LaTeX: Intermediate

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Goals:

- Get familiar with advanced parts om LaTeX
  - Commands
  - Environments
  - Figures
  - Styles
- Know how to structure larger projects
- Know how to include code and algorithms
- Know best practice when including graphs and figures
- Be able to work on complex documents
- Know how to do citation

Basics: 1/5

COMMANDS

- Begins with an ****
- Then comes the command name
- Then comes **[]**
  - With options inside
- Then comes **{}**
  - With input inside
  - NB: there can be multiple inputs in some functions

ENVIRONMENTS

- Starts with **\begin{name}**
- Then comes the contents
- Ends with **\end{name}**

Basics: 2/5

PACKAGES

- Provide extra functionality
  - There is a package for everything

\usepackage[options**]{**name**}**

- Most packages has an manual
- Distributed by CTAN
  - Comprehensive TEX Archive Network

MINIMAL DOCUMENT

```
\documentclass{article}
        [preamble]
\begin{document}


\end{document}
```

Basics: 3/5

LANGUAGE

- Using the package **babel**
  - **Norwegian:** norsk
  - **English:** english, USenglish, american, UKenglish, british, canadian, australian, newzealand

\usepackage[**norsk**]{**babel**}

INPUT - OUTPUT

- \usepackage[**utf8**]{**inputenc**}
  - To have special characters as input
- \usepackage[**T1**]{**fontenc**}
  - To have special characters as output

Basics: 4/5

MATH

- Use the **amsmath package**
  - **AMS** = American Mathematical Society
- Inline: **$** [Equation] **$**
- As equation:

```
\begin{equation}
   [Equation]
\end{equation}
```

- Unnumbered: `\begin{equation*}`

FLOATS

- Things that “float” in the document:
  - Tables
  - Figures
  - Custom floats
- Placement algorithm
- Text-to-Float ratio
  - If its to low – bad stuff happen

Basics: 5/5

FIGURES

- Uses the **figure** environment
- \includegraphics
  - **[options]** = scaling ++
    - Eg. width=0.6\textwidth
  - **{sau.jpg}** = What picture to include
    - NB: notice formats

```
\begin{figure}[htbp]
    \includegraphics[options]{sau.jpg}
    \caption[]{}
    \label{fig:sau1}
\end{figure}
```

TABLES

- Uses the **table** environment
  - Usually in a float
- **{ c | c c }** = columns
  - c = centred
  - r = right
  - l = left
  - | = vertical line
- **&** = next column
- **//** = end line
- **\hline** = Horizontal line

ShareLatex.com

- https://innsida.ntnu.no/wiki/-/wiki/English/ShareLaTeX
  - Campus License
- Synchronies with GitHub and Dropbox
- Easy to collaborate with others
- No need to install anything

Go to: empty.pippidis.no

TASK 1

Repitition

- Create a document:
  - Report
  - 2 chapter
  - 3 sections
  - A figure of a duck
  - A small table of duck sightings
  - Is UK English
  - Accepts ÆØÅ
  - Has an equation

- **Hint:** hint.pippidis.no

TASK 1

Solution

```
\documentclass[]{report}
\usepackage[UKenglish]{babel}
\usepackage[utf8]{inputenc}
\usepackage[T1]{fontenc}

\begin{document}

\chapter{A chapter}

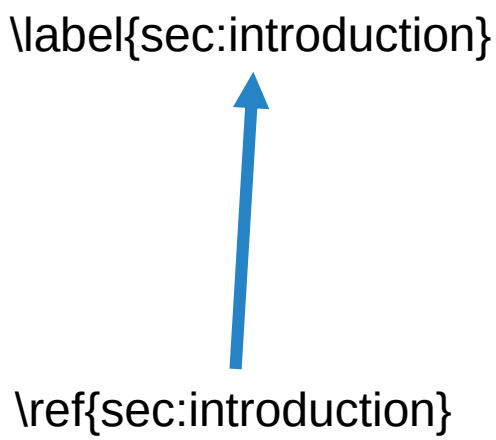
\section{A section}

\end{document}
```

Internal referencing:

- **\label{}**
- **\ref{}**

- Convention:
  - Chapter: chap:name
  - Figure: fig:name
  - Table: tab:name
  - Section: sec:name
  - Equation: eq:name
  - Algorithm: alg:name



NB: To make clickable: **hyperref** - package

Table of contents:

- Table of contents (TOC)
  - **\tableofcontents**
- List of figures (LOF)
  - **\listoftables**
- Table of tables (LOT)
  - **\listoffigures**

