USING THE NDSU THESIS DOCUMENT CLASS FOR LATEX

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ABSTRACT

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This document illustrates the NDSU Thesis document class `ndsuthesis` for LaTeX2ϵ. This document class was specifically designed to adhere to the document format requirements of the North Dakota State University Graduate School, outlined in the booklet *Guidelines for the Preparation of Disquisitions*, available both online (`http://www.ndsu.edu/gradschool`) and from the Varsity Mart in the Memorial Union. Nevertheless, students are urged to carefully read through and adhere to the specifications described in the *Guidelines*.

ACKNOWLEDGMENTS

First of all, I would like to thank Bonnie Cooper, the Disquisition Editor at the NDSU Graduate School, for her immense help in putting together both the NDSU Thesis document class and this document. I look forward to many years of hassle-free editing of LaTeX-based disquisitions.

A lot of the code for the document class was taken from *The LaTeX Companion* [3], *LaTeX2ε for Class and Package Writers* [6], *A guide to LaTeX2ε* [4], and the newsgroup `comp.text.tex` (available on the web at `http://groups.google.com`). It was also useful to look at some code by Brent Ellingson and Terry Pilling, both of whom developed primitive document classes for dissertations at NDSU.

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CHAPTER 1. THE DOCUMENT CLASS

LaTeX is a document preparation system that enables a writer to concentrate on the contents of their text, without bothering too much about its formatting. The file that contains the information about how to turn the logical structure of a document (stored in a file whose name ends in `.tex`) into formatting instructions is called a "document class." The document class file `ndsuthesis.cls` tells LaTeX how to interpret a `.tex` file that contains the logical code for a disquisition and produce a nice-looking document ready to be turned in to the NDSU Graduate School.

This chapter deals with the commands which need to be placed in a `.tex` file to get the proper formatting. This chapter does not deal with general LaTeX commands or with local implementation of LaTeX on any particular computing platform. A reader interested in a comprehensive guide to LaTeX should look at [3, 4].

1.1. General structure

The top of every `.tex` file looks more or less the same. In the case of a document using the `ndsuthesis` class, the general structure to follow is

```
\documentclass[< options >]{ndsuthesis}
...
\begin{document}
...
\end{document}
```

In place of the first set of ellipses (...), one would add commands to load extension packages, define macros, or change global variables. In place of the second set of ellipses, one would add the text of the disquisition. The *options* available allow various modifications to be made to the formatting. They can be divided into three sets as follows.

1.1.1. Selecting disquisition type

There are five options which determine the type of disquisition to be produced. These options affect the content of the cover and abstract pages (see Section 1.2).

The five disquisition types supported are

`phd`	Ph.D. dissertation. (*default*)
`thesis`	Master of Science thesis.
`paper`	Master of Science paper.
`ma-thesis`	Master of Arts thesis.
`ma-paper`	Master of Arts paper.

1.1.2. Draft mode

If the LaTeX line-breaking mechanism fails to make a clean break between words and hyphenation is turned off (see Section 1.2.6), part of the text will break into the right margin of the page. In this case, typesetting in "draft mode" will mark the text with a thick black bar to make it more noticeable. If "draft mode" is off, then lines that are too wide are not marked in any way. The option `draft` turns "draft mode" on; the option `final` turns "draft mode" off. The default is `final`.

1.1.3. Loading AMS-LaTeX

AMS-LaTeX is a collection of packages produced by the American Mathematical Society that greatly expand the capabilities of LaTeX to display mathematics. The `ndsuthesis` class automatically loads these packages. If memory is of the essence and these packages are not going to be used, then the `nomath` option may be used. For example, to produce an M.S. paper for which AMS-LaTeX is not used, the first line of the `.tex` file should read

```
\documentclass[paper, nomath]{ndsuthesis}
```

1.2. Prefatory material

The prefatory material of the disquisition should contain a cover page, an approval page, an abstract, and a table of contents. Some departments require or allow other pages, such as an acknowledgment or a dedication page, which follow the abstract.

