LaTeX hands-on tutorial

(Held on Nov. 10 2021)

This Material is Licenced Under:
Creative Commons Attribution-ShareAlike 4.0 International License (CC BY-SA 4.0)
https://creativecommons.org/licenses/by-sa/4.0/

About lecturer

Hayato Hashimoto (Doctoral course 3rd year)

Graduate School of Informatics

Statistical representation of word meanings

©NASA

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

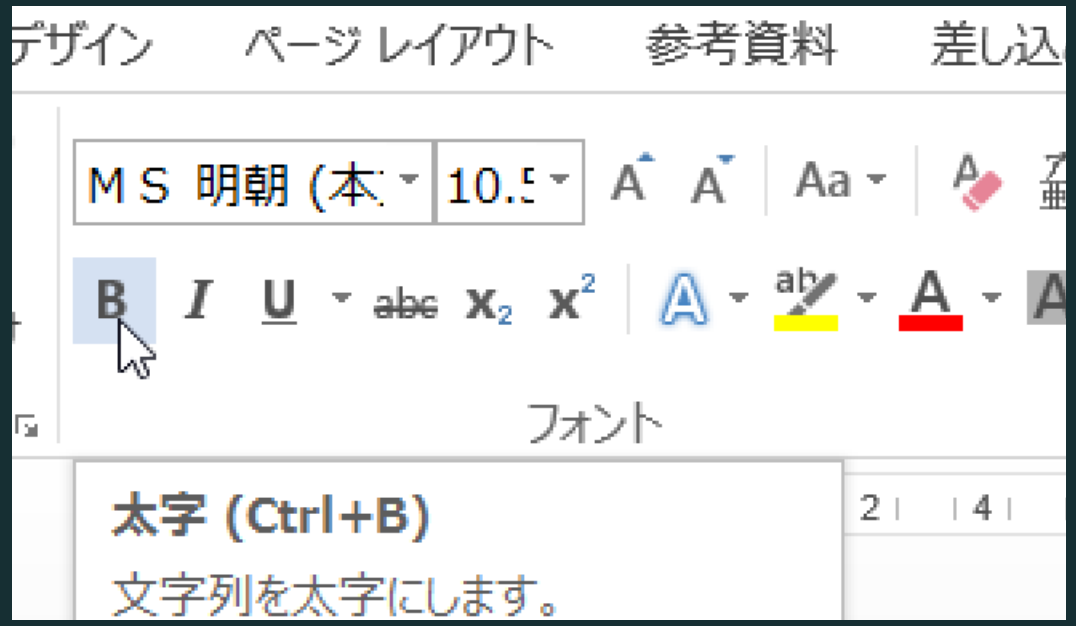
Typesetting software:

making (layouting) reports, articles, books

Microsoft Word vs. LaTeX

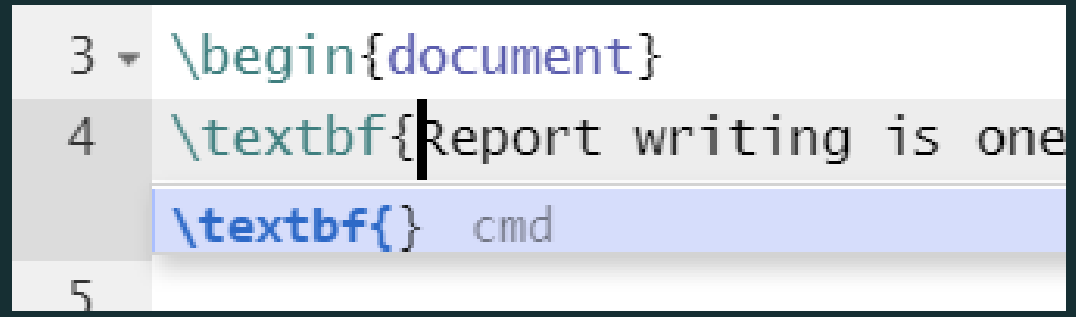
Word

Text formats specified by **GUI buttons** etc.



