

\LaTeX Workshop

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Plan for the Workshop

- 1 Introduction. →
- 2 Why bother learning \LaTeX ? →
- 3 Challenges and downsides. →
- 4 Basic structure of a \LaTeX document and compiling. →
- 5 Bibliographies. →
- 6 Article-style document: Formatting, figures, tables, bibliographies, equations (accompanying template).

Introduction

What is \LaTeX ?

\LaTeX is a typesetting language that allows you to produce publication-ready documents.

Goal for this Workshop

Give you a jump start into working with \LaTeX .

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Key to learning \LaTeX

- Good template.
- Basic idea of the structure of \LaTeX documents.

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- Good template.
- Basic idea of the structure of \LaTeX documents.
- Google should be your bff.
- Willingness to suffer a bit in the beginning.

Friendly Warning

If your dissertation is due in 2 weeks, do not start typesetting it in \LaTeX now!

Why bother learning \LaTeX

Just a few reasons why you should be using \LaTeX

- Free, open source.

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- Beautiful typesetting.
- Inserting and updating tables/figures from R or Stata.
- Inserting/updating bibliographies.
- Math typesetting and formal presentation (game trees, diagrams).

\LaTeX uses an advanced typesetting algorithm



Figure: Source <http://bit.ly/25VwZaG>.

\LaTeX —The quiz!

The Quiz: \LaTeX or Word?

The positioning of a specific armed non-state actor along the two dimensions might vary considerably across space and time. For example, certain cartels in Mexico might have a higher capacity and willingness to bend the rules of the game and project control into their areas of influence than others. Therefore, it should be noted that this theoretical approach is action-based and tied to a spatio-temporal unit, as opposed to specific actor identities. It is the nature of the predominant security challenge that a government faces in a specific spatio-temporal unit, rather than the identity of the violent non-state actor, that is thought to influence its welfare spending. Suppose for example, that rebel group g has some territorial control at time t in the subnational area i_1 , but not in area i_2 . Therefore, I expect to see group g conducting guerrilla-style attacks in area i_1 and terrorist-style attacks in area i_2 , both at time t . Consequently, in the next period $t + 1$, we should see higher levels of subnational welfare spending in area i_1 than in area i_2 , even though the governments of both areas face the same opponent g .

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INTRODUCTORY STATISTICS LECTURE

Segment on Hypothesis Testing

- Segment: three 50 minute class sessions (like IR 211 class).
- Segment after the midterm, i.e. second third of the class, when students are familiar with basic concepts such as sample, population, standard error, t-test, p-values, etc.
- Learning objective:
 - What is hypothesis testing and why is relevant?
 - How does it help us to understand statistical relationships?
 - How is it done (focus on one sample and two sample tests)?
 - What are some of the fallacies with regard to hypothesis testing?
- I assume that most students are PoliSci or IR majors.
- All mathematical examples for practicing hypothesis tests in class will be presented as cases that are either directly relevant to political science or IR, or present interesting real-world scenarios.

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The Quiz: \LaTeX or Word?

<i>Dependent Variable:</i>					
Naval Tonnage Index					
	(1)	(2)	(3)	(4)	(5)
<i>Naval Tonnage Index</i> _{<i>t,t-1</i>}		0.971*** (0.004)	0.970*** (0.004)	0.970*** (0.004)	0.971*** (0.004)
<i>Competition</i> _{<i>t,t-1</i>}	2.247*** (0.077)	0.146*** (0.020)	0.126*** (0.024)	0.120*** (0.024)	0.147*** (0.019)
<i>Democracy</i> _{<i>t,t-1</i>}			-0.002* (0.001)	-0.002** (0.001)	
<i>GDP</i> _{<i>t,t-1</i>}				1.597*** (0.268)	1.617*** (0.260)
Observations	4,226	4,226	4,051	4,051	4,226
R ²	0.169	0.955	0.956	0.956	0.956

Note: *p<0.1; **p<0.05; ***p<0.01

Figure: Markowitz, J. and C. Fariss: Power, Proximity, and Democracy: Geopolitical Competition in the International System. In *Journal of Peace Research* (Forthcoming).

The Quiz: \LaTeX or Word?