1.2.1. Cover page

The command `\coverpage` creates a standard NDSU cover page. The different components of the cover page are produced using internal variables. These variables can be set by the following sequence of commands:

`\title[`< *alt.title* >`]{`< *title* >`}`
`\name{`< *first.name* >`}{`< *last.name* >`}`
`\college{`< *college.name* >`}`
`\department{`< *dept.name* >`}`
`\professor{`< *prof.name* >`}`
`\date{`< *date* >`}`
`\coverpage[`< *whitespc* >`]`

If provided, *alt.title* is used on the cover page, allowing for more control over line breaks; otherwise, *title* is used. The default values for *college.name* and *dept.name* are "College of Science and Mathematics" and "Mathematics," respectively. Thus the corresponding commands may be omitted for a disquisition in Mathematics. The default value for *date* is the date of typesetting. The optional argument *whitespc* controls the white space left between the different components of the page. The default value is 15 mm; the value used in typesetting this document is 20 mm.

1.2.2. Approval page

All copies of the disquisition must include an *Approval of Disquisition Page* that follows the title page. This page must bear the signatures of the advisory committee members who have approved the disquisition and of the chair of the major department or director of the program. The original form, available only at the NDSU Graduate School, must be submitted with the final, approved copies. Note that `ndsuthesis` will skip page *ii* so the official approval page may be inserted there.

1.2.3. Abstract

The environment `abstract` produces the appropriate output for the abstract page. The introductory paragraph in this page is produced using the same internal variables that control the output of `\coverpage`. The proper usage is

```
\begin{abstract}
< abstract.text >
\end{abstract}
```

where *abstract.text* is the main text of the abstract.

1.2.4. Table of contents, list of tables, list of figures

A table of contents, a list of tables, and a list of figures can be automatically created by `\tableofcontents`, `\listoftables`, and `\listoffigures`. LaTeX gets the information for these pages directly from the sectioning and caption commands in the main body of the disquisition text (see Sections 1.3.1 and 1.3.2). Note that it is usually necessary to run LaTeX twice before these tables reflect the appropriate information from the text.

1.2.5. Optional prefatory sections

All optional pages in the prefatory part of the disquisition can be handled with the standard LaTeXcommand `\section*`. Thus,

```
\section*{Acknowledgments}
```

starts an acknowledgments page, as in page *iv* of this document. See Section 1.3.1.

1.2.6. Hyphenation

LaTeX will normally try to justify all text both to the left and the right. However, it often turns out that the break between two lines cannot be made between whole words without either shoving the text too close together or inserting huge gaps between the words. In this case, LaTeX will automatically try to hyphenate the word.

On the other hand, the NDSU Graduate School completely forbids the use of hyphenation in the prefatory and references sections of the disquisition. Hyphenation is allowed, although discouraged, in the main body of the disquisition. As a result, the `ndsuthesis` document class suppresses all hyphenation in the prefatory and reference sections, and all but disables it in the rest of the document.

Some care needs to be given when hyphenation is suppressed. If LaTeX cannot resolve a line break without resorting to hyphenation, then it will simply ignore the right hand margin and give and error of the form

`Overfull \hbox (`$x.xxx$`pt too wide) in paragraph ...`

The `draft` option may also be used to detect problem lines; see Section 1.1.2 for more details. Whenever such an error occurs, the margin has been broken. The problem must be resolved by somehow changing the wording of the text. If the error is not resolved, the disquisition will not be accepted by the NDSU Graduate School.[1]

1.3. Main body

The main body is the meat of the disquisition, where intricate equations are solved and grandiose theorems are proven. Before all that, though, the command `\mainbody` sets up the proper formatting, with page numbers in arabic numerals starting with 1. All pages appearing before the `\mainbody` command will have page numbers in lowercase Roman numerals.

1.3.1. Sectioning commands

The top-level sections in the main body of the disquisition are called chapters. Thus, from the point of view of an `ndsuthesis` LaTeXdocument, the terms "chapter" and "section" are completely synonymous. The table of contents, the list of figures, the list of tables, the references, as well as all unnumbered sections in the prefatory part (e.g., dedications, acknowledgments, etc.) of the dissertation and all appendices are all treated as chapters. Chapters are divided into subsections, and subsections into subsubsections. The following commands produce automatic, sequential sectioning:

`\chapter[`$<$ *toc.entry* $>$`]{`$<$ *title* $>$`}`
`\chapter*[`$<$ *toc.entry* $>$`]{`$<$ *title* $>$`}`

`\appendix[`$<$ *toc.entry* $>$`]{`$<$ *title* $>$`}`
`\appendix*[`$<$ *toc.entry* $>$`]{`$<$ *title* $>$`}`

[1] Occasionally "Underfull \hbox" errors might also occur. They can generally be ignored.