LaTeX

Text formats specified by **plain text commands**



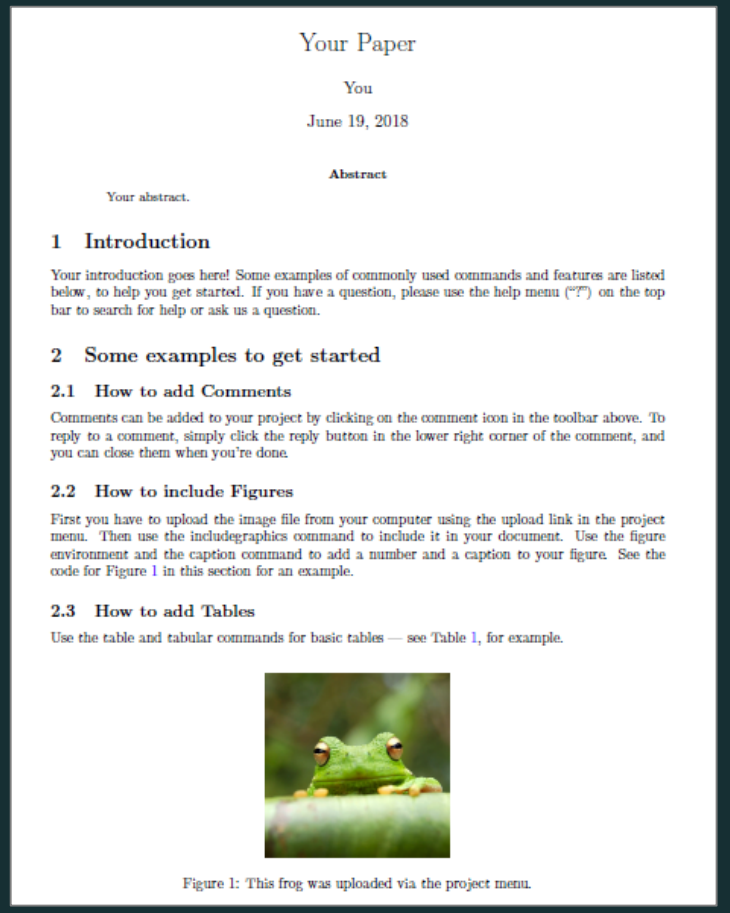
LaTeX is a converter

.tex file

```
\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

PDF file



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.

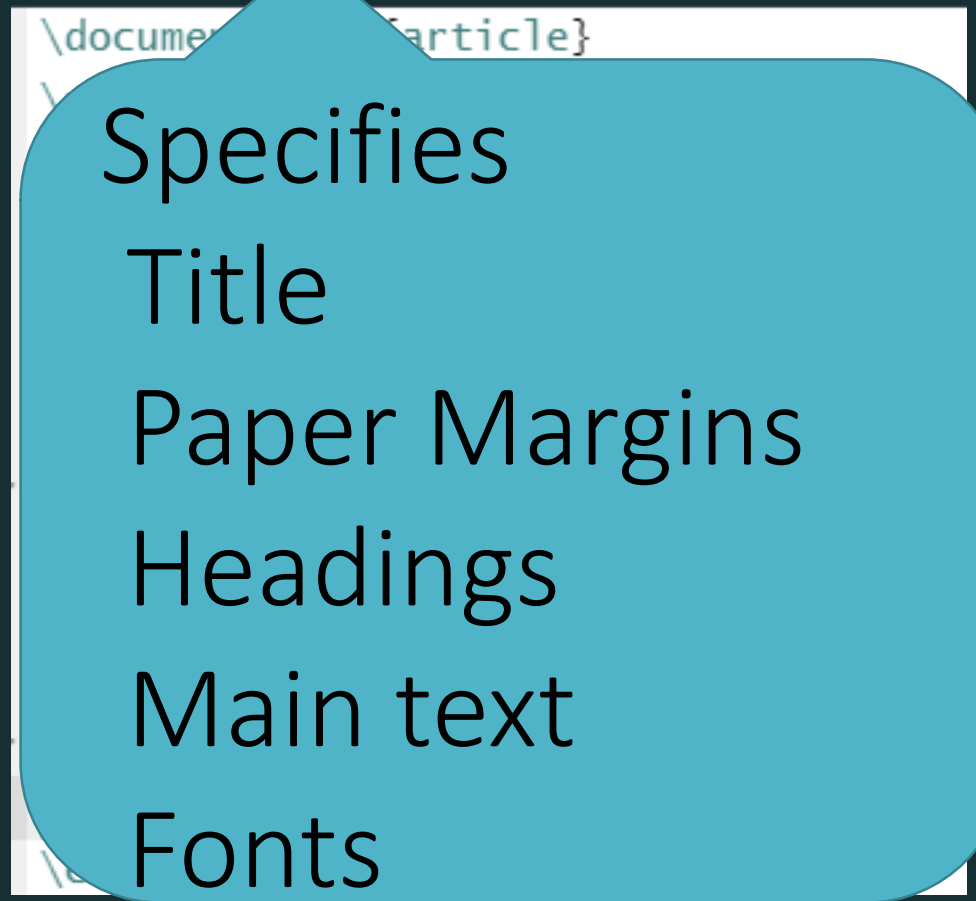
2.3 How to add Tables

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

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

