

# LaTeX hands-on tutorial



# About lecturer

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Statistical representation of word meanings

# Goal

- You understand what is LaTeX
- You can use Overleaf (online LaTeX editor)
- You can write a document with text, title, headings, math formulas, figures & tables using LaTeX

What is LaTeX?

# What is LaTeX?

**LaTeX** is a typesetting software

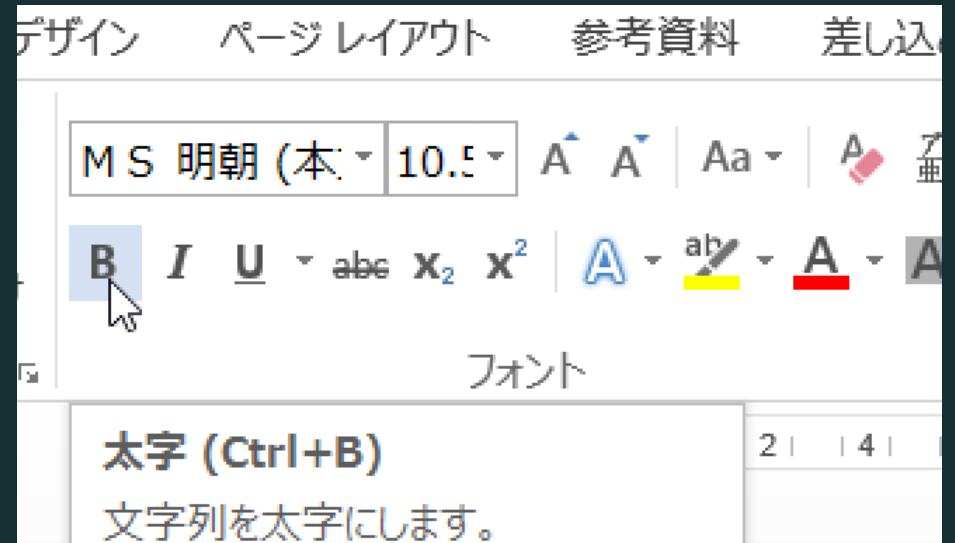
Typesetting software:

making (layouting) reports, articles,  
books

# Microsoft Word vs. LaTeX

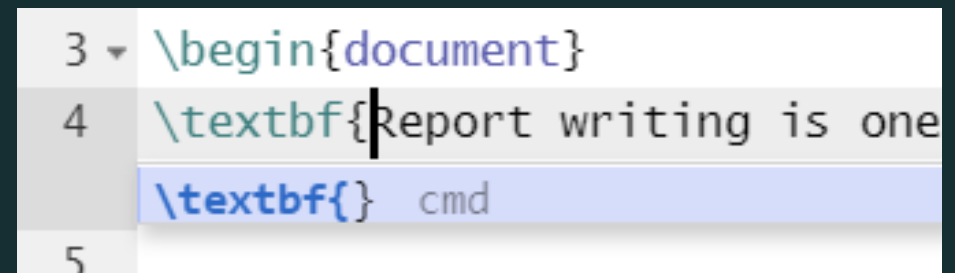
## Word

Text formats specified by GUI buttons etc.



## LaTeX

Text formats specified by plain text commands



# LaTeX is a converter

.tex file

PDF file

```
\documentclass{article}
\usepackage[utf8]{inputenc}

\title{Advances in the Report Writing}
\author{Hayato Hashimoto}
\date{April 2019}

\begin{document}

\maketitle

\section{Introduction}

\end{document}
```

convert



Your Paper

You  
June 19, 2018

Abstract

Your abstract.

## 1 Introduction

Your introduction goes here! Some examples of commonly used commands and features are listed below, to help you get started. If you have a question, please use the help menu (?) on the top bar to search for help or ask us a question.

## 2 Some examples to get started

### 2.1 How to add Comments

Comments can be added to your project by clicking on the comment icon in the toolbar above. To reply to a comment, simply click the reply button in the lower right corner of the comment, and you can close them when you're done.

### 2.2 How to include Figures

First you have to upload the image file from your computer using the upload link in the project menu. Then use the `includegraphics` command to include it in your document. Use the figure environment and the caption command to add a number and a caption to your figure. See the code for Figure 1 in this section for an example.

### 2.3 How to add Tables

Use the table and tabular commands for basic tables — see Table 1, for example.




Figure 1: This frog was uploaded via the project menu.