`\section[`< *toc.entry* >`]{`< *title* >`}`
`\section*[`< *toc.entry* >`]{`< *title* >`}`

`\subsection[`< *toc.entry* >`]{`< *title* >`}`
`\subsection*[`< *toc.entry* >`]{`< *title* >`}`

`\subsubsection[`< *toc.entry* >`]{`< *title* >`}`
`\subsubsection*[`< *toc.entry* >`]{`< *title* >`}`

In the first case (the no-`*`-form), a section of the appropriate type is created and given the next section number in the sequence. In the second case (the `*`-form), a section is created but given no section number. In both cases, *title* is used for the section heading and *toc.entry* is used for the section's entry in the table of contents. If *toc.entry* is not supplied, then *title* is also used for the table of contents.

1.3.2. Figures and tables

Figures and tables are handled by the LaTeX environments `figure` and `table`. In either of these, the command `\caption` places a caption in the text and makes an entry into the list of figures or tables, as appropriate.

According to the specifications of the NDSU Graduate School, the caption for a table should appear *above* the table, flush with the left margin of the page. On the other hand, the caption for a figure should appear *below* the figure, flush left and within the borders of the figure. To accommodate for this requirement, the `\caption` command takes an optional argument *width*, which is used in the case of figures to set the appropriate width of the caption.[2] The syntax for the `\caption` command in the `ndsuthesis` document class is

`\caption[`< *width* >`]{`< *caption.text* >`}`

As our first example, consider Table 1, which shows the values of the first ten triangular and pyramid numbers. The code used to generate this table is

[2] Note that this syntax is non-standard and differs from the behavior in other LaTeX document classes.

Table 1. Triangular and pyramid numbers T_n and P_n ($1 \le n \le 10$)

n	1	2	3	4	5	6	7	8	9	10
T_n	1	3	6	10	15	21	28	36	45	55
P_n	1	4	10	20	35	56	84	120	165	220

```
\begin{table}
\caption{\label{tab.trinums} Triangular and pyramid numbers
    $ T_{n} $ and $ P_{n} $ ($ 1 \le n \le 10 $)}
\begin{tabular*}{\linewidth}
    {@{}l@{\hspace{10mm}}*{10}{c@{\extracolsep{\fill}}}@{}}
\hline
$ n $ & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\
\hline
$ T_{n} $ & 1 & 3 & 6 & 10 & 15 & 21 & 28 & 36 & 45 & 55 \\
$ P_{n} $ & 1 & 4 & 10 & 20 & 35 & 56 & 84 & 120 & 165 & 220 \\
\hline
\end{tabular*}
\end{table}
```

Our second example is Figure 1, which shows the first five rows of Pascal's Triangle. The code used to generate that figure is

```
\begin{figure}
\setcounter{MaxMatrixCols}{11}
\[ \begin{matrix}
& & & & & 1 & & & & & \\
& & & & 1 & & 1 & & & & \\
& & & 1 & & 2 & & 1 & & & \\
& & 1 & & 3 & & 3 & & 1 & & \\
& 1 & & 4 & & 6 & & 4 & & 1 & \\
1 & & 5 & & 10 & & 10 & & 5 & & 1
\end{matrix} \]
\caption[65mm]{\label{fig.pascal} Pascal's Triangle.}
\end{figure}
```

Take particular notice of the use of the `\label` commands in both of these examples. In conjunction with the `\ref` command, these can be used to easily refer back to figures, tables, sections, and equations. In these examples, LaTeX will automatically insert the appropriate figure or table number wherever the phrases `\ref{tab.trinums}` or `\ref{fig.pascal}` are used in the text of the document.

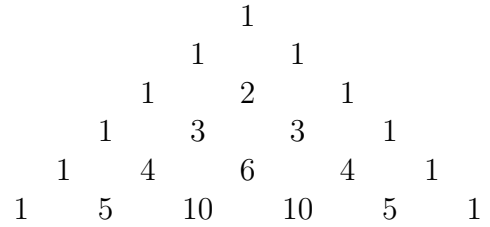

Figure 1. Pascal's Triangle.

