

AN EXAMPLE FILE FOR SENIOR PROJECT IN MATHEMATICS

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ABSTRACT. An abstract of at about 150 words (10 rows) should be included. The abstract should summarize the results of the paper and nothing more. The main purpose of the abstract is to enable the readers to take in the nature and results of the papers quickly and to decide whether they are willing to read the entire paper or not.

INTRODUCTION

The first section is usually an introduction. It has the role of presenting the general framework of the paper, historical notes, relevance of the project and an outline of the main results. Repetition should be kept to a minimum. The introduction should not have more than two pages. Acknowledgements of support and thanks (e.g. to the adviser) should be placed at the end of the introduction.

The body of the article should be usually divided in sections. Out of this introductory section, the following section may be dedicated to preliminary results, that is, a list of definitions and results (without proofs) that will be used in the project. Otherwise, the following section can be the main section, or a sequence of different sections, dedicated to the presentation of the project from the mathematical point of view.

The results should be distinguished correspondingly as theorems, propositions, lemmas and corollaries. Remarks, definitions, and examples can be used. Preferable is that all the items to be numbered within sections: the first figure is the section number, the latter designates the number of the item within the same section.

The beginning and the end of the proofs should be clearly emphasized. If necessary, proofs can be divided in steps. Nested proofs should be avoided as much as possible.

If draws are necessary, the available packages for producing different pictures in L^AT_EX2e can be used. If complicated pictures are needed, there are available packages for including graphics, e.g. in EPS (Encapsulated Post Script) or PDF (Portable Document Format).

Items listed as references should be relevant to the subject of the paper. The list of references must be in alphabetical-chronological order. Abbreviations of names of journals and references should follow the standard form established by the Mathematical Reviews.

1. PRELIMINARY RESULTS AND NOTATION

The second section can be dedicated to preliminary results, notation, and other topics that make the background of the project.

2. MAIN SECTION

In this section we exemplify the use of theorems, definitions, and proofs, with different mathematical formulas, tables, etc. By no means this file is supposed to be exhaustive. The student should consult the textbook indicated for L^AT_EX₂ε by creating more complicated mathematical formulas.

In this section we give some examples of use of macros and environments. There are two types of environments for results and the like. The first one is a “proclaim” type, used for theorems, corollaries, lemmas, propositions.

Theorem 2.1. *This is an example of a proposition. It contains a statement in italics, equations, formulas and possibly some itemed statements like these:*

- (i) *this is the first item;*
- (ii) *and this is the second.*

You can use an option for associating citations or names with a theorem:

Theorem 2.2 (My Friends’ Greatest Result, [3]). *This is another theorem. It contains three items that are more or less independent.*

- (a) *This is the first item.*
- (b) *This is the second item.*
- (c) *This is the third item.*

Proof. This is an example of a proof where you should always use the environment *proof* as we do. □

A proof may be provided with a special name.

Proof of Theorem 2.1. In this proof we emphasize a situation when the last row is a displayed equation. In this case, you should use a special command `\qedhere` to fix the rectangle indicated the end of the proof, like in the following:

$$(2.1) \qquad B(t) = b(s). \qquad \square$$

Fancy theorems, for which there is no automatic numbering and the tag is put manually, are available.

Theorem A. *This theorem is classical.*

A second type of environment that we call *statement* is for definitions, remarks, and examples.

Definition 2.3. This is an example of a definition. The defined *term* should be emphasized.

Another example of this type is a remark.

Remark 2.4. This is an example of a remar. It will appear in roman letters as the defintions and examples.

An example can have an emphasized text at the beginning to clearly state what is done.

Example 2.5. *We give an example that has an emphasized statement.*

Now it should follow the example which will be typed in roman letters.

For emphasizing text do not use boldface. Instead, the command `\emph` is highly recommended.

Another important recommendation is to not use your own breaks. This class file `amsart.cls` is designed in such a way to produce automatically spaces whenever is needed, and it reflects the style used very frequently in mathematics.

You should use all-over the article labeled cross references by using `\ref` command, e.g. citing Theorem 2.2. For equations it is recommended to use instead the command `\eqref`, like e.g. (2.1), that produces the round braces as well.

It is recommended to use alignments as follows:

$$(2.2) \quad \begin{aligned} B(t) &= B(t+1) + B(t+2) + B(t+3) \\ &= A(t) \end{aligned}$$

Note that you can have some rows without tags.

In the following we exemplify the use of matrices. With respect to the decomposition $\mathcal{K} = \mathcal{K}_1 \oplus \mathcal{K}_2$ we have

$$A+B = \begin{bmatrix} 0 & 0 \\ 0 & C \end{bmatrix}, \quad \pi_\rho(a) = \begin{bmatrix} \pi_{\rho,1}(a) & 0 \\ 0 & \pi_{\rho,2}(a) \end{bmatrix} \quad \text{for all } a \in \mathcal{A}, \quad \text{and} \quad V = \begin{bmatrix} V_1 \\ V_2 \end{bmatrix},$$

where C is an operator in $\mathcal{B}(\mathcal{K}_2)^+$, necessarily one-to-one, and commutes with $\pi_{\rho,2}(a)$, for all $a \in \mathcal{A}$.

If your formulas are longer, you should organize them as follows:

$$\begin{aligned} [A]B &= \begin{bmatrix} 0 & 0 \\ 0 & C^{1/2}FC^{1/2} \end{bmatrix} \begin{bmatrix} 0 & 0 \\ 0 & C^{1/2}(1-F)C^{1/2} \end{bmatrix} \\ &= \begin{bmatrix} 0 & 0 \\ 0 & [C^{1/2}FC^{1/2}](C^{1/2}(1-F)C^{1/2}) \end{bmatrix} \\ &= \begin{bmatrix} 0 & 0 \\ 0 & C^{1/2} [F](1-F) C^{1/2} \end{bmatrix} = D_\rho(\phi_{ac}). \end{aligned}$$

For more complicated mathematical formulas, tabulars, and arrays, you should consult the $\text{\LaTeX}2\epsilon$ textbook indicated in the syllabus.

3. FINAL REMARKS

You should be aware that complicated and longer aligned formulas can produce rare pages, because of the page break problems.

Citations of bibliography, like [3], should be done by labels.

When coding your $\mathcal{A}\mathcal{M}\mathcal{S}$ - \LaTeX file, please bear in mind the following general rules:

(1) Use the packages `amsmath`, `amssymb`, `amsfonts`, etc. for quality mathematical typesetting.

(2) Use the $\text{\LaTeX}2\epsilon$ and $\mathcal{A}\mathcal{M}\mathcal{S}$ - \LaTeX commands and cross-reference capabilities as much as possible. Do not hardcode your own layout, for example by creating your own section headings, theorems and the like, displayed equations, etc. Do not use your own spacing: use as much as possible the $\mathcal{A}\mathcal{M}\mathcal{S}$ - \LaTeX capabilities available in the `amsmath` package.

(3) Keep it simple. Do not define macros to create a complicated layout, as these will make the input process complicated.

(4) Be consistent. If you use a macro for a phrase, use it throughout.

(5) Figures may be inserted in the usual way using an `\includegraphics` command at the position in the article where they are cited.

(6) If the \LaTeX file is nicely written, the corrections can be easy.

REFERENCES

- [1] M.F. AUTHOR, Title of the article, *J. Operator Theory*, **79**(2009), 123-145.
- [2] M. NAME, Y. NAME, *Title of the Book*, Theta, Bucharest 2004.
- [3] M. STUDENT, *Title of the Dissertation*, PhD Dissertation, My University, My Town 1450.

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