# LaTeX is a converter

.tex file

PDF file

Specifies

Title

Paper Margins

Headings

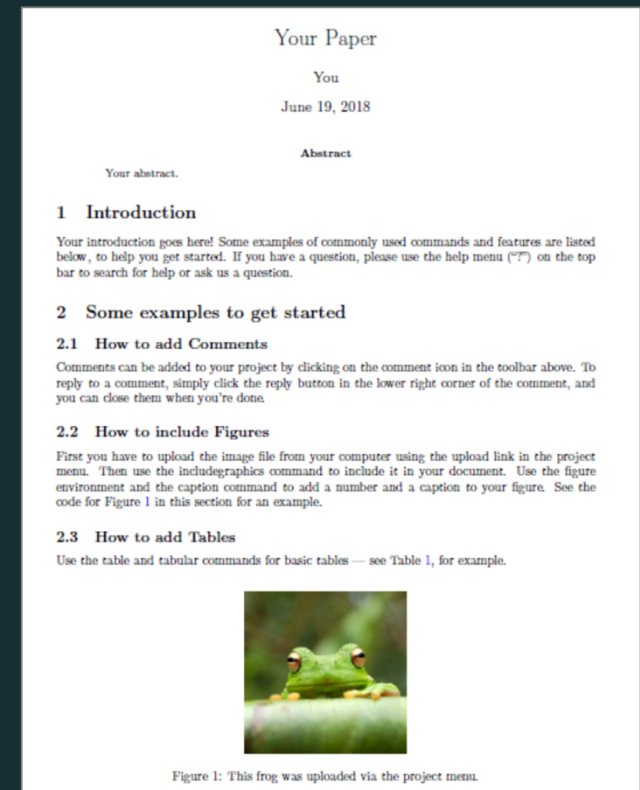
Main text

Fonts

convert



```
\documentclass{article}
```





Converter “What you MEAN is what you get”  
vs. GUI “What you SEE is what you get”

Pros:

- Good-looking auto-layouting by default
- Explicitly written styles
- No hassle required with buttons and windows: good at inputting math / reference

Cons:

- Manual adjustments require some hassle

# LaTeX is ...

... was developed by a mathematician

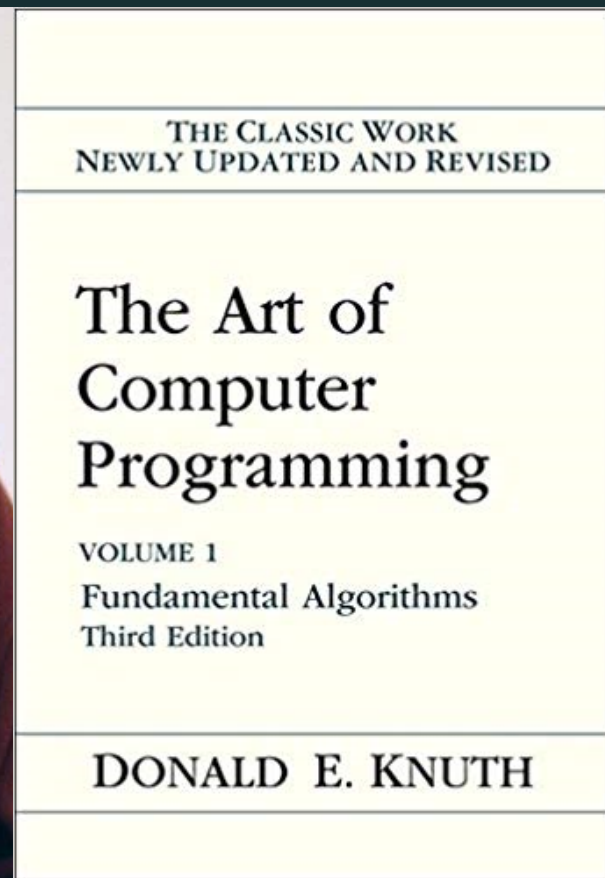
good display of math formula

... has long history

accepted by journals

functionalities

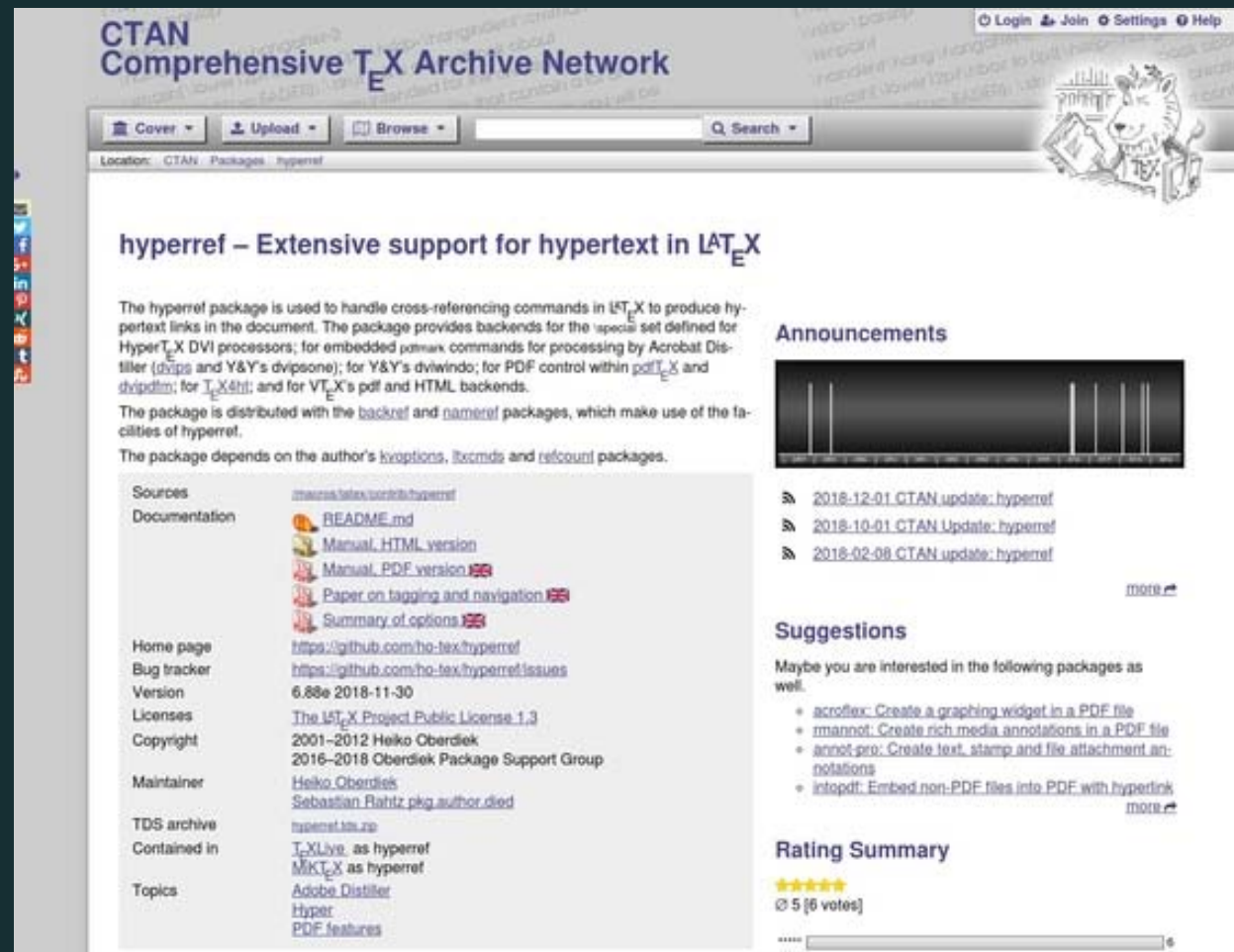
extended by users



# LaTeX is ...

has “macro” extensions  
users can add new  
functionality

has various “packages”  
Users can utilize ready-  
to-use macro packages  
shared by LaTeX users.



The screenshot shows the CTAN (Comprehensive T<sub>E</sub>X Archive Network) website page for the `hyperref` package. The page title is "hyperref – Extensive support for hypertext in L<sup>A</sup>T<sub>E</sub>X". The main content area contains a description of the package, its dependencies, and a list of sources and documentation. The right sidebar features sections for "Announcements", "Suggestions", and "Rating Summary".

**CTAN**  
Comprehensive T<sub>E</sub>X Archive Network

Location: CTAN Packages hyperref

## hyperref – Extensive support for hypertext in L<sup>A</sup>T<sub>E</sub>X

The hyperref package is used to handle cross-referencing commands in L<sup>A</sup>T<sub>E</sub>X to produce hypertext links in the document. The package provides backends for the special set defined for HyperT<sub>E</sub>X DVI processors; for embedded `pdfmark` commands for processing by Acrobat Distiller (`dvips` and Y&Y's `dvipdfm`); for Y&Y's `dvipdfm`; for PDF control within `pdfTEX` and `dvipdfm`; for T<sub>E</sub>X<sub>4</sub> and for V<sub>T</sub>E<sub>X</sub>'s pdf and HTML backends.

The package is distributed with the `backref` and `nameref` packages, which make use of the facilities of hyperref.

The package depends on the author's `kvoptions`, `ltxcmds` and `relcount` packages.

**Sources**

- Documentation
  - [README.md](#)
  - [Manual, HTML version](#)
  - [Manual, PDF version](#)
  - [Paper on tagging and navigation](#)
  - [Summary of options](#)

**Home page** <https://github.com/ho-tex/hyperref>

**Bug tracker** <https://github.com/ho-tex/hyperref/issues>

**Version** 6.88e 2018-11-30

**Licenses** The L<sup>A</sup>T<sub>E</sub>X Project Public License 1.3

**Copyright** 2001–2012 Heiko Oberdiek  
2016–2018 Oberdiek Package Support Group

**Maintainer** Heiko Oberdiek  
Sebastian Rahtz `pkg.author.died`

**TDS archive** [tug.ctan.org](https://tug.ctan.org/tex-archive/packages/hyperref)

**Contained in** T<sub>E</sub>X Live as hyperref  
MikT<sub>E</sub>X as hyperref

**Topics** Adobe Distiller  
Hyper  
PDF features

### Announcements

- 2018-12-01 CTAN update: hyperref
- 2018-10-01 CTAN Update: hyperref
- 2018-02-08 CTAN update: hyperref

[more](#)

### Suggestions

Maybe you are interested in the following packages as well.

- `acrofitx`: Create a graphing widget in a PDF file
- `mmannot`: Create rich media annotations in a PDF file
- `annot-pro`: Create text, stamp and file attachment annotations
- `intopdf`: Embed non-PDF files into PDF with hyperlink

[more](#)

### Rating Summary

★★★★★  
5 [6 votes]

.....

# Start with Overleaf



Overleaf

Overleaf is a web application for editing LaTeX

- No installation needed
- Free of charge (basic plan)
- Multi-user collaborative editing
- Used by many academic authors (including me)

# (just for reference) local PC installation

There are various *distributions* of LaTeX  
(*distribution: LaTeX + packages + fonts + auxiliary softwares*)

Use: TeX Live 2019

(requires > 5GB of storage space for *full installation*)

# Using

# Overleaf

The Overleaf logo, featuring a stylized leaf icon to the left of the word "Overleaf" in a white, sans-serif font.