However, in order to capture the correct caption number, the `\label` command must be placed *inside* the `\caption` command, as illustrated above.

1.4. Reference section

A reference section can be constructed manually, using the `\bibitem` command in the `references` environment. The appropriate code for this method would look something like

`\begin{references}[`< *sample.label* >`]`
...
`\bibitem[`< *label* >`]{`< *key* >`}` *entry.text*
...
`\end{references}`

Readers interested in this method should consult [3].

There is a separate program called BibTeX that will automatically generate the code for the reference section. BibTeX will search one or more database files (called `.bib` files) and list only those references that have actually been cited (using the `\cite` command) in the text. The file `ndsuthesis.bst` defines a BibTeX bibliography style designed to work together with the `ndsuthesis` document class. The commands which would set up a bibliography under this scheme would then be

`\bibliographystyle{ndsuthesis}`
`\bibliography{`< *bibdatabases* >`}`

Here *bibdatabases* would be the names of several `.bib` data files (without the `.bib` extension) separated by commas. With this code, `ndsuthesis.bst` automatically

sets up the reference section according to the standard AMS bibliography style (see Section 2.2).

This method has several advantages. For one thing, it involves less coding. More significantly, however, it allows several documents to share one large bibliographic database. Centralized document databases like *MathSciNet* can now produce BibTeX code suitable for a `.bib` file on demand. Used correctly, BibTeX can almost completely eliminate the hassles of writing bibliographies. Thus, in a major way, the BibTeX system can be used as the heart of a powerful on-line replacement for the more traditional card-index of literature references. As before, the interested reader is directed to [3] for more information on the proper usage of BibTeX.

CHAPTER 2. MATHEMATICAL WRITING

In this chapter, we discuss the grammatical and bibliographical styles that are accepted for use in mathematics disquisitions.

2.1. Grammar and style

For the most part, the writing of mathematics is like the writing of English prose. The basic rules of English grammar and style apply.

Write in complete sentences and punctuate correctly. Do not use contractions or abbreviations like "don't" (for "do not") or "til" (for "until").

Avoid the "stream of consciousness" style popularized by William Faulkner. When you finish a thought, stop, put down a period, and take a good breath before you begin the next sentence. Mathematics is already, by its nature, logically complex and subtle. The sentences that link the mathematics are usually most effective when they are simple, declarative sentences.

Steer a middle ground between too much detail and not enough. Give reasons for your answer sufficient to convince your reader that your argument is correct, but do not fill the pages by checking each tiny detail in writing; it only bores your reader and gives you writer's cramp. At one extreme of style are those sparsely-written texts (such as Rudin) that require the reader to ponder each sentence and fill in most of the details. At the other extreme are those problem set solutions written by your most conscientious fellow-student, so full of details that the basic idea is invisible! Try to hit somewhere in the middle.

The rest of this section deals with some issues of style that are peculiar to mathematical writing. The interested reader is referred to [2, 5, 7], from which these notes are taken loosely. The reader should also consult Appendix L in the Graduate School's *Guidelines for the Preparation of Disquisitions* for a discussion on some of the most common grammatical errors found in disquisitions.

2.1.1. Person

> **Mathematician joke:** When I was a child, I once asked a mathematician why mathematics was usually written in the first person plural: "We now prove this"; "Our task is thus"; "We conclude our story as follows." The rejoinder that I received was "This is so that the reader will think that there are a lot of you." ([5], p.33)

The custom in modern mathematics is to write in the first person plural, or "we". This style stresses the participatory nature of the enterprise. Thus "we" means you and the reader, or you with the reader looking on. It is also acceptable to use the third person singular, or "one"; however, this style can sometimes create awkward sentence structures. The use of the first person singular, or "I", is egotistical and irritating, and should be avoided. Nearly the only instance where choosing "I" seems appropriate is in the sentence

"At this time I do not know how to prove Conjecture A."

The choice is appropriate because, in fact, you are imparting to the reader specific information about what you yourself know. It would be presumptuous (and perhaps incorrect) to use "we" or "one" in this statement.

2.1.2. Articles and quantifiers

Articles are words like "a" or "the". They are used to identify either a specific, one-of-a-kind item (in the case of "the") or a general, non-specific item (in the case of "a"). Though small, these words can change the entire meaning of a sentence. Compare the meaning of the following statements:

"The function $f : \mathbb{R} \to \mathbb{R}$ is continuous if ..."

