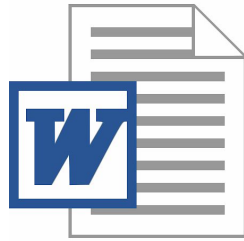# Tools of the Trade:

resources to help prepare papers and conduct research

Trung V. Dang, Shlomi Hod, Luowen Qian

Tool use shapes thinking

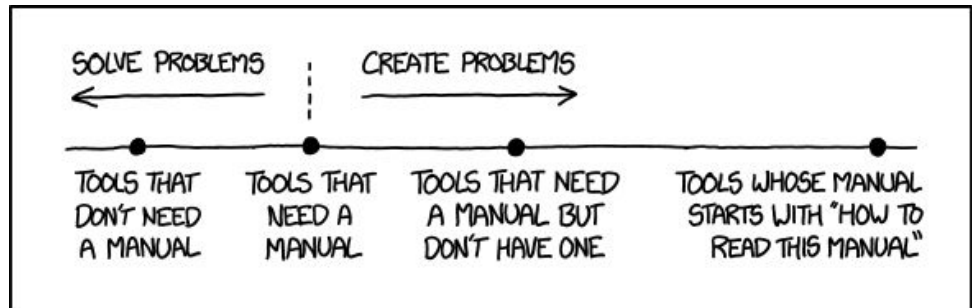# Few General Principles for Building your Toolbox

Goal: Effectiveness (ability) & Efficiency (productivity)

Define your system, design your process

Simplicity (proxy measure: numbers of clicks for an action)

Experiment with tools before committing to them

Sometimes you want use more than one tool for a task (e.g., offline and online writing in LaTeX)

Be aware...

HOW LONG CAN YOU WORK ON MAKING A ROUTINE TASK MORE EFFICIENT BEFORE YOU'RE SPENDING MORE TIME THAN YOU SAVE?
(ACROSS FIVE YEARS)

		50/DAY	5/DAY	DAILY	WEEKLY	MONTHLY	YEARLY
	1 SECOND	1 DAY	2 HOURS	30 MINUTES	4 MINUTES	1 MINUTE	5 SECONDS
	5 SECONDS	5 DAYS	12 HOURS	2 HOURS	21 MINUTES	5 MINUTES	25 SECONDS
	30 SECONDS	4 WEEKS	3 DAYS	12 HOURS	2 HOURS	30 MINUTES	2 MINUTES
HOW MUCH TIME YOU SHAVE OFF	1 MINUTE	8 WEEKS	6 DAYS	1 DAY	4 HOURS	1 HOUR	5 MINUTES
	5 MINUTES	9 MONTHS	4 WEEKS	6 DAYS	21 HOURS	5 HOURS	25 MINUTES
	30 MINUTES		6 MONTHS	5 WEEKS	5 DAYS	1 DAY	2 HOURS
	1 HOUR		10 MONTHS	2 MONTHS	10 DAYS	2 DAYS	5 HOURS
	6 HOURS				2 MONTHS	2 WEEKS	1 DAY
	1 DAY					8 WEEKS	5 DAYS

HOW OFTEN YOU DO THE TASK

Keyboard Shortcuts

Why?

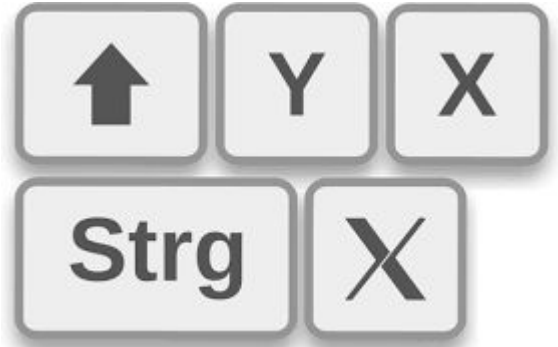   Spending more time on the things that matter

    Reducing cognitive load

    Good for preventing RSI (repetitive strain injury)

Sometimes steep learning curve

    Tip: flip your mouse, disable your touchpad

Good starting point: [lifehacker - Back to Basics: Learn to Use Keyboard Shortcuts Like a Ninja](#)

Tools for What?

1. Writing
2. Coding
3. Organizing
4. Collaborating
5. Presenting

…. and now an opinionated survey!