	Welfare spending			Military spending	
	(1)	(2)	(3)	(4)	(5)
Dummy 25 battle deaths (low)	-0.077 (0.298)			0.195*** (0.075)	
Dummy 1000 battle deaths (low)		-0.472 (0.389)			
Insurgency			-0.769* (0.424)		0.215** (0.105)
ln GDP p.c.	-0.831*** (0.296)	-0.827*** (0.296)	-0.905*** (0.299)	0.684*** (0.217)	0.689*** (0.220)
Democracy dummy	2.191*** (0.375)	2.169*** (0.377)	2.171*** (0.376)	-0.364** (0.154)	-0.375** (0.154)
GDP Growth	-0.007 (0.007)	-0.008 (0.007)	-0.009 (0.007)	0.001 (0.002)	0.0003 (0.002)
N	3,902	3,902	3,902	3,784	3,784
Adjusted R ²	0.041	0.042	0.043	0.062	0.061

*p < .1; **p < .05; ***p < .01. Two-way linear fixed effects with heteroskedasticity and serial correlation consistent covariance estimates are computed using the `p1m` function in R.

Figure: Anders, T. *The Relationship Between Violent Conflict and Welfare Spending Revisited* (unpublished manuscript).

Comparing Word, InDesign, and \LaTeX

Microsoft Word 2008

Call me Ishmael. Some years ago – never mind how long precisely – having little or no money in my purse, and nothing particular to interest me on shore, I thought I would sail about a little and see the watery part of the world. It is a way I have of driving off the spleen, and regulating the circulation. Whenever I find myself growing grim about the mouth; whenever it is a damp, drizzly November in my soul; whenever I find myself involuntarily pausing before coffin warehouses, and bringing up the rear of every funeral I meet; and especially whenever

Adobe InDesign CS4

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pdf-LaTeX 3.1415926

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Figure: <http://www.zinktypografie.nl/comparison.pdf>.

Comparing Word, InDesign, and \LaTeX

Hyphenation and inter-word spacing statistics			
	Word	InDesign	pdf- \LaTeX
Number of hyphenations	9	10	4
SD of IWS (pt)	2.26	1.94	1.42
Maximum IWS (pt)	14.4	13.2	9.0
Number of lines with IWS > 9 pt	5	2	0

SD: standard deviation; IWS: inter-word spacing

Figure: <http://www.zinktypografie.nl/comparison.pdf>.

Inter-word spacing is the spacing between words. \LaTeX uses an advanced algorithm to compute the optimal IWS for each document.

WYSIWYG and WYSIWYM

what-you-see-is-what-you-get (WYSIWYG)

Content = presentation. Example: Word.

what-you-see-is-what-you-mean (WYSIWYM)

Content \neq presentation. Example: \LaTeX .

Example for Separation of Content and Presentation

If your dissertation is due in 2 weeks, do not start
typesetting it in \LaTeX now!

```
\begin{center}  
If your dissertation is due in 2 weeks,  
\Huge\underline{do not}} start typesetting it in {\LaTeX} now!  
\end{center}
```

Pros and Cons: Separation of Content and Presentation

Pros

- Reproducibility.
- Stability.
- Unambiguous.
- Once set up, no need to worry about formatting. In fact, you should focus on content over form. \LaTeX will do the rest the form for you. \implies Templates!

Cons

- No/few “buttons” to press—need to learn commands.
- Steep learning curve. Can be time intensive.

Working Directory (WD)

- The WD is a specified path (think folder) on your machine.
- The program will look for and store all data in the WD.
- Unless otherwise specified, \LaTeX will use the folder where the main .tex file is stored as WD.
- Store all auxiliary data (graphs, tables, etc.) in the WD.

Adding graphs to \LaTeX files.

```
\begin{figure}[h!]  
\begin{center}  
\includegraphics[width = 2in]{latex_comic.jpg}  
\caption{Source \url{http://bit.ly/25VwZaG}.}  
\label{comic_fig}  
\end{center}  
\end{figure}
```



Figure: Source <http://bit.ly/25VwZaG>.

Integration of tables is one of the main perks!