"A function $f : \mathbb{R} \to \mathbb{R}$ is continuous if ..."

In the first, we are making a statement about a specific function, which we have named f. In the second, we are making a statement about every single function from the reals to the reals; in this case f does not denote any one function in particular.

Similar care has to be given to the transliteration of the quantifiers $\exists$ and $\forall$

into English. Often, mathematicians will say "any" when they really mean "all" or "each" or "every". For example, a typical problem from an analysis course might ask

> "Show that any continuous function f on the interval $[0, 1]$ has a point M in its domain such that $f(M) \geq f(x)$ for $x \in [0, 1]$."

The intent is that the student show the property is true for *every* function f. However, a student might instead interpret the sentence as asking him to show that the property is true for *some* particular function of their choosing. That is what "any" usually means! Although this abuse of language is prevalent in mathematical writing, you should endeavor to use the correct English quantifiers.

2.1.3. Definitions

When you define a term for the first time, you should italicize the word or phrase. An alternative is to use boldface.

Do not use the term "if and only if" in a definition; by tradition, "if" is sufficient. On the other hand, the term "if and only if" is appropriate when emphasizing logical equivalence outside of a definition. Some authors choose to write it "if, and only if," (with two commas). The neologism "iff" is a generally accepted abbreviation which may be used in formal writing. Regardless of the choice, you should never start a sentence with this phrase.

2.1.4. Conditionals

In a conditional *modus ponens* ("if ... then") statement, include the "then" – and the comma preceding it – as a matter of habit. For longer statements, place the conclusion in a separate sentence than the hypotheses. Otherwise, you might end up with an intractable statement of the form

⊗ "If $a = b$, $c = d$, $e = f$, $g = h$."

Also, do not ask a historical fact to depend on a mathematical hypothesis. Instead of

⊗ "If $x > 0$, then Euler proved in 1756 that ..."

write

"Euler proved in 1756 that if $x > 0$, then ..."

2.1.5. Numbers

A number should be expressed in words when it is less than 10, is not grouped for comparison, and does not represent a precise measurement. A number must be expressed in words when it begins a sentence, title, or heading; the measurement following should also be written out. Otherwise, use numerals to express a number that immediately precedes a unit of measurement. To form plurals, whether expressed in words or numerals, add "s" or "es" without an appostrophe. The symbol % is used only when preceded by a numeral; use the word "percentage" when a number is not given.

In English grammar, the word "fewer" is for comparing *number* while "less" is for comparing *quantity*. Therefore the signs at the checkout of the grocery store should really say "ten items or fewer," not "ten items or less." Mathematics deviates a bit from this rule, since we can say "3 is less than 5." The idea is that "3" and "5" refer to the quantities represented by those numbers. However, you should avoid saying "3 is smaller than 5," since "smaller" refers to *size*, not quantity.

2.1.6. Symbols

You should not use mathematical symbols as parts of speech in an ordinary sentence. Some bad examples are

- ⊗ "Consider the set of all numbers < 1."
- ⊗ "Consider the $\cap$ of the sets A and B."
- ⊗ "Consider a function f mapping $A \to B$."

Here is how to write these sentences correctly:

"Consider the set of all numbers less than 1."
"Consider the set of all numbers x such that $x < 1$."

"Consider the intersection of the sets A and B."
"Consider the set $A \cap B$."

"Consider a function f mapping A into B."
"Consider a function $f : A \to B$."

Do not use logical symbols *at all*. The symbols $\exists$, $\ni$, $\forall$, $\exists!$, $\wedge$, and $\vee$, as well as the abbreviations s.t., and w.r.t., are to be avoided in mathematical writing. In papers in logic, these symbols constitute part of the subject matter and are completely appropriate. In informal mathematical discourse, on blackboard or paper, they are often used as "parts of speech," in a sort of mathematical shorthand. However, they are not allowed by editors in formal mathematics writing. Just as you would not submit a history paper that is written partly in secretarial shorthand, do not submit a math paper written partly in mathematical shorthand!

