

Study Notes

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Contents

	I Mathematics	13
	1 Discrete Math	15
	1.1 Proof	15
	1.2 Quantifier	16
	1.3 Graph	17
	1.4 Number theory	17
	1.5 Algorithm	18
	II Computer Science	19
	2 Machine Learning	21
	2.1 Regression	21
	2.1.1 Gradient descent	21
	2.2 Support Vector Machine	21
	III Physics	23
	3 Quantum Mechanics	25
	3.1 Hamiltonian	25
	3.2 Path Integral	25
	3.3 Quantum Field Theory	25
	Appendices	27
	Appendix A Formulas	27
	A.1 Gaussian distribution	27
	Bibliography	29
	Alphabetical Index	31
List of Abbreviations and Symbols	7	
Preface	9	
0.1 Features of this template	9	
0.1.1 crossref	9	
0.1.2 ToC (Table of Content)	9	
0.1.3 header and footer	9	
0.1.4 bib	10	
0.1.5 preface, index, quote (epi-graph) and appendix	10	
0.1.6 symbol and glossary (abbrevi-ation)	10	
0.2 Related Tools	10	
0.2.1 VSCode	10	
0.2.2 lualatex and latexmk	10	
0.2.3 Zotero and Better-bibtex	11	
0.3 Copyright and License	12	

List of Figures

1.1	Elliptic curves [Chi09]	18
A.1	Theorem (Central limit theorem)	27

List of Theorems

1.1	Theorem	15
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List of Definitions

A.1	Definition (Gaussian distribution)	27
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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

0.1 Features of this template	9
0.2 Related Tools	10
0.3 Copyright and License	12

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

Contents

1.1	Proof	15
1.2	Quantifier	16
1.3	Graph	17
1.4	Number theory	17
1.5	Algorithm	18

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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Nulla malesuada porttitor diam. Donec felis erat, congue non, volutpat at, tincidunt tristique, libero. Vivamus viverra fermentum felis. Donec nonummy pellentesque ante. Phasellus adipiscing semper elit. Proin fermentum massa ac quam. Sed diam turpis, molestie vitae, placerat a, molestie nec, leo. Maecenas lacinia. Nam ipsum ligula, eleifend at, accumsan nec, suscipit a, ipsum. Morbi blandit ligula feugiat magna. Nunc eleifend consequat lorem. Sed lacinia nulla vitae enim. Pellentesque tincidunt purus vel magna. Integer non enim. Praesent euismod nunc eu purus. Donec bibendum quam in tellus. Nullam cursus pulvinar lectus. Donec et mi. Nam vulputate metus eu enim. Vestibulum pellentesque felis eu massa.

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1.2 Quantifier

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Nulla malesuada porttitor diam. Donec felis erat, congue non, volutpat at, tincidunt tristique, libero. Vivamus viverra fermentum felis. Donec nonummy pellentesque ante. Phasellus adipiscing semper elit. Proin fermentum massa ac quam. Sed diam turpis, molestie vitae, placerat a, molestie nec, leo. Maecenas lacinia. Nam ipsum ligula, eleifend at, accumsan nec, suscipit a, ipsum. Morbi blandit ligula feugiat magna. Nunc eleifend consequat lorem. Sed lacinia nulla vitae enim. Pellentesque tincidunt purus vel magna. Integer non enim. Praesent euismod nunc eu purus. Donec bibendum quam in tellus. Nullam cursus pulvinar lectus. Donec et mi. Nam vulputate metus eu enim. Vestibulum pellentesque felis eu massa.