- R packages such as `stargazer` or `xtable` will output beautifully formatted (regression) tables as a `.tex` file.
- `estout` package for Stata.
- Save the `.tex` file directly to you WD, then import the file into your \LaTeX document.

\backslash input{} command

The following table (stargazer output) is imported by the following line:

```
 $\backslash$ input{tab_simple.tex}
```

Disclaimer: In reality, to import the table into the beamer class, I use a wrapper:

```
 $\backslash$ resizebox{\linewidth}{!}{ $\backslash$ input{tab_simple.tex}}.
```


This is what the stargazer looks like

% Date and time: Wed, Apr 13, 2016 - 12:31:07

`\begin{tabular}{@{\extracolsep{5pt}}lccc}`

$\backslash[-1.8ex]\hline$

$$\sqrt[5]{-1.8ex}$$

```
& \multicolumn{4}{c}{\textit{Dependent variable:}} \\\
```

```
\cline{2-5}
```

`\[-1.8ex] & \multicolumn{3}{c}{internet} & life_exp \\\`

W[-1.8ex] & (1) & (2) & (3) & (4)W

 $\sqrt{\ln} \approx -1.8 \text{ ex}$

polity & 0.255^{***} & 0.084^{***} & & \

& (0.023) & (0.020) & & \\\

& & & & //

pop & 0.000 & W

& & (0.000) & & \\\

& & & & //

qdppc & & 0.001\$^{***}\$ & & 0.

```
& & (0.00002) & & (0.00001) \\\
```

&&&& //

life_exp & & & 1,101\$^{\ast\ast\ast}\$ & \

& & & (0,031) & \\\

Ⓢ Ⓢ Ⓢ Ⓢ //

Constant & 15.002\$^{***}\$ & 5.955\$^{***}\$

& (0.401) & (0.408) & (2.098) & (0.160) \\\

Ⓢ Ⓢ Ⓢ Ⓢ //

 $\backslash \text{line W}[-1.8\text{ex}]$

Observations & 3,126 & 3,003 & 3,376 & 4,126

$$R^2 = 0.039 \text{ \& } 0.384 \text{ \& } 0.276 \text{ \& } 0.334$$
Adjusted R² & 0.038 & 0.383 & 0.276 & 0.334 \\\

Residual Std. Error & 22.391 (df = 3124) & 17.953 (df = 2999) & 18.534 (df = 3374) & 8.625 (df = 4109) \\\n

F Statistic & 125.913\$N^{***}\$ (df = 1: 3124) & 622.987\$N^{***}\$ (df = 3: 2999) & 1.285.932\$N^{***}\$ (df = 1: 3374) & 2.063.299\$N^{***}\$ (df = 1: 4109) \

Vline

Vline W[-1.8ex]

`\nextit{Note:} & \multicolumn{4}{r}{ $p < 0.1$; $p < 0.05$; $p < 0.01$ }`

\end{tabular}

stargazer output with \LaTeX typesetting

	<i>Dependent variable:</i>			
		internet		life_exp
	(1)	(2)	(3)	(4)
polity	0.255*** (0.023)	0.084*** (0.020)		
pop		0.000 (0.000)		
gdppc		0.001*** (0.00002)		0.0005*** (0.00001)
life_exp			1.101*** (0.031)	
Constant	15.002*** (0.401)	5.955*** (0.408)	-60.212*** (2.098)	62.576*** (0.160)
Observations	3,126	3,003	3,376	4,111
R ²	0.039	0.384	0.276	0.334
Adjusted R ²	0.038	0.383	0.276	0.334
Residual Std. Error	22.391 (df = 3124)	17.953 (df = 2999)	18.534 (df = 3374)	8.625 (df = 4109)
F Statistic	125.913*** (df = 1; 3124)	622.987*** (df = 3; 2999)	1,285.932*** (df = 1; 3374)	2,063.299*** (df = 1; 4109)

Note:

*p<0.1; **p<0.05; ***p<0.01

Fancier stargazer output

<i>Dependent variable:</i>				
	Internet Users		Life Expectancy	
	(1)	(2)	(3)	(4)
Polity Score	0.2553*** (0.0228)	0.0842*** (0.0202)		
Population		0.0000 (0.0000)		
GDP p.c.		0.0010*** (0.00002)		0.0005*** (0.00001)
Life Expectancy			1.1005*** (0.0307)	
Constant	15.0024*** (0.4005)	5.9550*** (0.4082)	-60.2123*** (2.0975)	62.5757*** (0.1602)
Observations	3,126	3,003	3,376	4,111
R ²	0.0387	0.3839	0.2760	0.3343
Adjusted R ²	0.0384	0.3833	0.2757	0.3341
Residual Std. Error	22.3914 (df = 3124)	17.9527 (df = 2999)	18.5340 (df = 3374)	8.6253 (df = 4109)

Note:

*p<0.1; **p<0.05; ***p<0.01

Professional typesetting of math symbols

```
\begin{equation*}
\begin{split}
\frac{\partial EU_{ns_p}}{\partial s} &= A(v)f\gamma - S'(s) \leq 0 \\
\frac{\partial^2 EU_{ns_p}}{\partial s^2} &= -S''(s) < 0
\end{split}
\end{equation*}
```

$$\frac{\partial EU_{ns_p}}{\partial s} = A(v)f\gamma - S'(s) \leq 0$$
$$\frac{\partial^2 EU_{ns_p}}{\partial s^2} = -S''(s) < 0$$

Professional typesetting of regression equations

```
\begin{equation*}  
\text{exp}_{i,t} = \beta_1\text{conflict}_{i,t-1} +  
\beta_2\text{coca}_{i,t-1} +  
\beta_3\text{conflict}_{i,t-1} \times \text{coca}_{i,t-1}  
+ c_i + \delta_t + \epsilon_{i,t}  
\end{equation*}
```

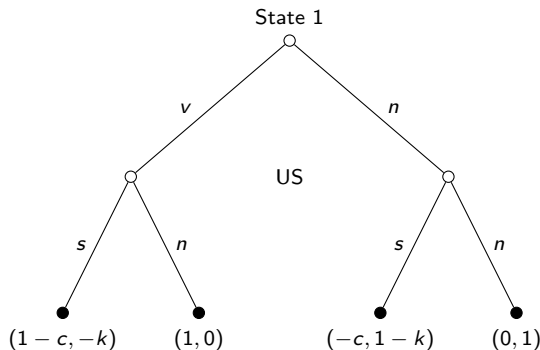
$$\text{exp}_{i,t} = \beta_1 \text{conflict}_{i,t-1} + \beta_2 \text{coca}_{i,t-1} + \beta_3 \text{conflict}_{i,t-1} \times \text{coca}_{i,t-1} + c_i + \delta_t + \epsilon_{i,t}$$