One exception to this rule is the use of the symbols $\Rightarrow$ (implies), $\Leftarrow$ (is implied by), and $\Leftrightarrow$ (is equivalent to). One of course does not use these symbols as word-substitutes any more than one uses $<$ or $+$ or $\cap$ as word-substitutes. But usage is allowed in phrases such as

"We show (a) $\Rightarrow$ (b) $\Rightarrow$ (c)."

"To show that (a) and (b) are equivalent, it suffices to show (a) $\Rightarrow$ (b) and (b) $\Rightarrow$ (a)."

There is a reason why editors (at least those who are also mathematicians) enforce these rules strictly. Most mathematical readers find sentences in which these rules are violated quite unreadable, just as they find secretarial shorthand unreadable. They translate the sentence into the English language (or French, or German, or ...) mentally, before attempting to understand it. Occasionally, a textbook editor (who is usually not a mathematician) will let an author get away with violating these rules. Here is a horrendous example, quoted from a well-known text, verbatim:

⊗ "Let $f : [0, 9) \to [0, \Omega)$ be s.t. $f(\alpha) < \alpha$ for all $\alpha \geq$ some α_0.
Then $\exists \beta_0 \, \forall \beta \, \exists \alpha \geq \beta : f(\alpha) < \beta_0$."

Some people can grasp the meaning of these two sentences immediately; most mathematicians cannot!

Never start a sentence or a clause with mathematical symbols. Doing so can be counted on to confuse. Some bad examples are

⊗ "Let f be a function. f is said to be *semicontinuous* if ..."

⊗ "For most points x, $x \in S$."

⊗ "Then $a > 4$. $b > 4$ also, since ..."

It is better to say

"A function f is said to be *semicontinuous* if ..."

"Therefore $x \in S$ for most points x."

"Then $a > 4$. In addition, $b > 4$ since ..."

2.1.7. Displayed formulas

Long formulas are usually better displayed (that is, set off on a separate line from the rest of the text), because they are difficult to read when embedded in the text. Of course, important formulas should be displayed no matter what their length. Do not display every single formula, for that will make your paper a cumbersome read. Try to strike a balance between displaying and embedding formulas in your text.

Formulas and equations, whether displayed or embedded in the text, should be written and punctuated as though they were sentences.[3] For example:

> "To prove that (1) $\Rightarrow$ (2), we assume there is an injective function $f : \mathbb{Z}_+ \to A$. Let the image set $f(\mathbb{Z}_+)$ be denoted by B; and let $f(n)$ be denoted by a_n. Because f is injective, $a_n \neq a_m$ if $n \neq m$."

> "Let X be a separable metric space. Let f be a continuous function that is defined on an open subset of X. Suppose that g is any positive function. Define
>
> $$S = \{x : f \cdot g \,\text{is differentiable at}\, x\}\,.$$

[3] There is some confusion regarding note 1 (Puncuating formulas and equations) on p. 31 of the *Guidelines*; in particular, colons are only necessary if an equation is not part of a sentence.

Then by Lemma 2.3.6, the set S is of second category."

"The equation

$$x^n + y^n = z^n$$

tells us that Fermat's Last Theorem is still alive."

"The equation for determining the validity of this property is as follows:

$$\frac{x+y}{p-r} = z,$$

where x equals space, y equals time, p equals product, and r equals rate."

2.2. American Mathematical Society bibliography style

Mathematics journals use several different bibliography styles, and a disquisition can follow any of them. The preferred style in a disquisition, however, is the approved bibliography style for AMS publications. It is recommended that a bibliography from an AMS journal (the *Bulletin of the AMS*, for example) be used as a model.

Items the bibliography are usually ordered alphabetically by author. The descriptions which follow are taken from [1].

2.2.1. All references

A reference should begin with the name(s) of the author(s) or editor(s). Give at least one full name; initials and last name is an acceptable form. If the reference is to an edited collection, such as the proceedings of a conference, insert "(ed.)" or "(eds.)" following the name(s) as appropriate. The name of the author is followed by a comma.

The title of the article or book should be italicized. In a title, the first word and any proper names should begin with capital letters; everything else should be lower case. (In a German title, all nouns should begin with capital letters.) If a title is followed by a part number, the title proper should be terminated by a period; the part number and any attached text should be set in roman type. The title is followed by a comma.