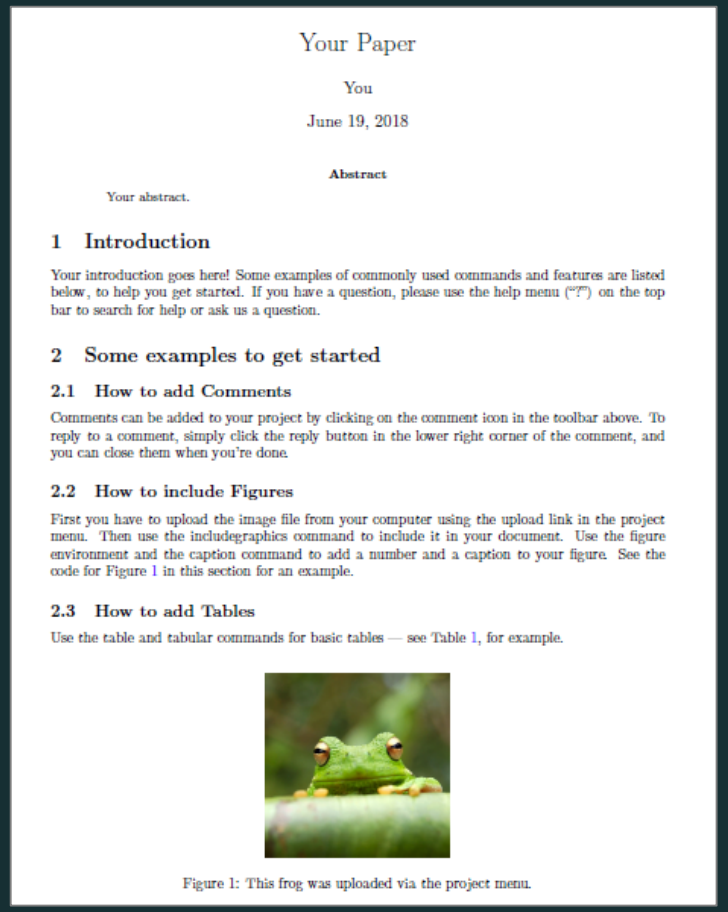
LaTeX is a converter

.tex file



convert

PDF file



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.

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

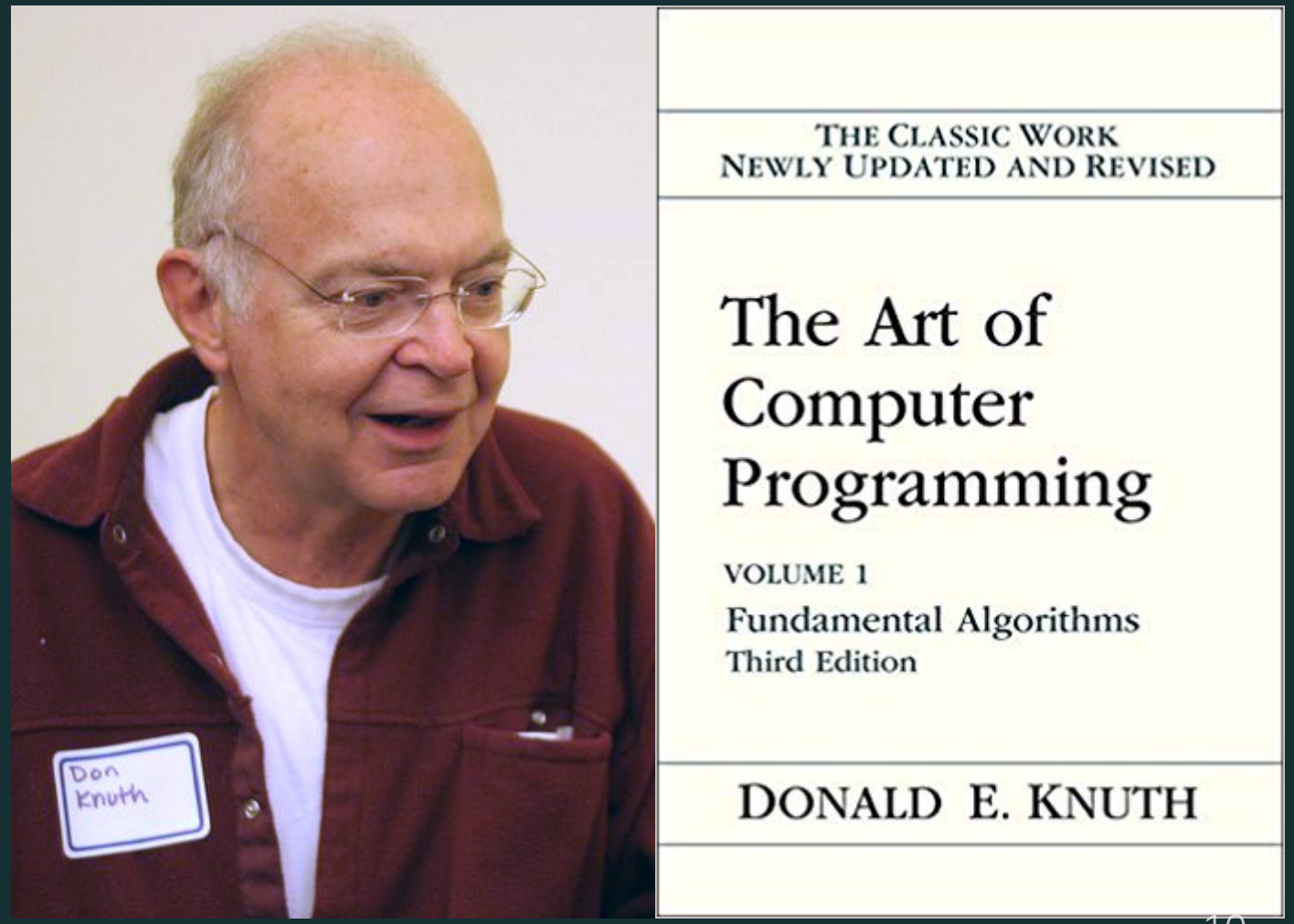
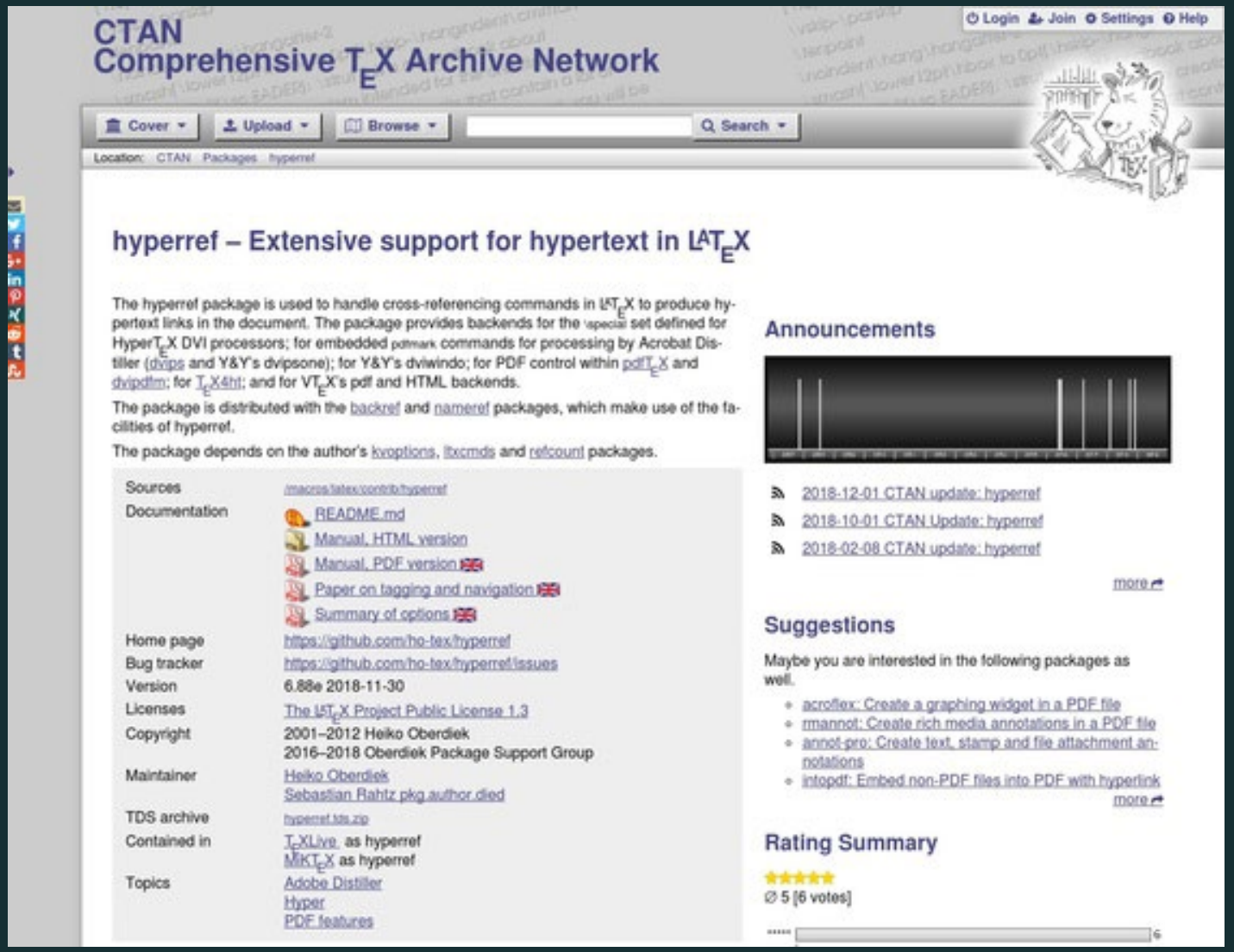


Photo by Wikimedia Commons（https://commons.wikimedia.org/wiki/File:KnuthAtOpenContentAlliance.jpg)

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.