**New Project**

All Projects

Your Projects

Shared with  
you

<input type="checkbox"/>	Title	Owner	Last Modified
--------------------------	-------	-------	---------------

# Using

# Overleaf

You can edit here

PDF preview

The screenshot displays the Overleaf web interface. At the top, there is a navigation bar with icons for Menu, a home arrow, and buttons for Abandon, Share, Submit, History, and Chat. Below this is a toolbar with icons for file operations and a 'Recompile' button. The main area is split into two panes. The left pane, titled 'Source', shows the LaTeX source code for a document. The right pane, titled 'PDF preview', shows the rendered output of the code.

```
1 \documentclass{article}
2 \usepackage[utf8]{inputenc}
3
4 \title{Advances in the Report Writing}
5 \author{Hayato Hashimoto}
6 \date{April 2019}
7
8 \begin{document}
9
10 \maketitle
11
12 \section{Introduction}
13
14 \end{document}
```

The PDF preview shows the following content:

Advances in the Report Writing  
Hayato Hashimoto  
April 2019

1 Introduction



# Using

# Overleaf

## PDF preview update button

The screenshot displays the Overleaf web interface. On the left, a file explorer shows 'main.tex' selected. The source code editor contains the following LaTeX code:

```
1 \documentclass{article}
2 \usepackage[utf8]{inputenc}
3
4 \title{Advances in the Report Writing}
5 \author{Hayato Hashimoto}
6 \date{April 2019}
7
8 \begin{document}
9
10 \maketitle
11
12 \section{Introduction}
13
14 \end{document}
```

The top navigation bar includes 'Menu', 'Advances in the Report Writing', 'Review', 'Share', 'Submit', 'History', and 'Chat'. Below this, a toolbar contains icons for file operations and a 'Recompile' button, which is circled in red. The right-hand side shows a PDF preview of the document, displaying the title 'Advances in the Report Writing', the author 'Hayato Hashimoto', the date 'April 2019', and the section '1 Introduction'.

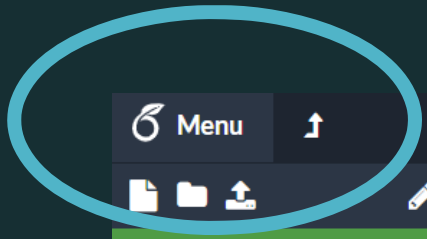
# Tips: Include Japanese texts

pdfLaTeX      Overleaf default, cannot handle non-Western characters

XeLaTeX      can include Japanese text. (requires font setting)

LuaLaTeX      Recommended when you use Japanese as a main language of the paper. Requires longer compile time.

# Tips: use Japanese texts



Advances in the Report Writing

Source Rich Text

main.tex

```
1 \documentclass{article}
2 \usepackage[utf8]{inputenc}
3 \pagestyle{headings}
4 \title{Advances in the Report Writing}
5 \begin{document}
6 \section{some section}
7 Report writing is one of the most important
  academic activities in universities.
8
9 Several technologies have been developed
  to help student to write reports.
  please give me A score!
10 \end{document}
11
```

Download

Source PDF

Actions

- Copy Project
- Word Count

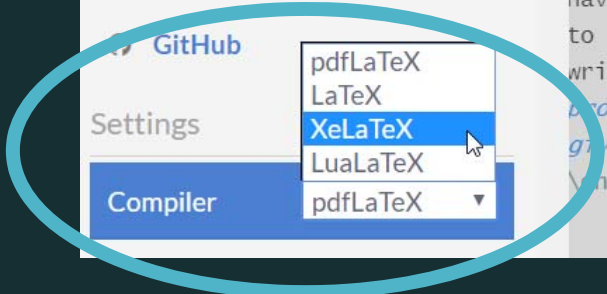
Sync

- Dropbox
- Git
- GitHub

Settings

Compiler

- pdfLaTeX
- LaTeX
- XeLaTeX
- LuaLaTeX
- pdfLaTeX



# Structure of .tex file

# Structure of a .tex file

```
\documentclass{article}
\usepackage[utf8]{inputenc}

\title{Advances in the Report Writing}
\author{Hayato Hashimoto}
\date{April 2019}
```

```
\begin{document}
```

```
\maketitle
```

```
\section{Introduction}
```

```
\end{document}
```

**\documentclass**

“Preamble”

**\begin{document}**

**main text**

**\end{document}**

# Structure of a .tex file

```
\documentclass{article}
\usepackage[utf8]{inputenc}

\title{Advances in the Report Writing}
\author{Hayato Hashimoto}
\date{April 2019}
```

## `\documentclass`

Specifies the type of the document.

Short report:

```
\documentclass{article}
```

Long report (e.g. thesis):

```
\documentclass{report}
```

# Structure of a .tex file

```
\documentclass{article}
\usepackage[utf8]{inputenc}

\title{Advances in the Report Writing}
\author{Hayato Hashimoto}
\date{April 2019}

\begin{document}

\maketitle

\section{Introduction}

\end{document}
```

Some paper receiving institute requires authors to use their own document class

In such cases, .cls file will be provided by the institution: authors need to place the provided file in the folder containing your .tex file

# Structure of a .tex file

```
\documentclass{article}
\usepackage[utf8]{inputenc}

\title{Advances in the Report Writing}
\author{Hayato Hashimoto}
\date{April 2019}

\begin{document}

\maketitle

\section{Introduction}

\end{document}
```

## Preamble

Loading packages

Setting the title

Setting margins

Setting whether to show  
page numbers

etc.