2.2.2. Journal articles

The name of the journal follows the title. The journal name, which is not italicized, may be given in abbreviated form. Refer to *MathSciNet* for standard journal abbreviations. If the journal name is modified by a series name, include that information following the name, in parentheses.

The volume number should be set in boldface. The issue number, if present, should be preceded by "no."; however, the issue number is normally omitted except where to do so would result in an ambiguous reference.

The year of publication is given in parentheses. If the paper has not yet appeared in print, the words "to appear" should replace the year. For some journals, the volume number is the same as the year of publication; in such a case, it should be given in bold, not enclosed in parentheses.

The next element is the page reference. If a span is involved, use an en-dash (typed as -- in LaTeX) to separate the page numbers.

If the article is in a language different from that of the title (usually because the title has been translated), or it is not possible to determine the language of the article from the title, include the language information in parentheses. Additional relevant information may be included, if appropriate, at the end of a reference. In particular, information about a translation follows the same style as the main reference.

Examples:

[1] H. Bass, E. H. Connell, and D. Wright, *The Jacobian conjecture*, Bull. Amer. Math. Soc. **7** (1982), 287–330.

[2] B. Coomes, *The Lorenz system does not have a polynomial flow*, J. Differential Equations (to appear).

[3] P. Gabriel, *Unzerlegbare Darstellungen.* II, Manuscripta Math. **6** (1972), 71–103.

[4] P. D. Lax and C. D. Levermore, *The small dispersion limit for the KdV equation.* I (overview), II, III, Comm. Pure Appl. Math. **36** (1983), 253–290, 571–594, 809–829.

[5] A. E. Martynyuk, *Some approximate methods for solving nonlinear equations with unbounded operators*, Izv. Vyssh. Uchebn. Zaved. Mat. **1966**, no. 6 (55), 85–94 (Russian), addendum, ibid. **1967** no. 8 (63), 111.

[6] G. S. Petrov, *Elliptic integrals and their nonoscillatory behavior*, Funktsional. Anal. i Prilozhen. **20** (1986), 46–49 (Russian), English transl. in Functional Anal. Appl. **20** (1986).

[7] L. N. Slobodetskiĭ, *Generalized Sobolev spaces and their application to boundary value problems for partial differential equations*, Leningrad. Gos. Ped. Inst. Uchen. Zap. **197** (1958), 54–112 (Russian), English transl. in Amer. Math. Soc. Transl. (2) **57** (1966).

2.2.3. Books

Additional book information should be given following the title, including the edition number or identification of a conference and its location (in parentheses) in the case of a proceedings volume.

The name of the publisher may be given in abbreviated form. The publisher's address should be given as the name of a city and state or foreign city where the book was published. The year of publication follows the publisher information. Language information, if necessary, is included in parentheses following the year. Additional information may be included if appropriate.

Examples:

[8] A. M. Arthurs, *Complementary variational principles*, 2nd ed., Clarendon, Oxford, 1980.

[9] V. L. Arnold, A. N. Varchenko, and S. M. Gusein-Zade, *Singularities of differentiable maps.* I, "Nauka", Moscow, 1982 (Russian), English transl., Birkhäuser, Basel, 1985.

[10] R. W. Cottle et al. (eds.), *Variational inequalities and complementarity problems*, Proc. Internat. School (Erice, 1978), Wiley, New York, 1980.

2.2.4. Articles in books

If the article is part of a collection, the article title should be followed by information which identifies the collection as a whole. Possible choices are the title of a named collection, the identification of a volume of conference proceedings, or a

series title. In this title, all important words begin with capital letters. If the book is the proceedings of a conference, the location and date of the conference should follow the title in parentheses.

For a named collection, the name(s) of the editor(s) should be given in parentheses with "ed." or "eds." following the name(s) as appropriate. Volume information for a book series should be given in the form "vol." followed by the volume number. If a collection is published with a dedication, that information may be given in parentheses following the main title and editorial information for the collection.

Publisher name and address should be entered in the same manner as for books. They are followed by the year of publication, using "to appear" if the collection has not yet been published. Page information follows the year of publication, preceded by "p." or "pp." as appropriate. For a span of pages, use an en-dash (`--`) to separate them.

Language information, if necessary, follows the same style as for a journal article. Additional information, if necessary, should be treated in a manner similar to that for a journal article or a book.