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

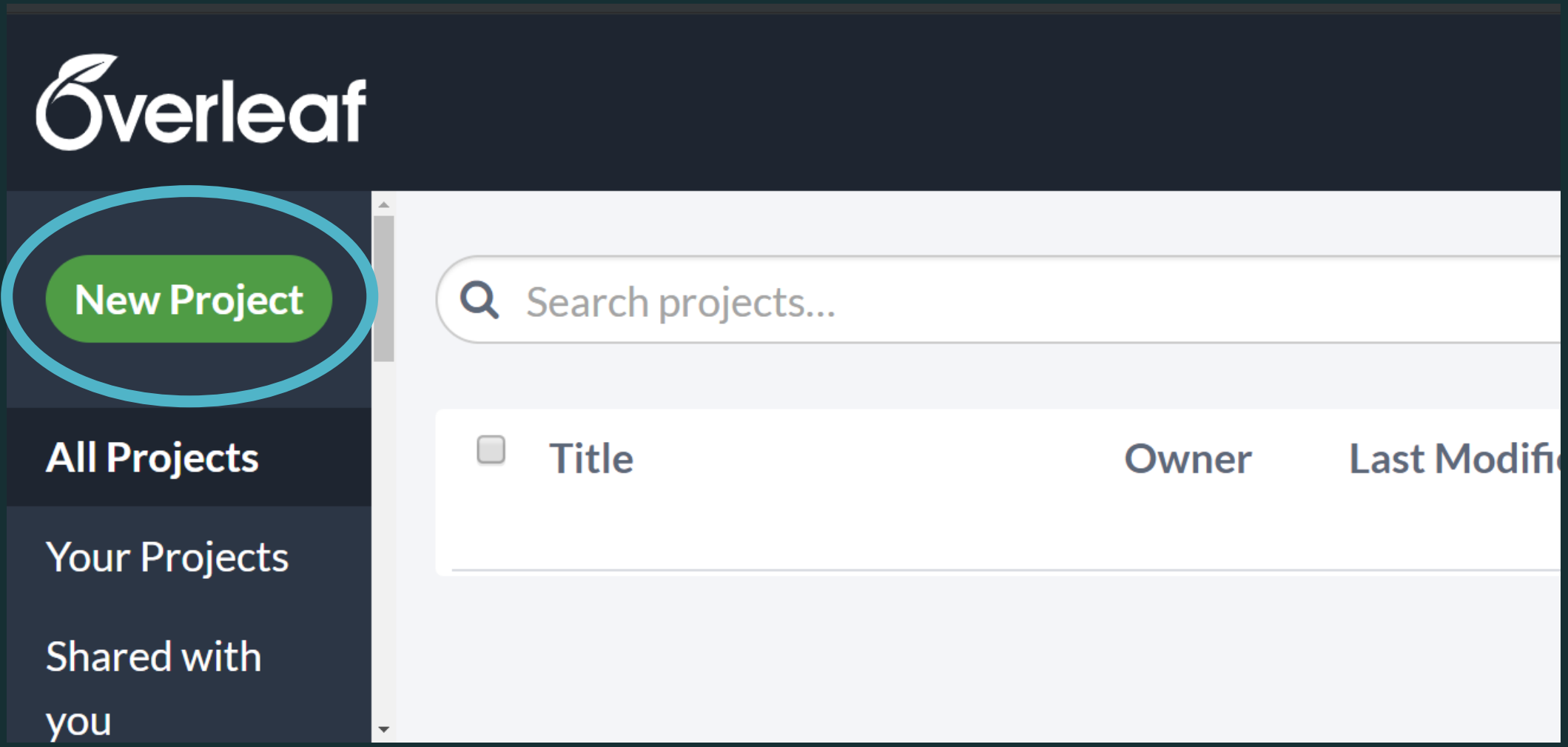
There are various *distributions* of LaTeX

(distribution: LaTeX + packages + fonts + auxiliary softwares)

Use: TeX Live 2019

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

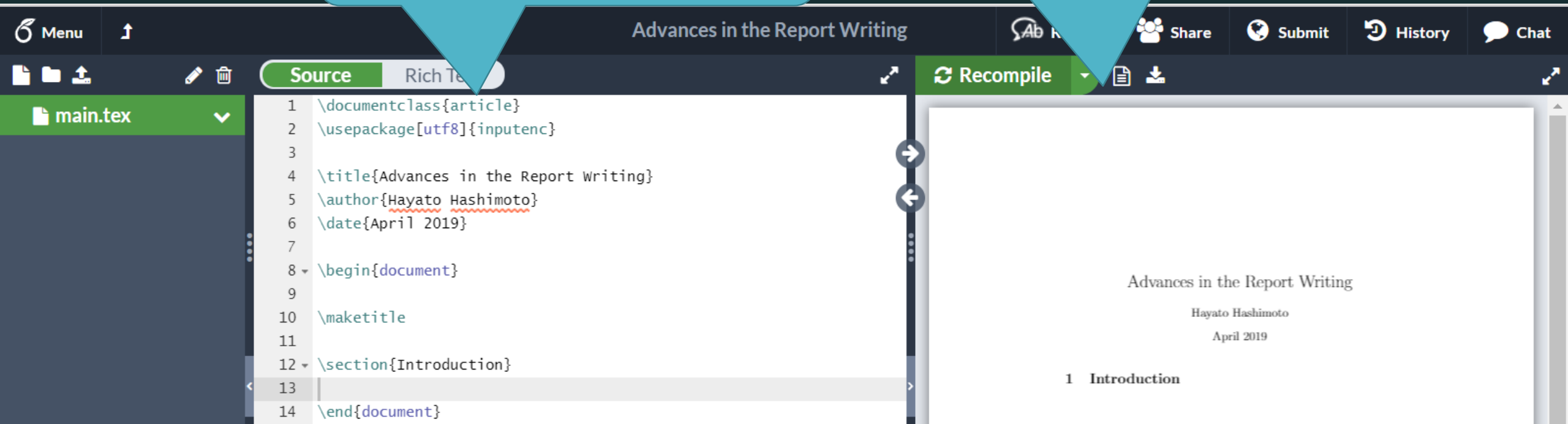
Using Overleaf



Using Overleaf

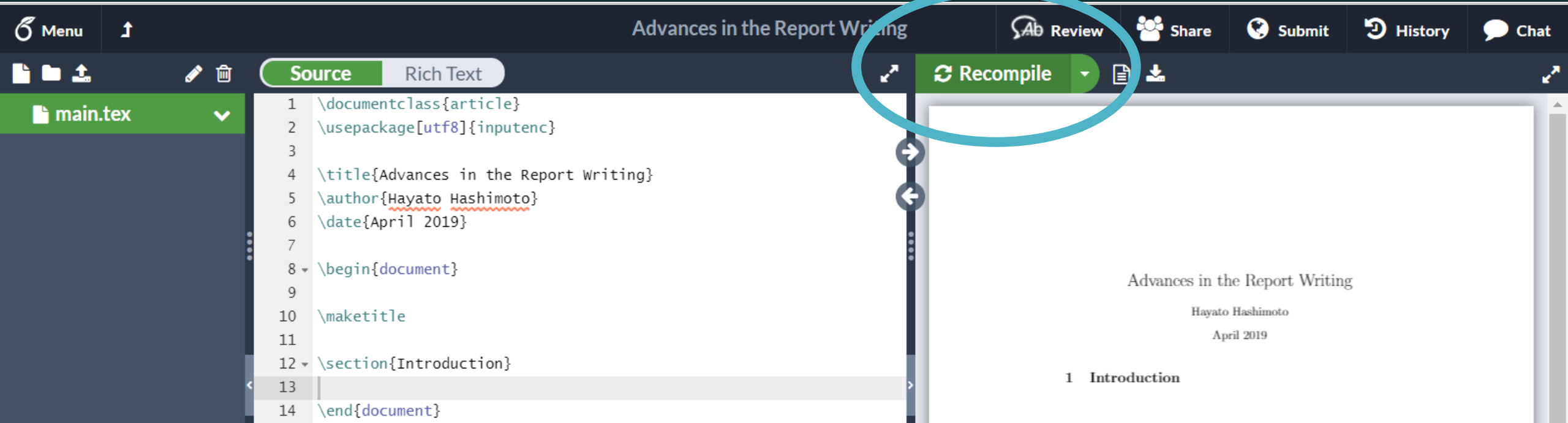
You can edit here

PDF preview



Using Overleaf

