

Study Notes

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Update on July 20, 2022

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List of Theorems

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List of Abbreviations and Symbols

L	Lagrangian. 25
\hat{H}	Hamiltonian. 25
\mathbb{R}	Real number. 10
\vec{v}	a vector. 10
GD	Gradient Descent. 21
QFT	Quantum Field Theory. 25
SVM	Support Vector Machine. 10 , 21

Preface

Contents

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0.1 Features of this template

TeX, stylized within the system as \LaTeX , is a typesetting system which was designed and written by Donald Knuth and first released in 1978. TeX is a popular means of typesetting complex mathematical formulae; it has been noted as one of the most sophisticated digital typographical systems.

- [Wikipedia](#)

0.1.1 crossref

different styles of clickable definitions and theorems

- nameref: [Gaussian distribution](#)
- autoref: [Definition A.1](#), [algorithm 1.5.1](#)
- cref: [Definition A.1](#),
- hyperref: [Gaussian](#),

0.1.2 ToC (Table of Content)

- mini toc of sections at the beginning of each chapter
- list of theorems, definitions, figures
- the chapter titles are bi-directional linked

0.1.3 header and footer

fancyhdr

- right header: section name and link to the beginning of the section

- left header: chapter title and link to the beginning of the chapter
- footer: page number linked to ToC of the whole document

0.1.4 bib

- titles of reference is linked to the publisher webpage e.g., [Kit+02]
- backref (go to the page where the reference is cited) e.g., [Chi09]
- customized video entry in reference like in [Bab16]

0.1.5 preface, index, quote (epigraph) and appendix

index page at the end of this document...

0.1.6 symbol and glossary (abbreviation)

examples: \mathbb{R} , SVM, \vec{v}

usage

- glossary package

```
pdflatex notes_template.tex
makeglossaries notes_template
pdflatex notes_template.tex
```

- glossary-extra package and bib2gls

```
pdflatex notes_template.tex
bib2gls notes_template
pdflatex notes_template.tex
```

0.2 Related Tools

0.2.1 VSCode

Extension: [Latex Workshop by James Yu](#)

settings

0.2.2 lualatex and latexmk

.latexmkrc configuration file

```
$pdflatex_=_ 'lualatex_--synctex=1_-interaction=nonstopmode_--shell-escape_%0_%S';
@generated_exts_=(@generated_exts_,_ 'synctex.gz');
$pdf_mode_=_1;

add_cus_dep('glo',_ 'gls',_ 0,_ 'makeglo2gls');
sub_makeglo2gls{
system("makeindex_-s_ '$_[0]'_.ist_-t_ '$_[0]'_.glg_-o_ '$_[0]'_.gls_ '$_[0]'_.glo");
}
```

To explain

```
# Also delete the *.glstex files from package glossaries-extra. Problem is,
# that that package generates files of the form "basename-digit.glstex" if
# multiple glossaries are present. Latexmk looks for "basename.glstex" and so
# does not find those. For that purpose, use wildcard.
$clean_ext = "%R-*.glstex";

push @generated_exts, 'glstex', 'glg';

add_cus_dep('aux', 'glstex', 0, 'run_bib2gls');

# PERL subroutine. $_[0] is the argument (filename in this case).
# File from author from here: https://tex.stackexchange.com/a/401979/120853
sub run_bib2gls {
    if ( $silent ) {
        # my $ret = system "bib2gls --silent --group '$_[0]'"; # Original version
        my $ret = system "bib2gls --silent --group $_[0]"; # Runs in PowerShell
    } else {
        # my $ret = system "bib2gls --group '$_[0]'"; # Original version
        my $ret = system "bib2gls --group $_[0]"; # Runs in PowerShell
    };

    my ($base, $path) = fileparse( $_[0] );
    if ($path && -e "$base.glstex") {
        rename "$base.glstex", "$path$base.glstex";
    }

    # Analyze log file.
    local *LOG;
    $LOG = "$_[0].glg";
    if (!$ret && -e $LOG) {
        open LOG, "<$LOG";
        while (<LOG>) {
            if (/^Reading (.*\.bib)\s$/ ) {
                rdb_ensure_file( $rule, $1 );
            }
        }
        close LOG;
    }
    return $ret;
}
```

0.2.3 Zotero and Better-bibtex

[todo] <https://retorque.re/zotero-better-bibtex/> customized entry, e.g., **Online Video**

0.3 Copyright and License

- GitHub Repo: <https://github.com/Jue-Xu/Latex-Template-for-Scientific-Style-Book>
- Overleaf template: <https://www.overleaf.com/latex/templates/latex-template-for-scientific-style-ntprxjksmqxx>

Part I

Mathematics

Chapter 1

Discrete Math

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gls examples:

- [Greatest Common Divisor \(GCD\)](#); [Greatest Common Divisor](#); [GCD](#); [Greatest Common Divisor \(GCD\)](#)

1.1 Proof

Lemma 1.1.

Claim 1.1.

Theorem 1.1.

Example 1.1.

Fact 1.1.

Remark 1.1.