Examples:

[11] V. I. Berdichevskiĭ, *A variational equation of continuum mechanics*, Problems of the Mechanics of a Solid Deformable Body (L. I. Sedov and Yu. N. Robotnov, eds.), "Sudostroenie", Leningrad, 1970, (V. V. Novozhilov Sixtieth Birthday Vol.), pp. 55–66 (Russian).

[12] E. Formanek, *Generating the ring of matrix invariants*, Lecture Notes in Math., vol. 1197, Springer-Verlag, Berlin and New York, 1986, pp. 73–82.

[13] J. L. Lions, *Problèmes mixtes abstraits*, Proc. Internat. Congr. Math. (Edinburgh, 1958), Cambridge Univ. Press, London and New York, 1960, pp. 389–397.

[14] G. H. Meisters, *Polynomial flows on* $\mathbb{R}^n$, Proc. Semester on Dynamical Systems (Warsaw, Autumn 1986), Springer-Verlag, Berlin, Heidelberg, and New York, (to appear).

[15] S. Osher, *Shock capturing algorithms for equations of mixed type*, Numerical Methods for Partial Differential Equations (S. I. Hariharan and T. H. Moulton, eds.), Longman, New York, 1986, pp. 305–322.

2.2.5. Other types of references

Ph.D. theses are similar to books, but in place of publisher information, the phrase "Ph.D. thesis" and the name of the institution granting the degree should be given.

Examples:

[16] J. A. Calvo, *Geometric knot theory: the classification of spatial polygons with a small number of edges*, Ph.D. thesis, Univ. California, Santa Barbara, 1998.

[17] B. Coomes, *Polynomial flows, symmetry groups, and conditions sufficient for injectivity of maps*, Ph.D. thesis, Univ. Nebraska, Lincoln, 1988.

REFERENCES

[1] American Mathematical Society, *Guidelines for preparing electronic manuscripts (AMS-LaTeX)*, 1991, available online at `http://www.math.psu.edu/doc/tex-inputs/author-info/guidelines`.

[2] L. Gillman, *Writing mathematics well*, Mathematical Association of America, Washington, DC, 1987.

[3] M. Goossens, F. Mittelbach, and A. Samarin, *The LaTeX companion*, Addison Wesley, Boston, MA, 1994.

[4] H. Kopka and P. Daly, *A guide to LaTeX2ε*, Addison Wesley, Boston, MA, 1995.

[5] S. G. Krantz, *A primer of mathematical writing*, American Mathematical Society, Providence, RI, 1996.

[6] LaTeX3 Project, *LaTeX2ε for class and package writers*, 1995, available online at `http://www.latex-project.org/guides/clsguide`.

[7] N. E. Steenrod, P. R. Halmos, M. M. Schiffer, and J. E. Dieudonné, *How to write mathematics*, 2nd ed., American Mathematical Society, Providence, RI, 1981.

APPENDIX A. SAMPLE TEMPLATE

Here we present a brief template of the code used to produce this document.

```
\documentclass{ndsuthesis}
\begin{document}

\title[Using the NDSU Thesis \\ Document Class for LaTeX]
     {Using the NDSU Thesis Document Class for LaTeX}
\name{Jorge Alberto}{Calvo}
\professor{Dr. Jorge Alberto Calvo}
\coverpage[20mm]

\begin{abstract}
...
\end{abstract}

\section*{Acknowledgments}
...

\tableofcontents
\listoffigures
\listoftables
\mainbody

\section{The document class}
...

\subsection{General structure}
...

\subsubsection{Selecting disquisition type}
...

\subsubsection{Draft mode}
...

\subsubsection{Loading AMS-\LaTeX}
...

\subsection{Prefactory material}
...
```

```
    \subsubsection{Cover page}
...

\subsubsection{Approval page}
...

\subsubsection{Abstract}
...

\subsubsection{Table of contents, list of figures, list of tables}
...

\subsubsection{Optional prefactory sections}
...

\subsubsection{Hyphenation}
...

\subsection{Main body}
...

\subsubsection{Sectioning commands}
...

\subsubsection{Figures and tables}
...

\subsection{Reference section}
...

\section{Mathematical writing style}
...
...
...

\bibliographystyle{ndsuthesis}
\bibliography{mythesis}

\appendix{Sample template}
...

\end{document}
```