Professional math typesetting

Basic list of math symbols in \LaTeX

<http://web.ift.uib.no/Teori/KURS/WRK/TeX/symALL.html>

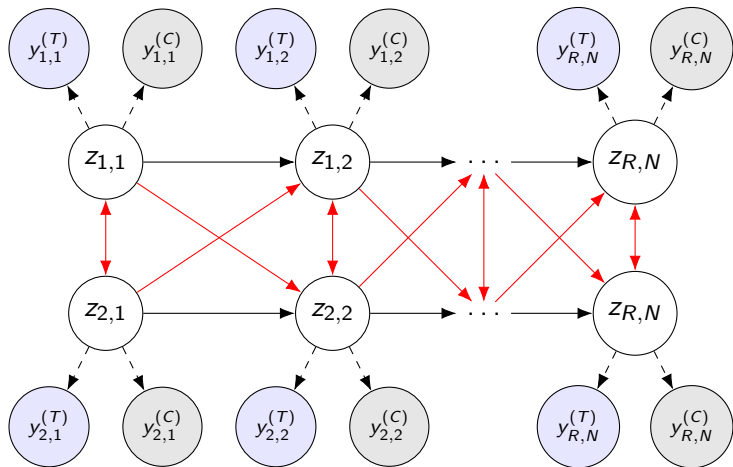
Game trees with tikz package



Game trees with tikz package

```
\usetikzlibrary{calc}
\tikzset{
  solid node/.style={circle,draw,inner sep=1.5,fill=black},
  hollow node/.style={circle,draw,inner sep=1.5}
}
\begin{tikzpicture}[scale=1.2,font=\scriptsize]
  \tikzstyle{level 1}=[level distance=15mm,sibling distance=35mm]
  \tikzstyle{level 2}=[level distance=15mm,sibling distance=15mm]
  \node(0)[hollow node,label=above:{State 1}]{ }
  child{node(1)[hollow node]{ }
    child{node[solid node,label=below:{ $(1-c,-k)$ }]{} edge from parent node[left]{$s$}}
    child{node[solid node,label=below:{ $(1,0)$ }]{} edge from parent node[right]{$n$}}
    edge from parent node[left,xshift=-3]{$v$}
  }
  child{node(2)[hollow node]{ }
    child{node[solid node,label=below:{ $(-c,1-k)$ }]{} edge from parent node[left]{$s$}}
    child{node[solid node,label=below:{ $(0,1)$ }]{} edge from parent node[right]{$n$}}
    edge from parent node[right,xshift=3]{$n$}
  }
};
\node at ($(1)!.5!(2)$) {US};
\end{tikzpicture}
```


Diagrams with tikz package



Diagrams with tikz package

```
\tikzstyle{hv}=[circle,draw]
\tikzstyle{ovt}=[hv,fill=blue!10]
\tikzstyle{ovc}=[hv,fill=black!10]
\tikzstyle{a}=[-{\Latex[length=2mm,width=1.5mm]}]
\tikzstyle{ao}=[a,dashed]
\tikzstyle{across}=[a,red]
\tikzstyle{d}=[above]
\tikzstyle{both}=[{\Latex[length=2mm,width=1.5mm]}--{\Latex[length=2mm,width=1.5mm]},red]
\begin{tikzpicture}[every node/.style={scale=1}]
  \node (z11) at (-3,2) [hv] {\(z_{1,1}\)};
  \node (z12) at (0,2) [hv] {\(z_{1,2}\)};
  \node (z1n) at (4,2) [hv] {\(z_{R,N}\)};
  \node (y11t) at (-3.75,3.5) [ovt] {\scriptsize\(\hat{y}^{(T)}_{1,1}\)};
  \node (y11c) at (-2.25,3.5) [ovc] {\scriptsize\(\hat{y}^{(C)}_{1,1}\)};
  \node (y12t) at (-0.75,3.5) [ovt] {\scriptsize\(\hat{y}^{(T)}_{1,2}\)};
  \node (y12c) at (0.75,3.5) [ovc] {\scriptsize\(\hat{y}^{(C)}_{1,2}\)};
  \node (y1nt) at (3.25,3.5) [ovt] {\scriptsize\(\hat{y}^{(T)}_{R,N}\)};
  \node (y1nc) at (4.75,3.5) [ovc] {\scriptsize\(\hat{y}^{(C)}_{R,N}\)};
  \node (z1dots) at (2,2) {\ldots};
  \draw[a] (z11) -- (z12);
  \draw[a] (z12) -- (z1dots);
  \draw[a] (z1dots) -- (z1n);
  \draw[ao] (z11) -- (y11t);
  \draw[ao] (z11) -- (y11c);
  \draw[ao] (z12) -- (y12t);
  ...
\end{tikzpicture}
```

Challenges

Steep Learning Curve

The key to learning \LaTeX

- Learning by doing
- Trial and error
- Google
- PATIENCE



Figure: Source <http://bit.ly/1VP56MS>.

Co-Authoring

Reproducibility is one of the main advantages of \LaTeX . But co-authoring can be tricky with a basic \LaTeX distribution.

Challenges toward collaboration

- Co-authors that don't know \LaTeX .
- Special packages, fonts, etc.
- Limited tracking of changes.
- Limited commenting abilities (except % or).

Tools for collaboration

Online platform <https://www.overleaf.com>

Limited free version, many templates.

`todonotes` package

Adds margin and in-text comments.

Journal submission

- Some journals will not accept \LaTeX files for final manuscript submission.
- There are software tools for converting \LaTeX to Word, but it is a pain.
- Especially frustrating for: Tables, bibliographies, equations.
Hence, all the reasons why you would want to use \LaTeX in the first place.