PDF preview update button



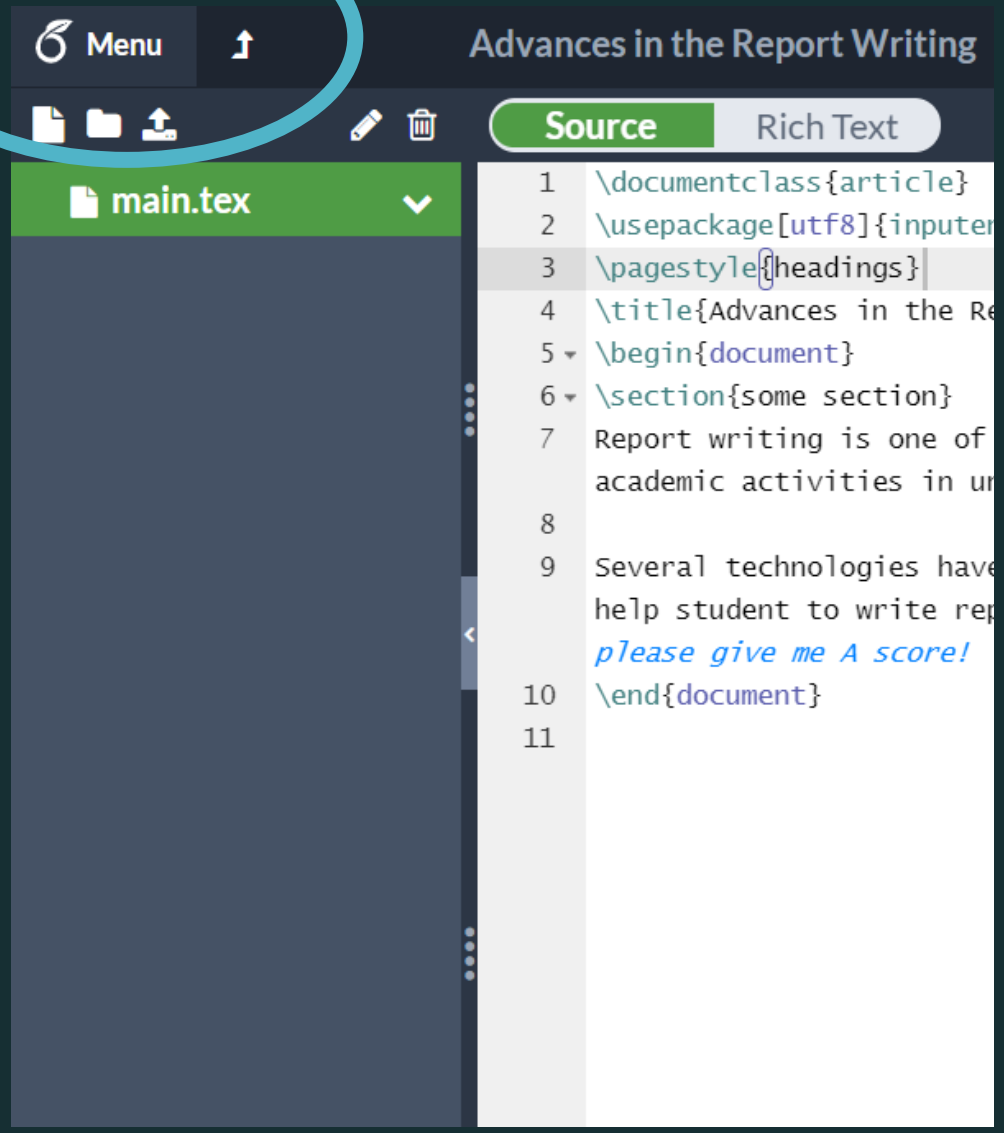
Tips: Include Japanese texts

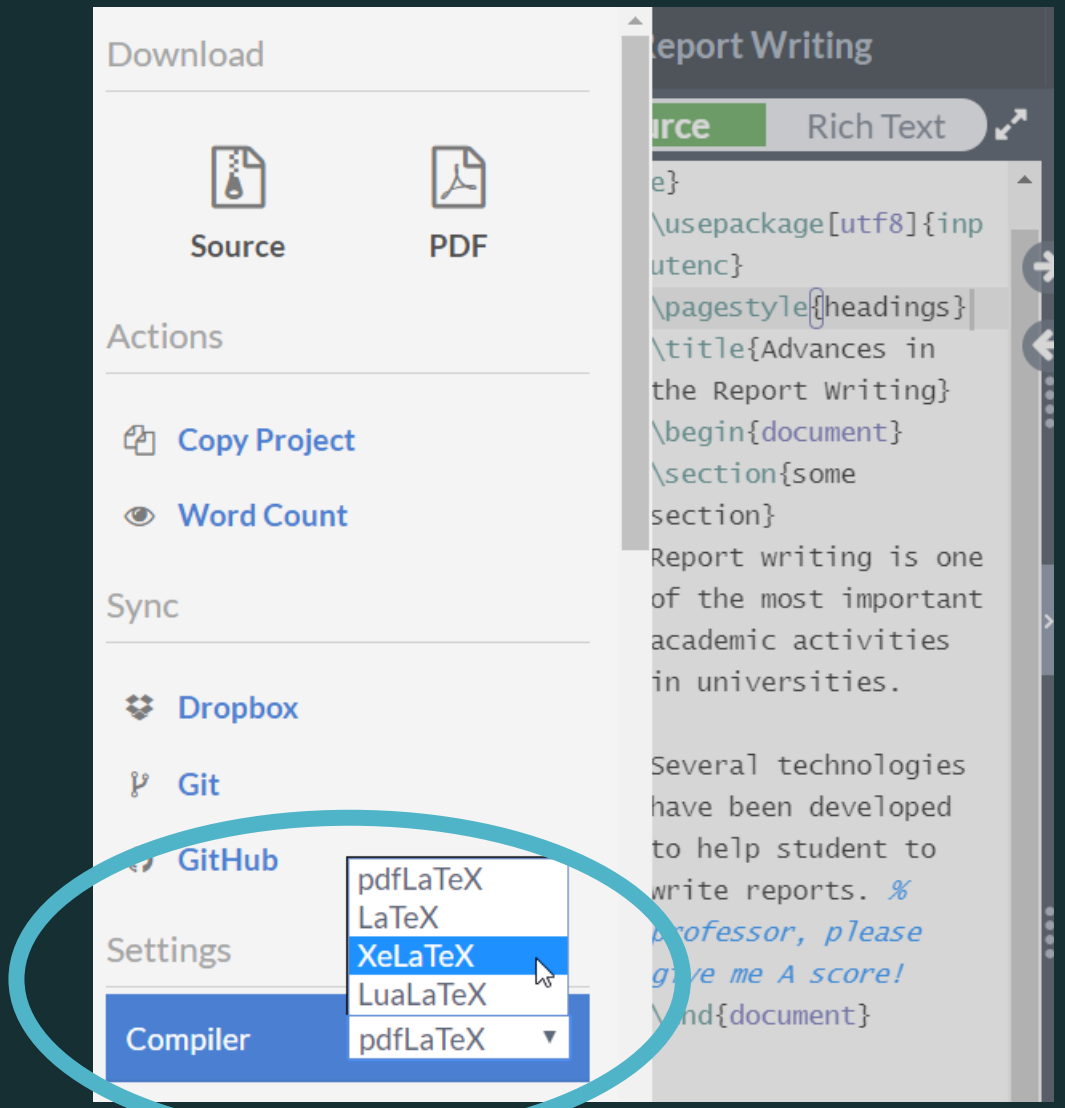
pdfLaTeX Overleaf default, cannot handle non-Western characters

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 Japanse texts





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
   important academic activities in
   universities.
5
6  Several technologies have been
   developed to help student to write
