LaTeX Experiments

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1 TeX distributions

1.1 MacTeX

The best for Mac.

```
$ brew cask install mactex
```

1.2 Visual Studio Code LaTeX Workshop Extension

LaTeX Workshop is an extension for Visual Studio Code, aiming to provide core features for LaTeX typesetting with Visual Studio Code.

- `https://github.com/James-Yu/LaTeX-Workshop`
- `https://github.com/James-Yu/LaTeX-Workshop/wiki/Compile`

Build LaTeX file by calling the command `Build LaTeX project` from the Command Palette or from the TeX badge. This command is bound to `Cmd+Ctrl+b`

You can change VS Code settings by opening Settings tab:
`Cmd+, -> Extensions -> LaTeX`
or, alternatively, by directly editing settings.json file:
`~/Library/Application\ Support/Code/User/settings.json`
Recommended settings for LaTeX Workshop:

```
{
    "latex-workshop.view.pdf.viewer": "tab",
    "latex-workshop.latex.outDir": "%DIR%/texout",
    "latex-workshop.latex.autoBuild.run": "never",
    "latex-workshop.latex.autoClean.run": "onBuilt"
}
```

1.3 MiKTeX

Not for Mac. Old MiKTeX installation:
`/usr/local/bin/`
`/Applications/MiKTeX\ Console.app/`

1.4 TinyTeX

TinyTeX - a lightweight, cross-platform, portable, and easy-to-maintain LaTeX distribution based on TeX Live.

Currently TinyTeX works best for R users. Installing and maintaining TinyTeX is easy for R users, since the R package tinytex has provided wrapper functions.

For other (non-R) users:

- See TinyTeX docs here.
- In the directory
  `~/Library/TinyTeX/texmf-dist/tex/latex/`
  you can find all LaTeX packages installed for TinyTeX.
- If you compile a LaTeX document and run into an error message like this:
  `! LaTeX Error: File 'times.sty' not found.`
  It basically indicates a missing LaTeX package.

  Use the command `tlmgr search` to find the name of the missing package:
  ```
  $ tlmgr search --global --file "/times.sty"
  psnfss: texmf-dist/tex/latex/psnfss/times.sty
  ```

  In this case, the missing package is `psnfss`, and we can install a package via `tlmgr install`, e.g.,
  ```
  $ tlmgr install psnfss
  ```

  If you still see error messages that you don't understand, you may need to update everything:
  ```
  $ tlmgr update --self --all
  $ tlmgr path add
  $ fmtutil-sys --all
  ```
- To uninstall TinyTeX use command line:
  ```
  $ tlmgr path remove
  $ rm -r "~/Library/TinyTeX"
  ```

2 Epigraph

> *In doing what we ought we deserve no praise, because it is our duty.*
>
> — Saint Augustine

2.1 Online docs

TeXdoc Online is TeX and LaTeX documentation lookup system.

2.2 verbatim

```
Text enclosed inside
    \begin{verbatim} ... \end {verbatim}
environment                         is printed directly
and all \LaTeX{} commands are ignored.

Text␣enclosed␣inside␣\begin{verbatim*}␣environment
␣␣␣␣␣is␣printed␣directly
and␣all␣\LaTeX{}␣commands␣are␣ignored,
and␣white␣spaces␣are␣emphasized␣with␣a␣special␣symbol.
```

Use `\verb+<inline verbatim text>+` like this:
The `\ldots` command produces ...

2.3 listings: Source code printing

- listings package documentation
- `https://www.overleaf.com/learn/latex/Code_listing`

2.3.1 minimal setup

Example of using the `\begin{lstlisting}[language=Python]` environment from the `\usepackage{listings}` package to highlight Python code:

```
import numpy as np

def incmatrix(genl1,genl2):
    m = len(genl1)
    n = len(genl2)
    M = None #to become the incidence matrix
    VT = np.zeros((n*m,1), int)  #dummy variable

    #compute the bitwise xor matrix
    M1 = bitxormatrix(genl1)
    M2 = np.triu(bitxormatrix(genl2),1)

    for i in range(m-1):
        for j in range(i+1, m):
            [r,c] = np.where(M2 == M1[i,j])
            for k in range(len(r)):
                VT[(i)*n + r[k]] = 1;
                VT[(i)*n + c[k]] = 1;
                VT[(j)*n + r[k]] = 1;
                VT[(j)*n + c[k]] = 1;

                if M is None:
```

```
                M = np.copy(VT)
            else:
                M = np.concatenate((M, VT), 1)

            VT = np.zeros((n*m,1), int)

    return M
```