# Structure of .tex file

```
\documentclass{article}
\usepackage[utf8]{inputenc}

\title{Advances in the Report Writing}
\author{Hayato Hashimoto}
\date{April 2019}

\begin{document}

\maketitle

\section{Introduction}

\end{document}
```

Main text

# Practice 1 : Try writing something in **the main text**

- Paragraphs are separated by blank lines  
(= hit Enter key twice to start new paragraphs)
- Everything after % sign will be ignored  
(to keep private memo like TODOs)  
(Type \% to show % itself in the document)
- Symbols ¥ \ { } \$ have special meanings
- Multiple spaces are treated as a single space

Source

Rich Text



Recompile



```
1 \documentclass{article}
2 \usepackage[utf8]{inputenc}
3 \begin{document}
4 Report writing is one of the most
5 important academic activities in
6 universities.
7
8 several technologies have been
9 developed to help student to write
10 reports. % professor, please give me A
11 score!
12
13 \end{document}
```



Report writing is one of the most important academic activities in universities.  
Several technologies have been developed to help student to write reports.

$\backslash$  is a special symbol

$\backslash$  is a symbol to start a *command*

*Commands* can change the style of document, formatting of the text, insert a math formula, etc.

*Command* the preamble, the main text or a math formula.

# `\command` with *parameters*

Command with no  
*parameter*

```
\newpage
```

Command with two  
parameters

```
\rule{3cm}{1mm}
```


`\begin, \end`  
(environment)

```
\begin{verbatim}  
sample text  
\end{verbatim}
```

Command with a *option*  
*parameter*

```
\includegraphics  
[width=5cm]  
{test.png}
```

# Tips: Using Japanese keyboards

In  Windows, some Japanese fonts confuse `\` (backslash) with ¥ (yen) (for some historical reasons)

On a Japanese keyboard, typing a `\` key and a ¥ key will input the same `\` (backslash) symbol.

In  Mac, ¥ and `\` are distinguished correctly.

When using a Japanese keyboard,  
hit **Option** + ¥ to input a `\` symbol.

# Preamble commands

```
\title{Comprehensive LaTeX guide}  
\author{Hayato Hashimoto}  
\date{April 1st, 2020}  
\usepackage{amsmath}  
\usepackage{graphicx}  
\usepackage[top=1cm]{geometry}
```

# Practice 2: Change titles and margins

```
\title \author \date  
\usepackage[top=1cm,bottom=...]{geometry}  
top bottom right left  
cm mm in(=inch) pt(=1/72.27 inch)  
em (width of "M") ex (height of  
"x")
```



# Headings

# Headings

These levels only appear in books or theses:

```
\part{Typesetting software: LaTeX}
```

```
\chapter{History of LaTeX}
```

Also in reports and journal papers:

```
\section{Initial development by Knuth}
```

```
\subsection{"Literate" programming}
```

```
\subsubsection{web}
```

```
\paragraph{web2c}
```

# Headings

Sections will be numbered automatically

When section numbers are not needed, use command with a \*

```
\section*{Preface}
```

# Make a table of contents automatically

One command in the **main text** will generate table of contents in place:

```
\tableofcontents
```

# Practice 3: Headings

Try using these commands:

```
\section \subsection  
\subsubsection \paragraph
```

Try writing more than **two sections** and confirm that the section number increases

# Practice 3 solution

```
1 \documentclass[ja=standard,xelatex]{bxjsarticle}
2 \usepackage[utf8]{inputenc}
3 \pagestyle{headings}
4 \title{Advances in the Report Writing}
5 \begin{document}
6 \section{Knuthによる開発}
7 \subsection{文芸的プログラミングとは}
8 \subsubsection{web}
9 \paragraph{web2c} web2c
   はオリジナルのTeXの実装に用いられていたweb
   言語を、一般に普及したプログラミング環境であるC
   言語に変換するソフトウェアである。
10 \section{コミュニティによる進化}
11 \subsection{CTANとは}
12 \end{document}
13
```

## 1 Knuthによる開発

---

### 1 Knuthによる開発

#### 1.1 文芸的プログラミングとは

##### 1.1.1 web

■web2c web2c はオリジナルの TeX の実装に用いられていた w  
環境である C 言語に変換するソフトウェアである。

### 2 コミュニティによる進化

#### 2.1 CTAN とは

## Tip: Showing section title on each pages

The following command in the preamble

```
\pagestyle{headings}
```

will show section titles at the top of the each pages

# Writing math formulas



# Two types of math formulas

The total energy  $K$  of body of mass  $m$  moving with speed  $v$  is defined to be:

$$K = \frac{1}{2}mv^2.$$

Inline math formulas, embedded in the text  
Displayed math formulas, in a separate line

# Math formulas

## Inline math formulas

are marked by surrounding  $\$$   $\$$

*Kinetic Energy  $\$ K \$$  is ...*

## Displayed math formulas

are marked by surrounding  $\backslash[$   $\backslash]$

*is defined to be:  $\backslash[ K = \backslashfrac{1}{2} mv^2 . \backslash]$*

# Math mode commands

## Fractions

`\frac{x}{y}` {x `\over` y}

## Greek letters

`\alpha` `\beta` `\gamma` ... `\pi` ...