Task I: Tools for Writing Papers - LaTeX

- Pros: ...
- Cons: …

You don't have a choice so you don't need to care

LaTeX editors

Emacs + AUCTeX, Vim + LaTeX-suite, Sublime Text + LaTeXTools…

Pros:

- Efficient given you know the editor very well
- Easy to use if you spend time configuring it

Cons:

- You spend time finding plugins/extensions for it
- You spend time configuring it
- You need to be ready to debug editors if things are not working or are slow

LaTeX IDEs

a.k.a. LaTeX editors that work out of the box

Ordered by community preference: (https://tex.stackexchange.com/q/339/97178)

- TeXstudio (formerly TexMakerX)
- Texmaker
- TeXworks
- Kile
- TexShop for Mac
- TeXnicCenter for Windows
- … (you don't need to know the rest)

Find yours: https://en.wikipedia.org/wiki/Comparison_of_TeX_editors

Overleaf (formerly ShareLaTeX)

overleaf.com

Better than IDEs:

- Works in your browser
- Built-in collaboration tools (more on this later)

Worse than IDEs: (caveats)

- "Lost Connection" "Please refresh the page to continue."
- "Planned Maintenance"
- Has maximum compilation size (suggested by Andrew Wood)

Example: Forward/Inverse Search

TeXstudio: right click, choose "Go to PDF" or "Go to Source"

Overleaf: double click or

Emacs + AUCTeX, instructions:
https://tex.stackexchange.com/q/161797/97178

Punchline: use an IDE
(unless you have already invested in an editor + plugins)

LaTeX Packages

- LaTeX is Turing complete
- TeX is a macro language
- Macro packages are macros written by other people
- Use macros & packages!

LaTeX Packages for Making Figures

- Use `graphicx` for inserting:
  - Bitmaps (jpg/png) you make elsewhere (hopefully not Microsoft Paint)
  - Graphics (ps/eps) you export from mathematical or scientific graphics software
  - PowerPoint figures can be converted into ps/eps: http://www.cs.bu.edu/~reyzin/pictips.html
- Use `tikz` for drawing images in TeX (remember to use macros or `\tikzset`!)
  - Interactive tools that can export tikz: Asymptote, Inkscape, GeoGebra
- Other packages: PStricks, Xy-pic, Metapost...

LaTeX Packages for Code

- Packages `algorithmic`, `algorithm2e`, `algorithmicx`, `program`
  Looks nice but more or less equally hard to use
- ~~Just use `enumerate` for pseudocode~~
- Use `listings` or `minted` to typeset real code

LaTeX Tools for Bibliography

- Use `biblatex` [unless you are submitting to a journal](it is more easily configurable and has better Unicode support)
- Use `bibliography`/`bibtex` for simplicity
- Use `thebibliography` if you like complete control
  (i.e. do not use this under normal circumstances)

Finding BibTeX citations:

- General search engines -- [dblp](), [MathSciNet](), [Google Scholar]()
- Publisher website

Comparison of BibTeX entries

```
@inproceedings{DBLP:conf/crypto/GargOS18,
  author    = {Sanjam Garg and
               Rafail Ostrovsky and
               Akshayaram Srinivasan},
  editor    = {Hovav Shacham and
               Alexandra Boldyreva},
  title     = {Adaptive Garbled {RAM} from Laconic Oblivious Transfer},
  booktitle = {Advances in Cryptology - {CRYPTO} 2018 - 38th Annual International
               Cryptology Conference, Santa Barbara, CA, USA, August 19-23, 2018,
               Proceedings, Part {III}},
  series    = {Lecture Notes in Computer Science},
  volume    = {10993},
  pages     = {515--544},
  publisher = {Springer},
  year      = {2018},
  url       = {https://doi.org/10.1007/978-3-319-96878-0\_18},
  doi       = {10.1007/978-3-319-96878-0\_18},
  timestamp = {Tue, 14 May 2019 10:00:48 +0200},
  biburl    = {https://dblp.org/rec/conf/crypto/GargOS18.bib},
  bibsource = {dblp computer science bibliography, https://dblp.org}
}
```

dblp

```
@incollection {MR3847907,
    AUTHOR = {Garg, Sanjam and Ostrovsky, Rafail and Srinivasan, Akshayaram},
     TITLE = {Adaptive garbled {RAM} from laconic oblivious transfer},
 BOOKTITLE = {Advances in cryptology---{CRYPTO} 2018. {P}art {III}},
    SERIES = {Lecture Notes in Comput. Sci.},
    VOLUME = {10993},
     PAGES = {515--544},
 PUBLISHER = {Springer, Cham},
      YEAR = {2018},
   MRCLASS = {94A60},
  MRNUMBER = {3847907},
       DOI = {10.1007/978-3-319-96878-0_18},
       URL = {https://doi.org/10.1007/978-3-319-96878-0_18},
}
```