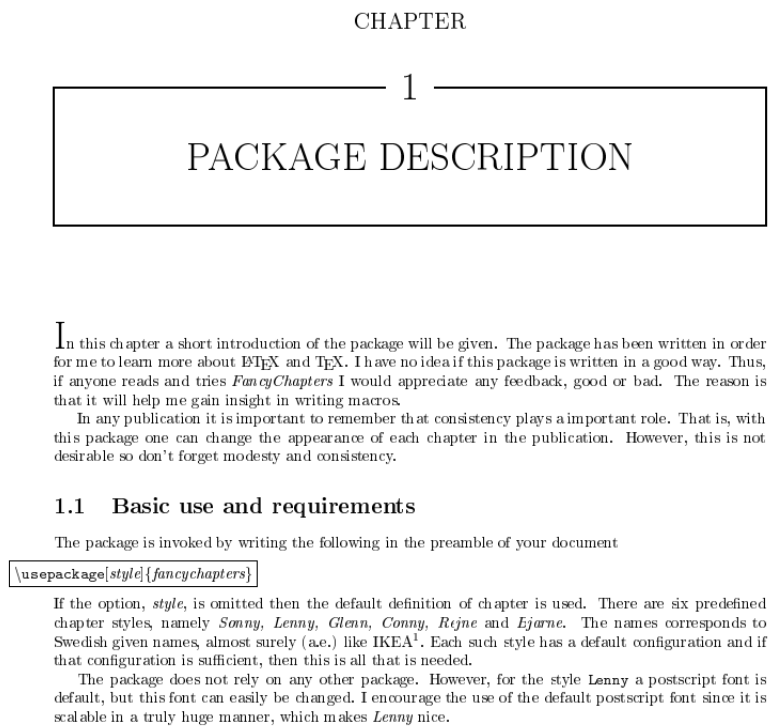
NB: To get these lists in TOC:
\addcontentsline{toc}{chapter}{Table of Contents**}**

Style:

- Using the **fncychap** package
  - 7 standard chapter designs
  - Can modify your own style

\usepackage[**style**]{**fncychap**}

- **Lenny** is commonly used



CHAPTER 1

PACKAGE DESCRIPTION

In this chapter a short introduction of the package will be given. The package has been written in order for me to learn more about LaTeX and TeX. I have no idea if this package is written in a good way. Thus, if anyone reads and tries *FancyChapters* I would appreciate any feedback, good or bad. The reason is that it will help me gain insight in writing macros.

In any publication it is important to remember that consistency plays a important role. That is, with this package one can change the appearance of each chapter in the publication. However, this is not desirable so don't forget modesty and consistency.

1.1 Basic use and requirements

The package is invoked by writing the following in the preamble of your document

`\usepackage[style]{fancychapters}`

If the option, *style*, is omitted then the default definition of chapter is used. There are six predefined chapter styles, namely *Sonny*, *Lenny*, *Glenn*, *Conny*, *Rejne* and *Ejarne*. The names corresponds to Swedish given names, almost surely (a.e.) like IKEA[1]. Each such style has a default configuration and if that configuration is sufficient, then this is all that is needed.

The package does not rely on any other package. However, for the style Lenny a postscript font is default, but this font can easily be changed. I encourage the use of the default postscript font since it is scalable in a truly huge manner, which makes *Lenny* nice.

Rejne Style

Headers and Footers: 1/2

- Using the **fancyhdr** package
  - Can change header and footer
  - Set page style

\usepackage[…]{**fancyhdr**}

- Logos can be added
  - Using includegraphic

- Gives the commands:
  - \fancyhf{…}
  - \fancyhead[…]{..}
  - \fancyfoot[…]{…}
  - \renewcommand{\headrulewidth}{…}
  - \renewcommand{\footrulewidth}{…}

- Placement commands:
  - L, R, C – Left, Right, Center
  - E, O – Even, Odd

```
\fancyfoot[LE,RO]{\thepage}
```