Exercise 1.1. Prove $A \iff B$

Solution. By induction:

□

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1.2 Quantifier

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1.3 Graph

“Graph Isomorphism in Quasipolynomial Time” [Bab16]

1.4 Number theory

a Figure example

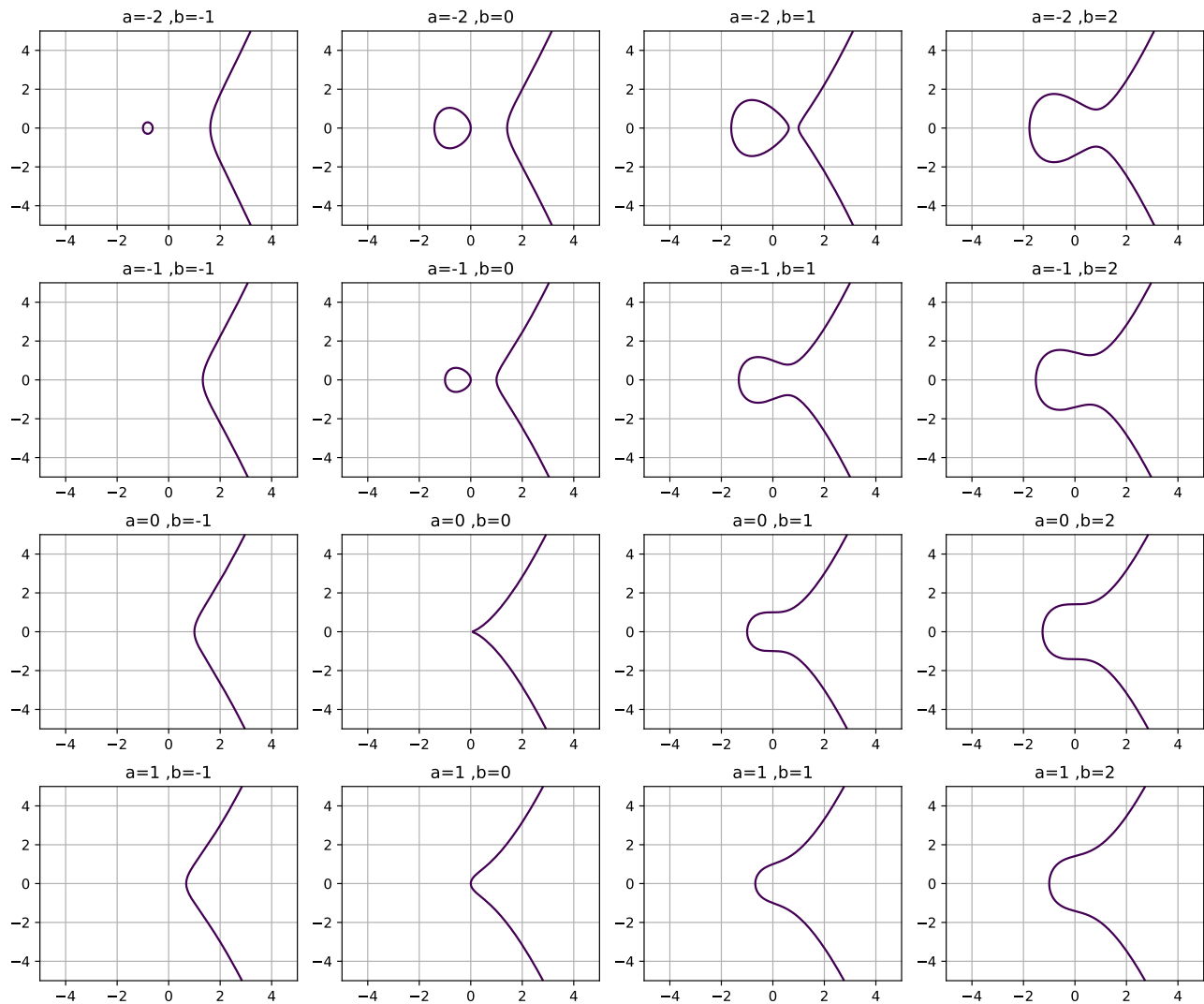


Figure 1.1: Elliptic curves [Chi09]

1.5 Algorithm

Algorithm 1.5.1: Primality testing - first attempt

input : Integer N and parameter 1^t

output: A decision as to whether N is prime or composite

```

1 for  $i = 1, 2, \dots, t$  do
2    $a \leftarrow \{1, \dots, N_1\}$                                      // this is a comment
3   if  $a^{N-1} \not\equiv 1 \pmod N$  then
4     return "composite"
5 return "prime"
```

Part II

Computer Science

Chapter 2

Machine Learning

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2.1 Regression

2.1.1 Gradient descent

GD;

2.2 Support Vector Machine

SVM;

Part III

Physics

Chapter 3

Quantum Mechanics

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3.1 Hamiltonian

\hat{H} ;

3.2 Path Integral

L

3.3 Quantum Field Theory

QFT;

Appendix A

Formulas

A.1 Gaussian distribution

Definition A.1 (Gaussian distribution). *Gaussian distribution*

Theorem A.1 (Central limit theorem).

Bibliography

- [Bab16] László Babai. “Graph Isomorphism in Quasipolynomial Time”. Jan. 19, 2016. arXiv: [1512.03547](#) [[cs](#), [math](#)] (cit. on pp. [10](#), [17](#)). [ONLINE VIDEO](#)
- [Chi09] Andrew M. Childs. *Universal Computation by Quantum Walk*. Physical Review Letters 102.18 (May 4, 2009), p. 180501. arXiv: [0806.1972](#) (cit. on pp. [10](#), [18](#)).
- [Kit+02] Alexei Yu Kitaev et al. *Classical and quantum computation*. 47. American Mathematical Soc., 2002 (cit. on p. [10](#)).

Alphabetical Index

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