2.3.2 with code styles and colours

You need `\usepackage{xcolor}` package for the code colouring.
Just like in floats (tables and figures), captions can be added to a listing for a more clear presentation. This caption can be later used in the list of Listings `\lstlistoflistings`.

```python
import numpy as np

def incmatrix(genl1,genl2):
    m = len(genl1)
    n = len(genl2)
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    #compute the bitwise xor matrix
    M1 = bitxormatrix(genl1)
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    for i in range(m-1):
        for j in range(i+1, m):
            [r,c] = np.where(M2 == M1[i,j])
            for k in range(len(r)):
                VT[(i)*n + r[k]] = 1;
                VT[(i)*n + c[k]] = 1;
                VT[(j)*n + r[k]] = 1;
                VT[(j)*n + c[k]] = 1;

                if M is None:
                    M = np.copy(VT)
                else:
                    M = np.concatenate((M, VT), 1)

                VT = np.zeros((n*m,1), int)

    return M
```
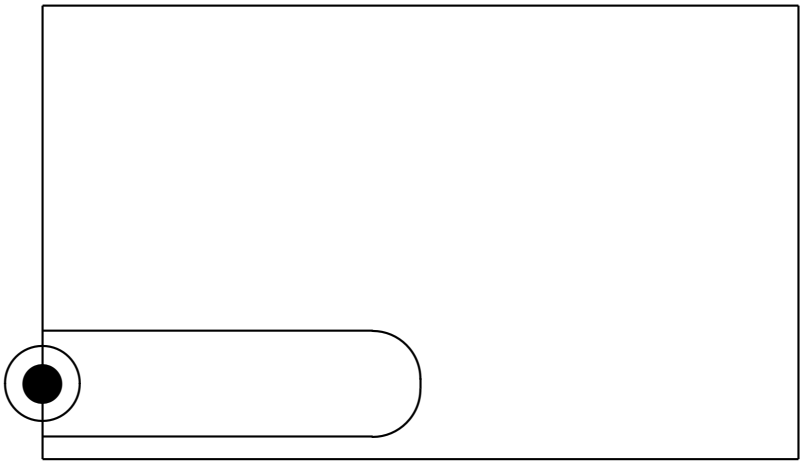
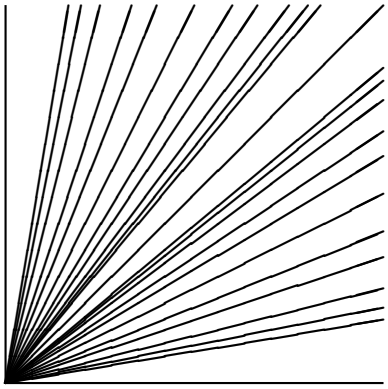

Listing 1: Python example

3 Picture environment

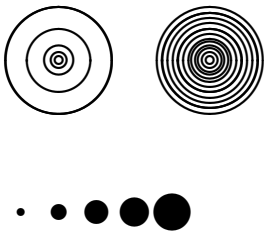
- `https://en.wikibooks.org/wiki/LaTeX/Picture`
- `https://www.overleaf.com/learn/latex/Picture_environment`

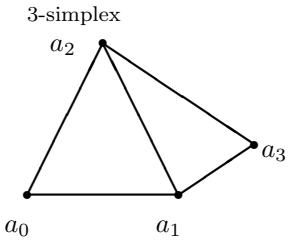


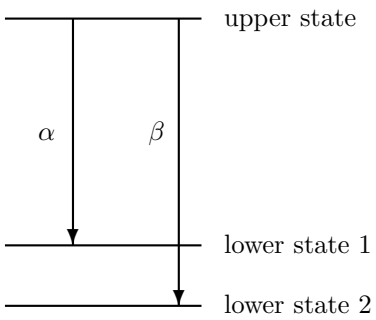
The components of the direction vector `(x1,y1)` of the line segment `\line(x1,y1){length}` are restricted to the integers $(-6, -5, ..., 5, 6)$ and they have to be coprime. The figure below illustrates all 25 possible slope values in the first quadrant.

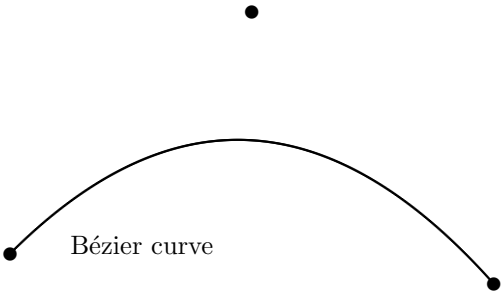


The picture environment only admits diameters up to approximately 14mm, and even below this limit, not all diameters are possible.




3-simplex
a_2
a_3
a_0
a_1


upper state
α
β
lower state 1
lower state 2


Bézier curve

Listings