`\omega`

## Exponents and subscripts

`K=mv^2` `e^{-\lambda t}`

`m_{i,j}`

$$\frac{x}{y}$$

$$\alpha, \beta, \gamma, \dots, \pi, \dots, \omega$$

$$K = mv^2 \quad e^{-\lambda t} \quad m_{i,j}$$

# Math formula extending multiple lines

Use `align` environment from `amsmath` package

```
... \usepackage{amsmath} ...
```

```
\begin{document} ...
```

```
\begin{align}
```

```
z & = & x^2 - y^2 \nonumber \\
```

```
& = & (x + y) (x - y)
```

```
\end{align}
```

`&` to align, `\\` to break lines

# Practice 4: Describe the solution of the quadratic equation

Solutions of a quadratic equation  $ax^2 + bx + c = 0$  ( $x \neq 0$ ) are given by:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

√ (square root) `\sqrt{ }`

± (plus minus) `\pm`

≠ (not equal) `\neq`

# Practice 4 solution

Source

Rich Text

Recompile



13 Solutions of a quadratic equation  $ax^2 + bx + c = 0$  ( $x \neq 0$ ) are given by:

14 
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Solutions of a quadratic equation  $ax^2 + bx + c = 0$  ( $x \neq 0$ ) are given by:

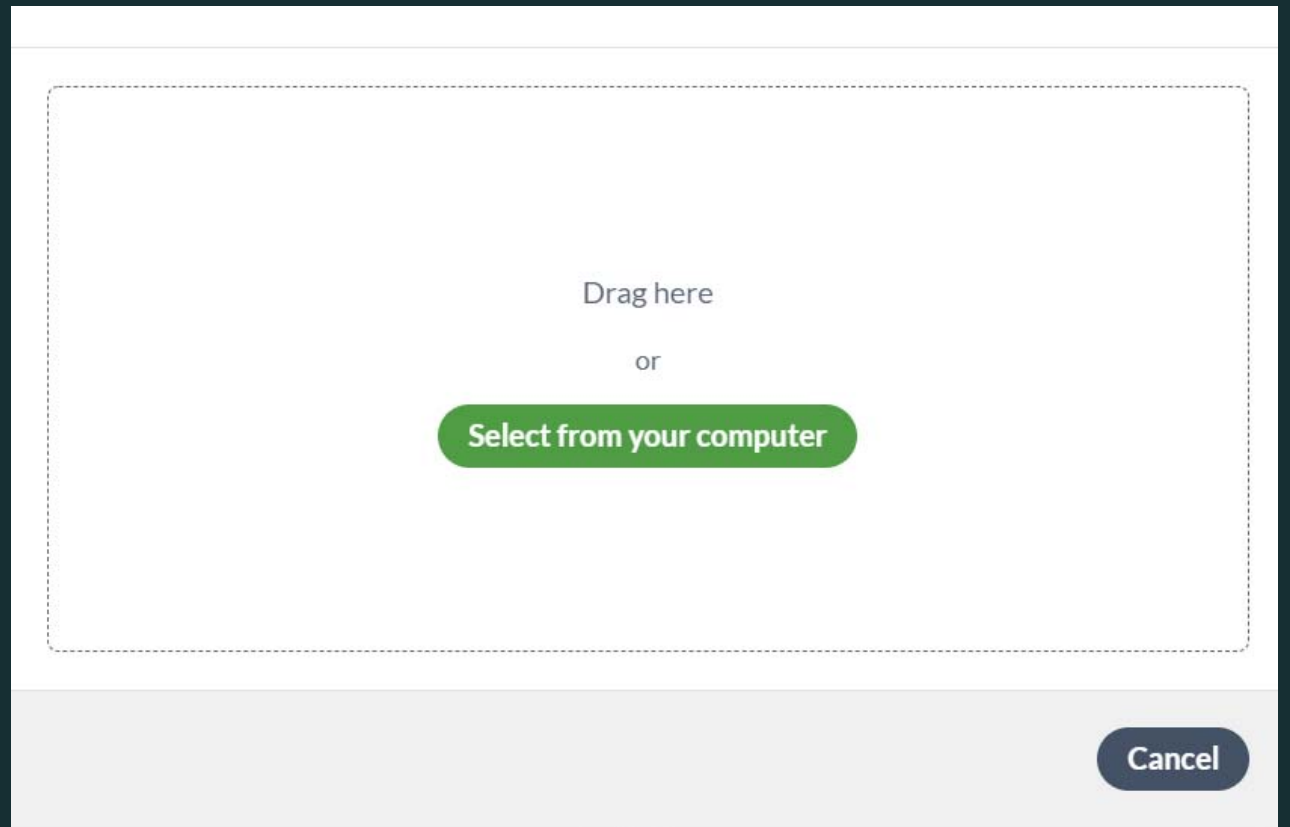
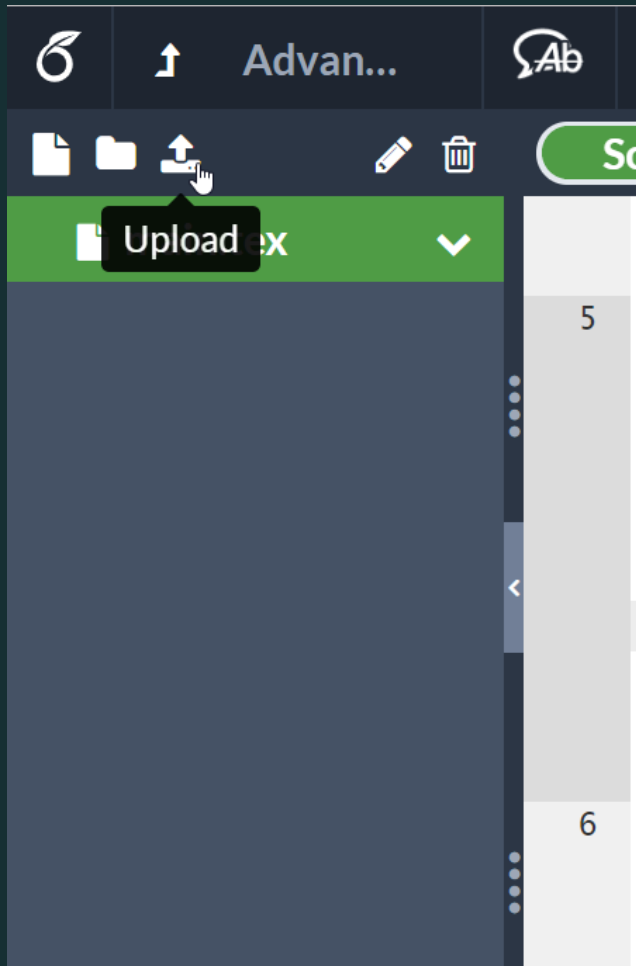
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Insert figures and tables