   reports. % professor, please give me A
   score!
7  \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.

\ is a special symbol

\ 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

1.1 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 **\[\]**

is defined to be: **\[** `K = \frac{1}{2} mv^2 .` **\]**

Math mode commands

Fractions

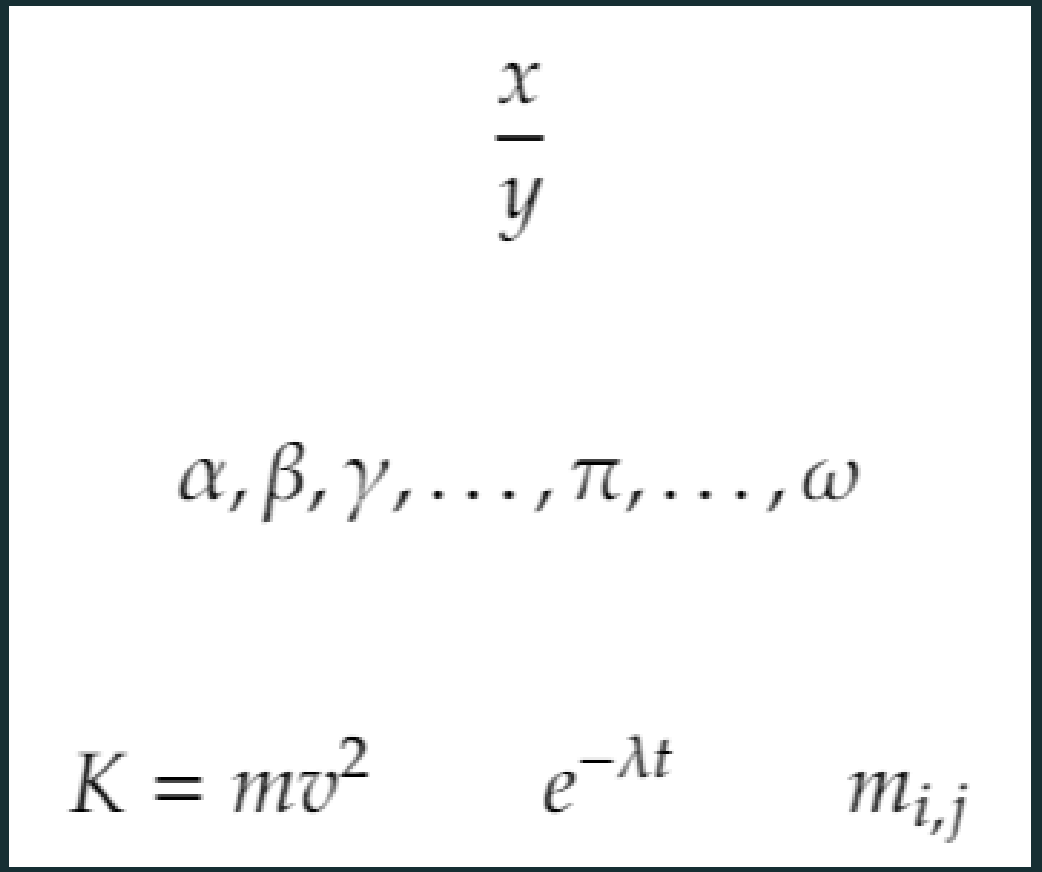
```
\frac{x}{y} {x \over y}
```

Greek letters