MathSciNet

```
@InProceedings{10.1007/978-3-319-96878-0_18,
author="Garg, Sanjam
and Ostrovsky, Rafail
and Srinivasan, Akshayaram",
editor="Shacham, Hovav
and Boldyreva, Alexandra",
title="Adaptive Garbled RAM from Laconic Oblivious Transfer",
booktitle="Advances in Cryptology -- CRYPTO 2018",
year="2018",
publisher="Springer International Publishing",
address="Cham",
pages="515--544",
abstract="We give a construction of an adaptive garbled RAM scheme. In the
adaptive setting, a client first garbles a ``large'' persistent database which is
stored on a server. Next, the client can provide garbling of multiple adaptively
and adversarially chosen RAM programs that execute and modify the stored database
arbitrarily. The garbled database and the garbled program should reveal nothing
more than the running time and the output of the computation. Furthermore, the
sizes of the garbled database and the garbled program grow only linearly in the
```

Springer (publisher)

```
@inproceedings{garg2018adaptive,
  title={Adaptive garbled RAM from laconic oblivious transfer},
  author={Garg, Sanjam and Ostrovsky, Rafail and Srinivasan, Akshayaram},
  booktitle={Annual International Cryptology Conference},
  pages={515--544},
  year={2018},
  organization={Springer}
}
```

Google Scholar

LaTeX compilers

- arXiv only supports ((PDF)La)TeX
  (yes, you are required to submit your source files there)
- XeLaTeX/LuaLaTeX is more modern and more friendly for Unicode

