The student should make the presentation helpful in this process and need not stress the fine details of his or her accomplishments.

Following the oral presentation there will be a question-and-answer period with the committee having the first opportunity to ask questions. Immediately after the oral examination, the faculty will deliberate privately, and decide if the candidate has passed the Final Public Oral Examination.