```
\alpha \beta \gamma … \pi …
\omega
```

Exponents and subscripts

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



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 $ a x^2 + b x +
    c = 0 $ ($x \ne 0$) are
    given by:
14  \[ x = \frac{-b \pm
    \sqrt{b^2 - 4 a c}}{2a}
    .\]
```

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

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

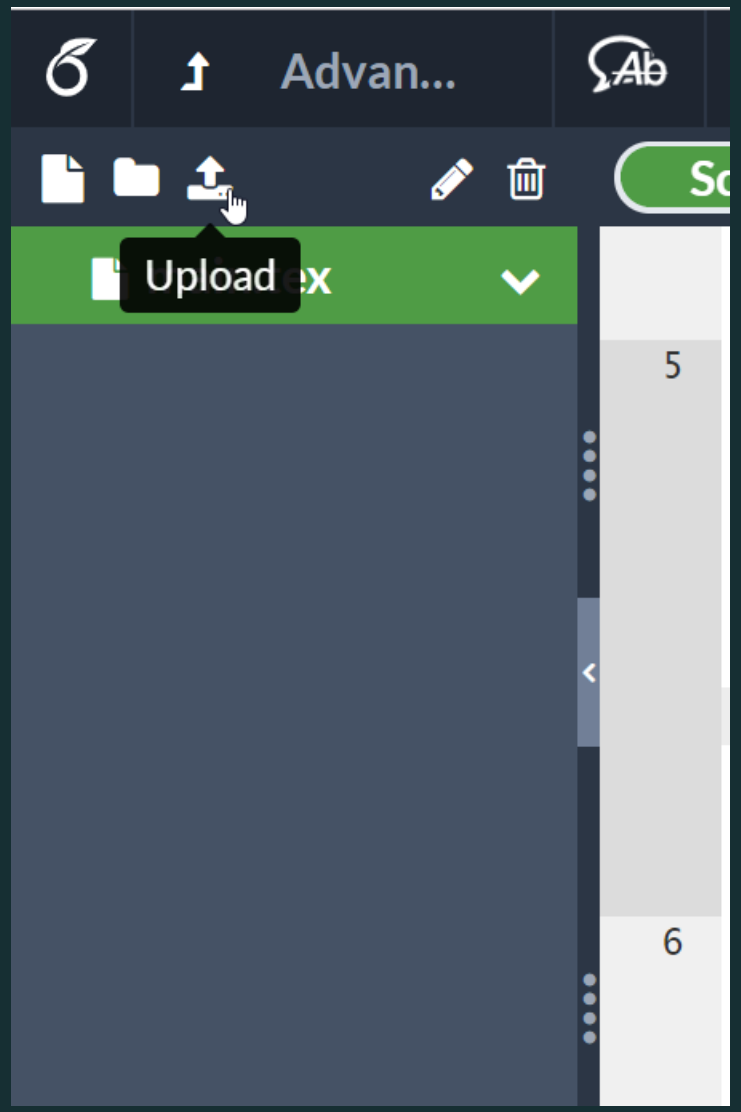
Insert figures and tables

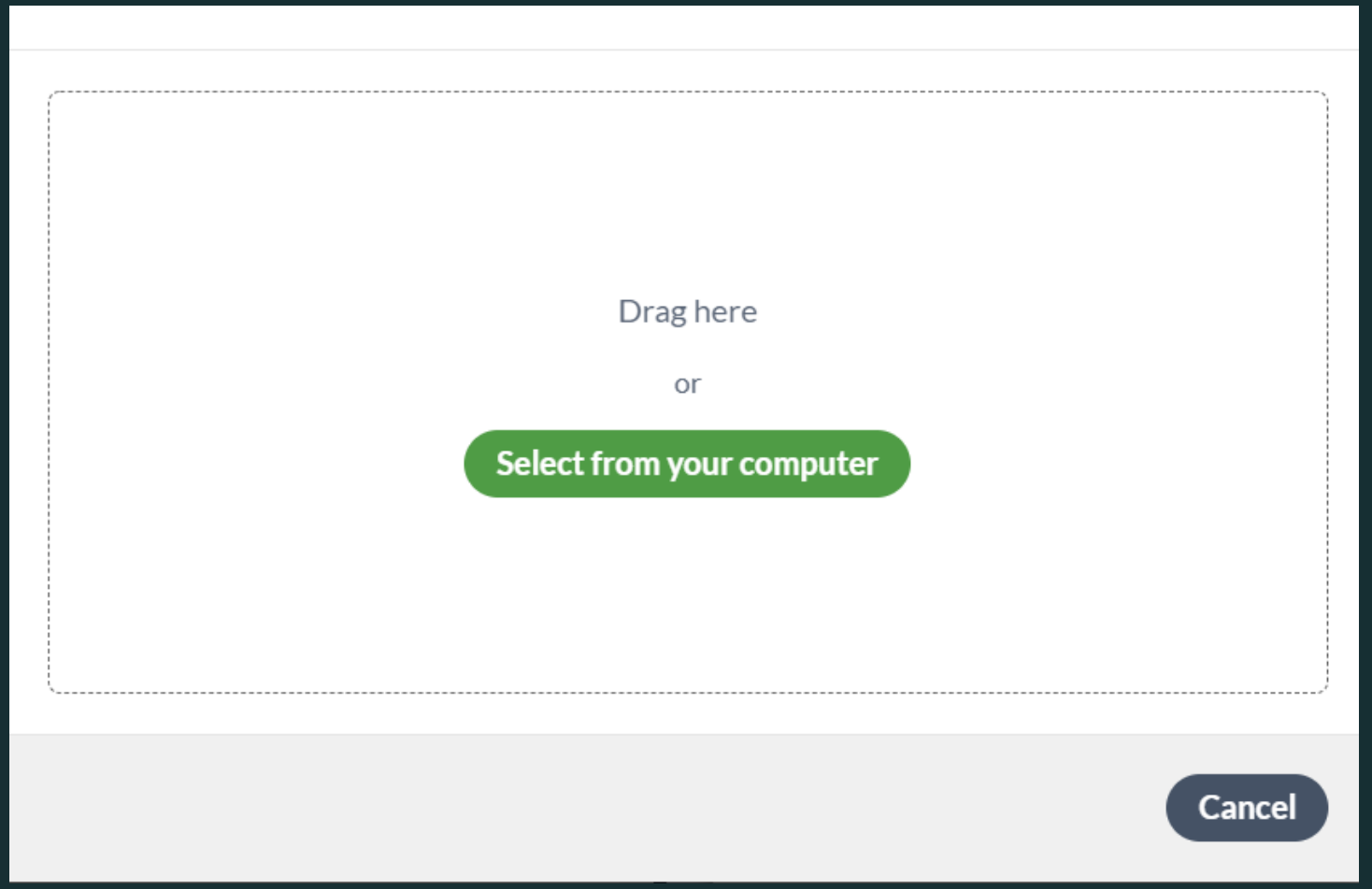
Include figures in the document

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


Advan...
Upload
5
6


Drag here
or
Select from your computer
Cancel

Inserting figures