Use `iftex` to get best of both worlds…

```
\usepackage{iftex}
\ifpdftex
    \usepackage[noTeX]{mmap}
\else
    \usepackage[T1]{fontenc}
    \usepackage{unicode-math}
\fi
```
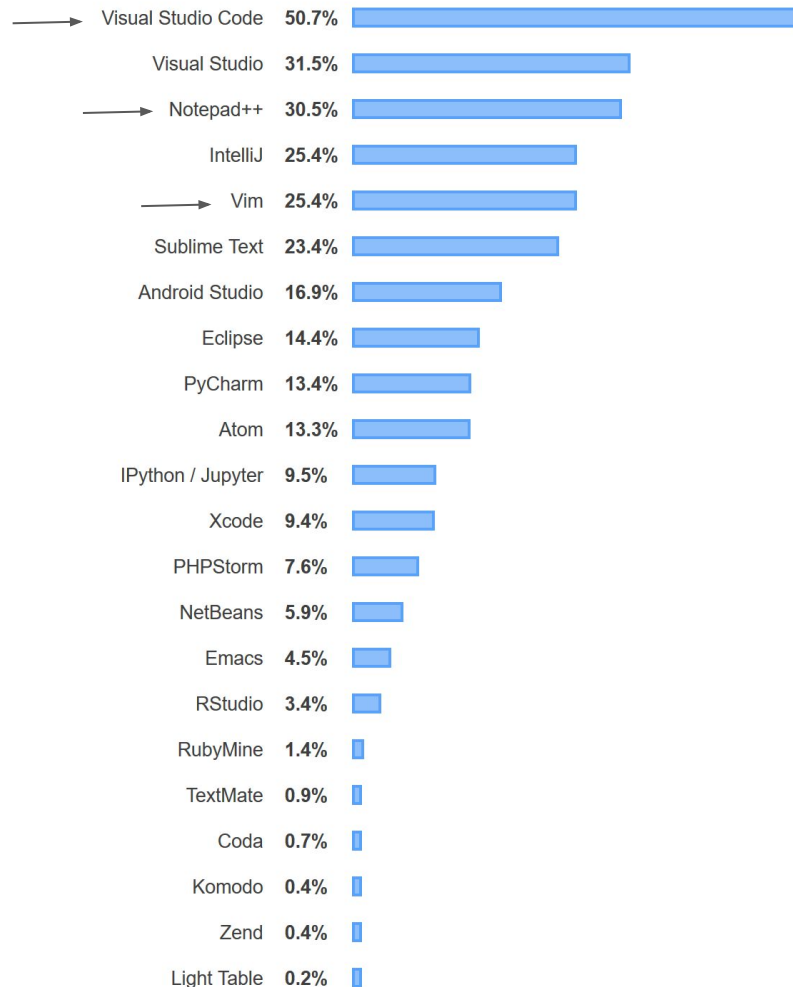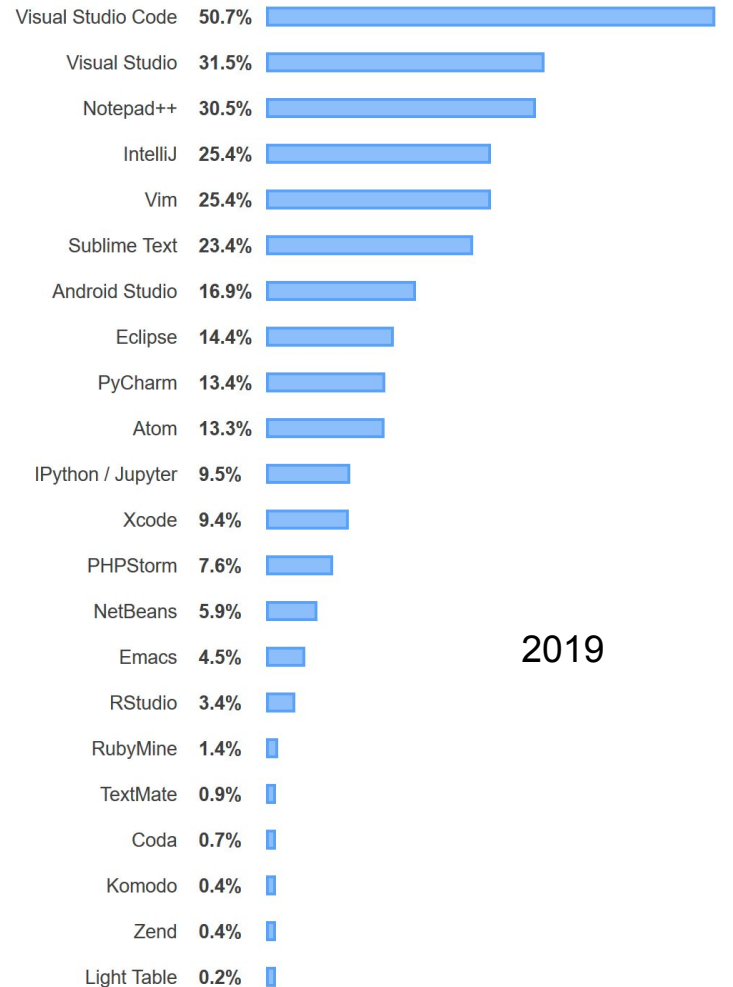
Task II: Coding

If you want to...	IDE	GUI E	TER E
get off the ground fast?	✓		
work with a specific language only supported by an IDE (matlab, verilog, etc.)	✓		
remain on a same tool for decades?			✓
code on many languages		✓	✓
do the work remotely			✓
auto complete, code lint, code hint, etc.	✓	✓	
get rid of the mouse			✓
advanced tools (database, git integration, deployment, etc.)	✓	✓	
customize your environment	✓	✓	✓

2019 Survey

Most popular development environment
(Stack Overflow Developer Survey)

- Don't be a jake of all trades
- Don't be too loyal to a tool

Tool	%
Visual Studio Code	50.7%
Visual Studio	31.5%
Notepad++	30.5%
IntelliJ	25.4%
Vim	25.4%
Sublime Text	23.4%
Android Studio	16.9%
Eclipse	14.4%
PyCharm	13.4%
Atom	13.3%
IPython / Jupyter	9.5%
Xcode	9.4%
PHPStorm	7.6%
NetBeans	5.9%
Emacs	4.5%
RStudio	3.4%
RubyMine	1.4%
TextMate	0.9%
Coda	0.7%
Komodo	0.4%
Zend	0.4%
Light Table	0.2%