# Include figures in the document

1. Prepare a photo file in JPEG format or a graph file in PDF or PNG format.  
(PDF is recommended when your graphing software supports saving charts in PDF)
2. Upload to Overleaf
3. Insert into the LaTeX document





# Inserting figures

```
\usepackage{graphicx}
...
\begin{figure}[tp]
\centering
\includegraphics[width=0.5\hsize]
{myfigure.png}
\caption{ the description of the
figure }
\label {Label for later reference }
\end{figure}
```

# Practice 5: Insert Figure

Reproduce the following figure

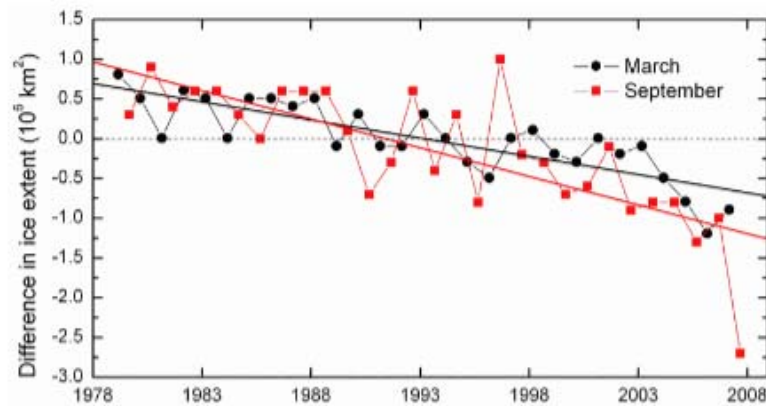


Figure 1: Ice extent changes observed in the Arctic.

## 1 Method

We examined satellite image of the Arctic Ocean and the percentage of area covered by ice is obtained by the standard procedure.

(Source of the image: NOAA)

# Practice 5 solution

Source Rich Text

Recompile



```
1 \documentclass{article}
2 \usepackage[utf8]{inputenc}
3 \usepackage{graphicx}
4 \begin{document}
5 \section{Method}
6 \begin{figure}
7   \centering
8   \includegraphics[width=0.8\hsize]{arctic_ice_extent.png}
9   \caption{Ice extent changes observed in the Arctic.}
10  \label{fig:arctic_ice}
11 \end{figure}
12 We examined satellite image of the Arctic Ocean and the percentage of area covered by ice is obtained by the standard procedure.
13 \end{document}
```

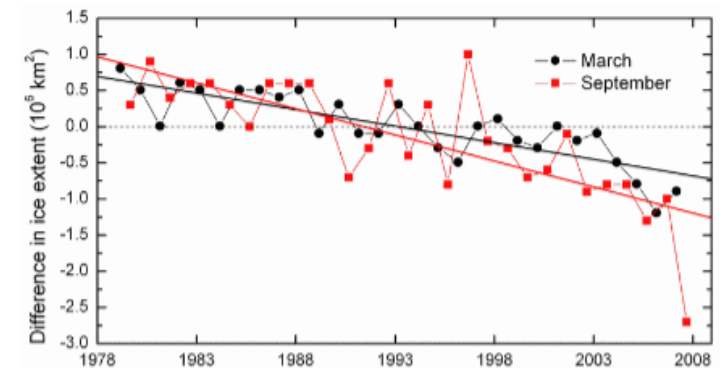


Figure 1: Ice extent changes observed in the Arctic.

## 1 Method

We examined satellite image of the Arctic Ocean and the percentage of area covered by ice is obtained by the standard procedure.

## Tip: Floats

Bare `\includegraphics` command will insert the image embedded in the main text

Boxes like `figure` environment are called *Floats*

LaTeX may move floats to unexpected pages when there are too many floats per page.