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

Practice 5: Insert Figure

Reproduce the following figure

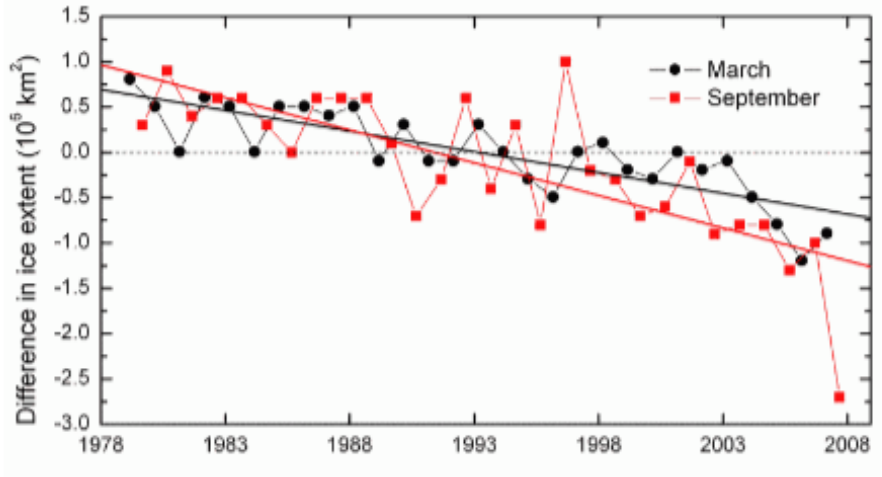


Figure 1: Ice extent changes observed in the Arctic.

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

```
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_exte
       nt.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}
```

Recompile

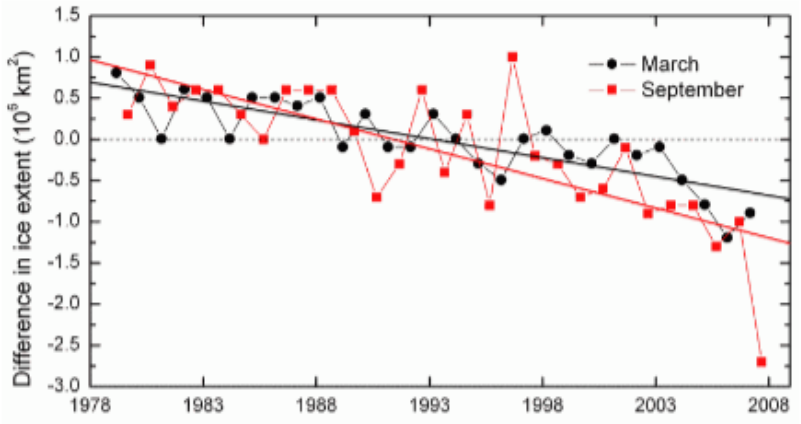


Figure 1: Ice extent changes observed in the Arctic.

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

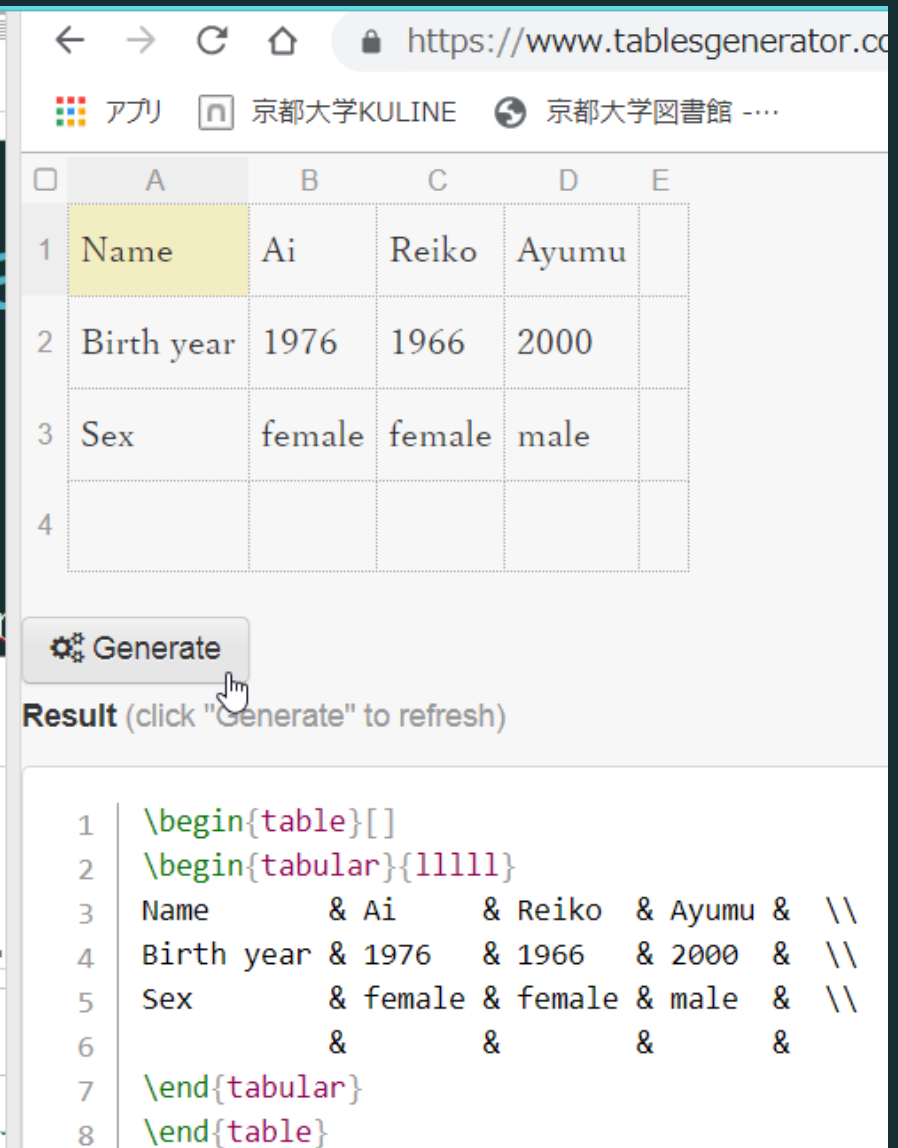
Practice 6 solution

```
¥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



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