2017		2019	
Visual Studio	38.8%	Visual Studio Code	50.7%
Notepad++	34.3%	Visual Studio	31.5%
Sublime Text	31.4%	Notepad++	30.5%
Vim	27.1%	IntelliJ	25.4%
Visual Studio Code	24.0%	Vim	25.4%
IntelliJ	23.0%	Sublime Text	23.4%
Atom	20.0%	Android Studio	16.9%
Eclipse	20.0%	Eclipse	14.4%
Android Studio	14.0%	PyCharm	13.4%
PHPStorm	11.7%	Atom	13.3%
Xcode	9.2%	IPython / Jupyter	9.5%
NetBeans	7.8%	Xcode	9.4%
PyCharm	7.7%	PHPStorm	7.6%
Emacs	4.2%	NetBeans	5.9%
IPython / Jupyter	3.4%	Emacs	4.5%
RubyMine	2.2%	RStudio	3.4%
RStudio	1.3%	RubyMine	1.4%
TextMate	1.2%	TextMate	0.9%
Coda	0.7%	Coda	0.7%
Komodo	0.6%	Komodo	0.4%
Zend	0.5%	Zend	0.4%
Light Table	0.2%	Light Table	0.2%

# Don't forget to...

WHEN YOU FORGOT TO SAVE AND YOU'RE DEAD INSIDE

Keep track of your work

- Make yourself comfortable with git
- Your BU's home directory is taken snapshot hourly, nightly and weekly!
- Make sure your results are reproducible (save experiment details, use random seed, etc.)

Don't forget to...

Keep track of environment and dependencies

- Use package manager: pip, anaconda, npm
- Use virtual machine or virtual environment
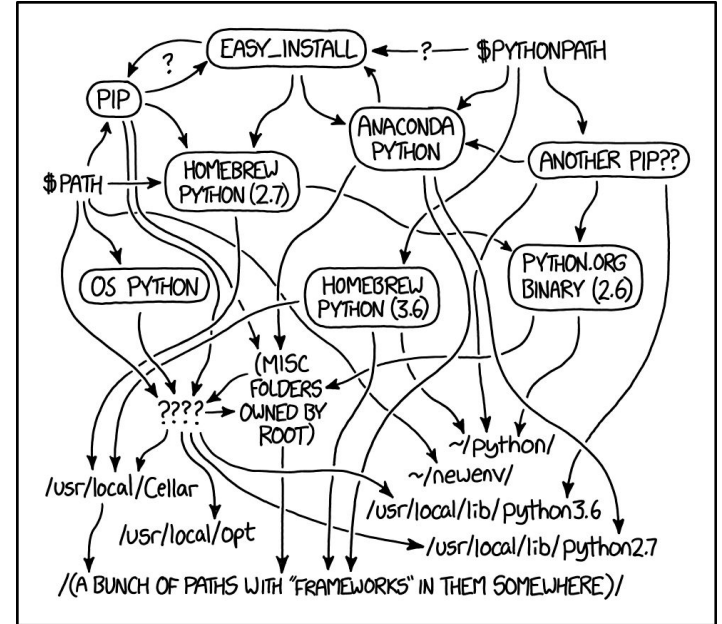
MY PYTHON ENVIRONMENT HAS BECOME SO DEGRADED THAT MY LAPTOP HAS BEEN DECLARED A SUPERFUND SITE.

Task III: Organization

Organization of what….? Everything!
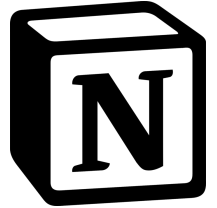
Build your "life operation system"

    Notes, Docs

    Knowledge Base

    Tasks, Projects

    Databases

https://www.notion.so/product

Free Personal plan with @bu.edu

Task III: Organization - con't

Organization of what….? Research, Knowledge.