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1.3 Graph

“Graph Isomorphism in Quasipolynomial Time” [Bab16]

1.4 Number theory

a Figure example

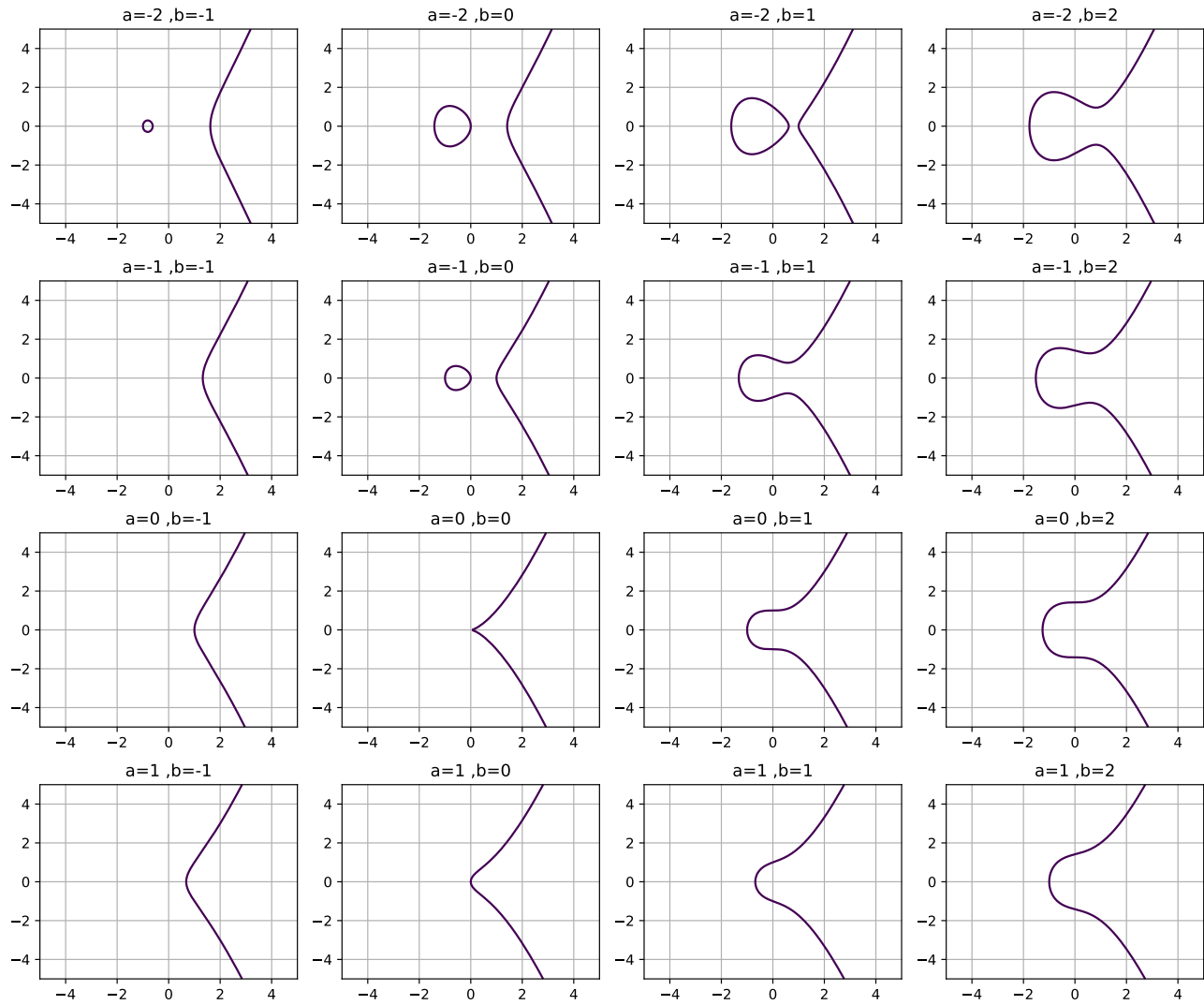


Figure 1.1: Elliptic curves [Chi09]

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    $a \leftarrow \{1, \dots, N_1\}$ ;
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

Contents

2.1	Regression	21
2.2	Support Vector Machine	21

2.1 Regression

2.1.1 Gradient descent

GD;

2.2 Support Vector Machine

SVM;

Part III

Physics

Chapter 3

Quantum Mechanics

Contents

3.1	Hamiltonian	25
3.2	Path Integral	25
3.3	Quantum Field Theory	25

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

G

Gaussian distribution, [27](#)

I

index, [10](#)