## Tip: figure referring label

Define a *label for reference*

```
\caption{...} \label{fig:a}
```

Use the *command for referencing the label* to insert figure numbers

```
Figure \label{fig:a} => Figure 1
```

# Insert a table

```
\begin{table}
\centering
\begin{tabular}{|c|c|r|}
A1 & B1 & C1 \\ \hline
A2 & B2 & C2 \\ \hline
\end{tabular}
\caption{ description of the table }
\end{table}
```

# Practice 6: Create Tables

Reproduce the following table

	Taro	Hanako	Kyota
Height (cm)	174	166	159
Weight (kg)	67	59	57

Table 1: The height and weight of my family members



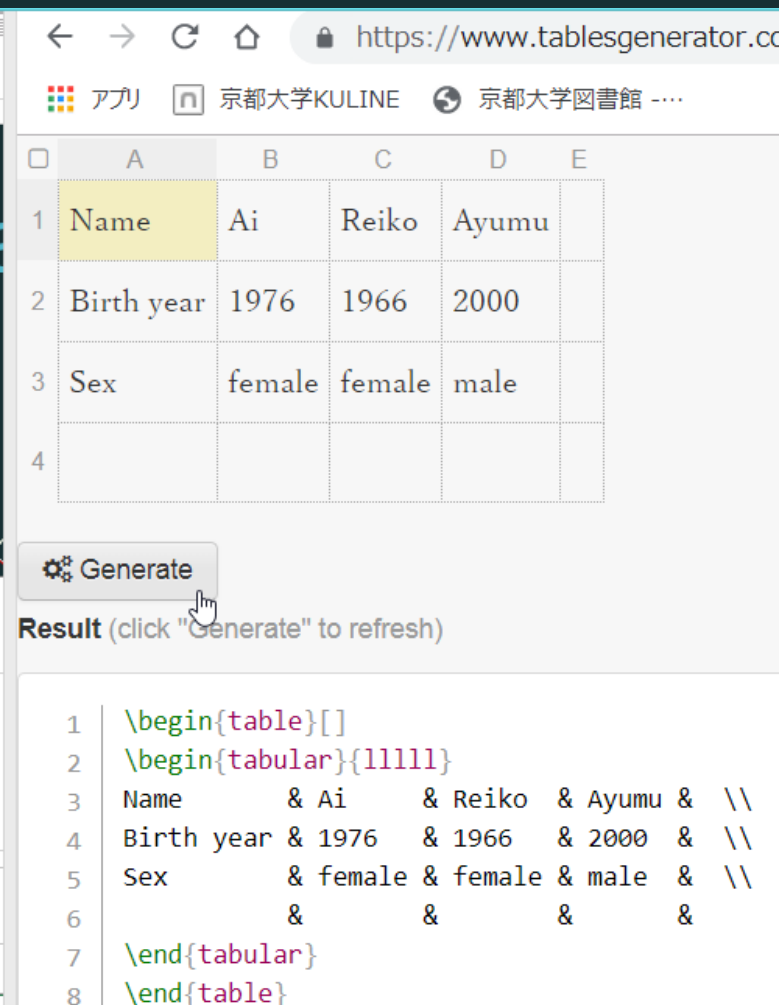
# Practice 6 solution

```
¥begin{table}[h]
¥begin{tabular}{|c| | |c|r|} ¥hline
& Taro & Hanako & Kyota ¥¥ ¥hline
Height (cm) & 174 & 166 & 159 ¥¥ ¥hline
Weight (kg) & 67 & 59 & 57 ¥¥ ¥hline
¥end{tabular}
¥caption{The height and weight of my family
members}
¥end{table}
```

	Taro	Hanako	Kyota
Height (cm)	174	166	159
Weight (kg)	67	59	57

Table 1: The height and weight of my family members

# Tip: making tables easily



The screenshot shows a web browser window with the URL <https://www.tablesgenerator.com>. The browser's address bar and tabs are visible. The main content area displays a table with the following data:

	A	B	C	D	E
1	Name	Ai	Reiko	Ayumu	
2	Birth year	1976	1966	2000	
3	Sex	female	female	male	
4					

Below the table is a "Generate" button. Underneath, the "Result" section shows the LaTeX code generated from the table:

```
1 \begin{table}[]
2 \begin{tabular}{lllll}
3 Name & Ai & Reiko & Ayumu & \\
4 Birth year & 1976 & 1966 & 2000 & \\
5 Sex & female & female & male & \\
6 & & & & \\
7 \end{tabular}
8 \end{table}
```

You can use a web app to generate latex commands (*LaTeX Table Generator*)

Copy from Excel (or whatever spreadsheet app) and paste to the LaTeX Table Generator

# Learning materials for latex

“Wikibooks for LaTeX”  
is a concise guide for beginners



Learning Support Desk

場所：附属図書館1階  
ラーニングcommons

学習相談受付中!

レポート・授業・調べもの

大学院生スタッフが、学習に関するご相談にお答えします。  
事前予約もできます。お気軽にお尋ねください！ 2018/4

	月	火	水	木	金
13:00 ↓ 16:00	<b>自己紹介 キーワード</b> 市広社会論 イスラーム 南アジア ワールドワーズ	教育社会学 文化研究 東アジア 中国語・韓国語	情報学 中国語	政治と宗敎 移民 フランス語	法制史 台湾研究 中国語
	<b>所属</b> アジア・アフリカ 国際研究科 与英科	教育学研究科 修士2年 留学生	情報学研究科 修士2年 留学生	人権・政治学 国際科 修士2年	法学研究科 修士2年 留学生
16:00 ↓ 19:00	<b>自己紹介 キーワード</b> 政治学 国際関係論	物理学 天文学 数値計算	ツーリズム 東南アジア インドネシア語	政治と宗敎 移民 フランス語	経済法 米教養学法
	<b>所属</b> 人間・文化学 国際科 修士1・2年	理学研究科 修士1年	アジア・アフリカ 国際研究科 修士1年	人権・政治学 国際科 修士2年	法学研究科 修士2年 国際法研究員

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