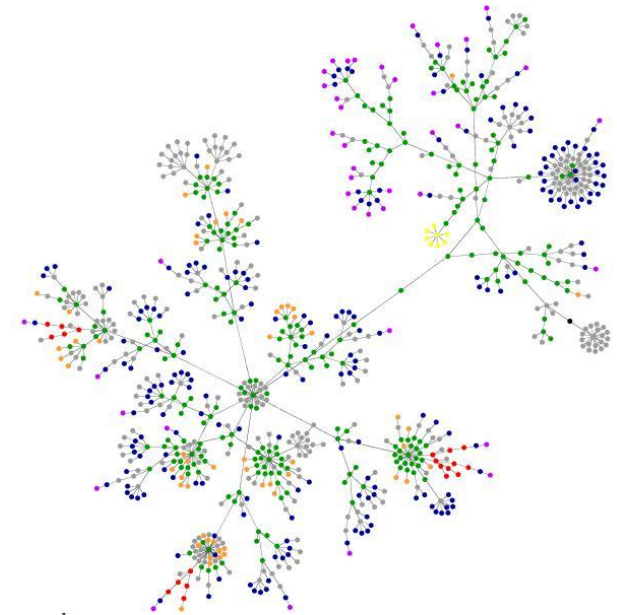**Mind Mapping!** (Wikipedia list)

My (current) favorite: Coggle

example 1
example 2

"Research Tree"

Task IV: Tools for Collaboration - Remote Meetings

- Best way to communicate is to talk offline
- Zoom has comprehensive features but expensive
  - University sponsored license
  - Virtual whiteboard support with annotations (more on this later)
- Skype is free and widely used (so are your favorite video calling apps)
- [Whereby](#) works in-browser

Task IV: Tools for Collaboration - Virtual Whiteboards

The only usable one: [Google Jamboard (jamboard.google.com)](jamboard.google.com)

Honorable mention: Microsoft Whiteboard

Also consider Google docs if your collaborators do not have a stylus

Microsoft

Sign in

Sorry, but we're having trouble signing you in.

AADSTS50020: User account ▬▬▬▬▬▬ from identity provider
'live.com' does not exist in tenant 'Microsoft Services' and cannot access the
application '95de633a-083e-42f5-b444-a4295d8e9314'(Microsoft Whiteboard
Services) in that tenant. The account needs to be added as an external user in the
tenant first. Sign out and sign in again with a different Azure Active Directory user
account.

Task IV: Tools for Collaboration - Coding

Use git, with your code hosted on GitHub/GitLab/BitBucket…

- Branching and merging
- Bisecting
- Submodules

Unpopular alternatives: Apache Subversion, Mercurial SCM…

Task IV: Tools for Collaboration - Writing in LaTeX

Overleaf:

- Real-time source code updates
- Almost no learning curve: your co-authors might not know git

git:

- Resolving conflicts using branching and merging
- Use it with your favorite LaTeX editor/IDE
- Works offline!

Use both if possible to get best of both worlds

Task V: Presentation

Popular:

- Good for general use: PowerPoint
- Good for collaboration: Google Slides

For researcher & developer

- Good for fast prototyping: Markdown
- Good for scientific presentation: Latex Beamer

Create your academic personal website

How to...

- create a static & minimal homepage? *Jenkyll*
- start a blog? *Wordpress, Medium, etc.*
- register a domain? *github, google domains (?)*

Homer J. Simpson

Nuclear Safety Inspector

This is the executive summary. You should write a few brief, concise, and meaningful sentences about yourself from a professional context, and your immediate career goals. Make the length appropriate for your needs, but K.I.S.S.

Contact me

Experience

Springfield Nuclear Power Plant

Safety Inspector • Nov, 1980 – Present

Write about your core competencies in one or two sentences describing your position. If you held the position for a long time, it could be a longer section, including a couple bullet points:

- Ate lots of donuts
- Fell asleep rarely
- Left promptly at end of day (sometimes earlier)

Remote Working

Best practice for working from home

https://coronavirustechhandbook.com/remote

Summary

1. Introduction - Tool use shapes thinking, Building your Toolbox, Shortcuts
2. Writing - IDE, Overleaf, BibTeX, LaTeX packages
3. Coding
4. Organizing - Notion, Coggle
5. Collaborating
6. Presenting

Discussion

What makes a good tool?

Do you have a story about a tool that really changed the way they work?

How do you find tools?

References

https://academia.stackexchange.com/a/56513/86377

https://github.com/overleaf/translations/blob/50a9bc3d03961f6604bed335c0635b0a7dea5407/locales/en.json#L885

https://web.iit.edu/sites/web/files/departments/academic-affairs/graduate-academic-affairs/pdfs/figure-help1.pdf

https://tex.stackexchange.com/a/597/97178

https://en.wikibooks.org/wiki/LaTeX/Algorithms

https://en.wikibooks.org/wiki/LaTeX/Source_Code_Listings