Other Challenges

- Limited spell-checking options. Depends on editor.
- Debugging is part of the process.
 - Check for typos.
 - Read error message of compiler.
 - Google error message.
 - Trial and error.

Some misconceptions

No word counts

Many compilers don't have a build in function, but there is external programs (e.g. <http://app.uio.no/ifi/texcount/>) and ShareLaTeX also has a word count option.

Tables in \LaTeX suck

Programming tables from scratch is no fun! But, there are tools such as the `stargazer` and `estout` packages, plug-ins for Excel, and online tools (<http://www.tablesgenerator.com>).

Structure and compiling

Basic Structure

Preamble

Document type, basic settings, packages. Not printed.

Title section

Title, date, author information.

Main Body

Document content including title wrapped by

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

Preamble

```
\documentclass[11pt,letterpaper,oneside](article) %Change basic font size and paper size here.
\usepackage[setspace, graphicx, fullpage, fancyhdr, amssymb, amsmath, epsfig, natbib, array, multirow, hyperref, tabularx, lscap,
booktabs, sidecap, subfig, longtable, enumitem]
```

```
\hypersetup{
bookmarks=false, % show bookmarks bar?
unicode=false, % non-Latin characters in Acrobat's bookmarks
pdftoolbar=true, % show Acrobat's toolbar?
pdfmenubar=true, % show Acrobat's menu?
pdfwindow=false, % window fit to page when opened
pdfstartview=(FitH), % fits the width of the page to the window
pdftitle={}, % title
pdfauthor={}, % author
pdfsubject=(Subject), % subject of the document
pdfcreator=(Creator), % creator of the document
pdfproducer=(Producer), % producer of the document
pdfkeywords=(keywords), % list of keywords
pdfnewwindow=true, % links in new window
colorlinks=true, % false: boxed links; true: colored links
linkcolor=blue, % color of internal links
linkbordercolor=(0 0 0), %border color
citebordercolor=(0 0 0),
citecolor=blue, % color of links to bibliography
filecolor=black, % color of file links
uricolor=blue, % color of external links
}
```

Most important
parameter is
`documentclass{}`

- article
- resume
- beamer
- letter

Packages and
`hypersetup` differ.

Compiling a document

Workflow might differ for each editor. Example TeXShop:

- 1 Running \LaTeX first time will produce general text.
- 2 Running BibTeX to create bibliography (if necessary).
- 3 Running \LaTeX second time will product internal links, table of contents, and references.

Some editors like Overleaf will compile everything at once.

Shortcut for typesetting on MAC

⌘ + T

\LaTeX commands and special characters

All \LaTeX commands start with a `\`. Example: `\begin{}`

Characters with special meaning

- `{` and `}`: Used in functions and for delineation.
- `%`: Comment (nothing that follows will be printed).
- `$`: In-line math.
- `&`: Alignment character (tables and math).

To use any of these symbols in text, we need to use an escape character. For example, to print `%` `&` `$`, we need to type:

`\% \& \$`

Miscellaneous Notes

- Using `section{}`, `subsection{}`, and `subsubsection{}`, \LaTeX automatically creates a structure that pdf readers will understand.

Miscellaneous Notes

- Using `section{}`, `subsection{}`, and `subsubsection{}`, \LaTeX automatically creates a structure that pdf readers will understand.
- `section*{}`, `subsection*{}`, and `subsubsection*{}` are the non-numbered equivalents.

Miscellaneous Notes

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Bibliographies

Basic structure

Bibliographic data base, e.g. `sample_bib.bib`.

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@article{fearonlaitin2003,  
  Author = {James D. Fearon and David D. Laitin},  
  Journal = {American Political Science Review},  
  Number = {1},  
  Pages = {75-90},  
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Moving on...

Any questions before we move on to part II?

\LaTeX Lingo

Distribution

Collection of \TeX -related software. Examples: MiKTeX, TeX Live.

Editor

Creation of documents. Examples: TeXworks, TeXShop.

Format

Different \TeX -based languages. Examples: \LaTeX , plain \TeX .

Packages

Add ons to basic systems. Examples graphicx, natbib.