Headers and Footers: 1/2

- Can define own style:

fancypagestyle{stylename**}{**…**}**

\pagestyle{stylename**}**

- Useful for different parts
  - Frontmater
  - Mainmater
  - Backmater

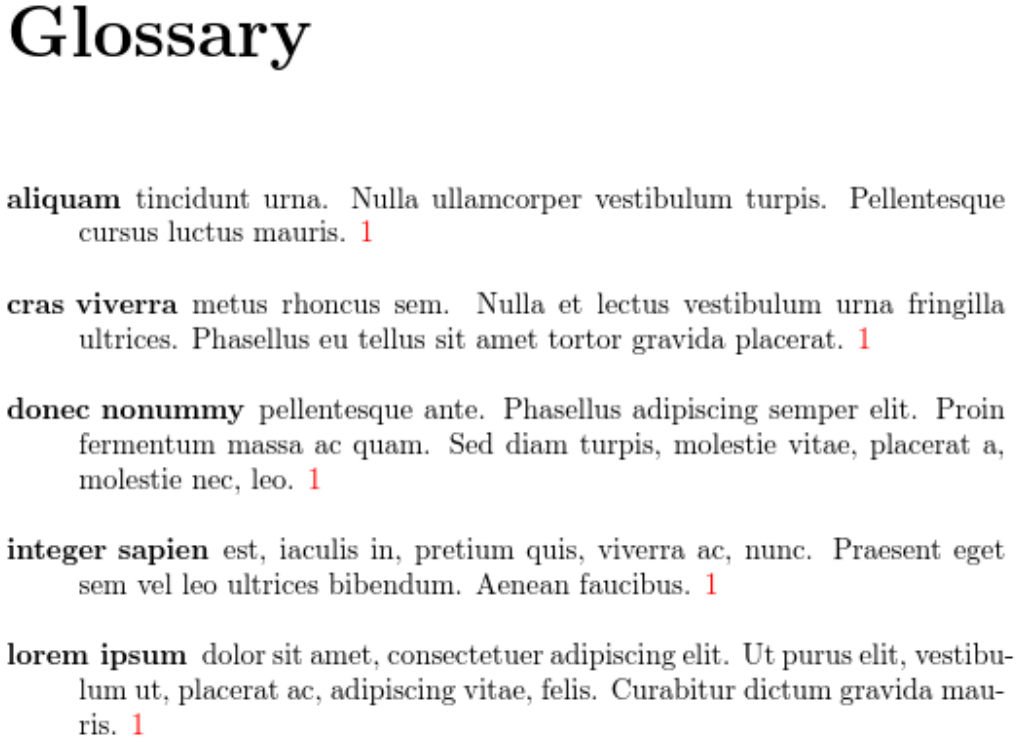
Glossary and Aberrations: 1/2

- Using the **glossaries** package

\usepackage{glossaries}

Needs: \makeglossaries

- Prints the glossarie:
  - **\printglossaries**



Glossary

aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris. 1

cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. 1

donec nonummy pellentesque ante. Phasellus adipiscing semper elit. Proin fermentum massa ac quam. Sed diam turpis, molestie vitae, placerat a, molestie nec, leo. 1

integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. 1

lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. 1

www.texblog.org/2014/01/15/glossary-and-list-of-acronyms-with-latex/

Glossary and Aberrations: 2/2

- Add an entry to the glossary

\newglossaryentry{utc}{name=UTC**, description={**Coordin[…]Time**}}**

- Use in text:
  - **\gls{**utc**}** = Standard command
  - **\Gls{**est**}** = Capitalize first letter
  - **\glspl{**utc**}** = Pluralize term
  - **\Glspl{**adt**}** = Capitalize and pluralize term

Note: Sometimes you need to delete cached files to get the to glossary to update

TASK 2

Heading and footer, design, lists

- Add heading and footers:
  - **Date** in left foot
  - **Page** in right foot
  - Your **name** in left header
  - **Version** in center header
  - **Document name** in right header
  - **Line** under the header and over the footer
- Set style to **Lenny**
- Has a list of: **Contents**, **Tables** and **Figures**
- **Hint:** use fancyhdr and package
- **Hint 2:** Still google it.

TASK 2

Solution

```
\usepackage{fancyhdr}
\pagestyle{fancy}

\fancyhf{}
\fancyhead[L]{Johannes P. Lorentzen}
\fancyhead[C]{Version: 0.1}
\fancyhead[R]{Master Thesis}
\fancyfoot[L]{\today}
\fancyfoot[R]{\thepage}
\renewcommand{\headrulewidth}{.4pt}
\renewcommand{\footrulewidth}{.4pt}

\usepackage[Lenny]{fncychap}

\tableofcontents
\listoftables
\listoffigures
```

Larger projects: 1/3

- Split into multiple files!
  - Document setup
  - Chapters
  - Appendix
  - +++
- Use folders
  - Chapters
  - Frontmatter
  - Figures
- The Main file should be **SMALL**



Larger projects: 2/3

- **\input**
  - Copy & Paste
  - Simple
- **\include**
  - Adds clear page
  - Has **\includeonly**
  - Limited*
- **Subfile** package
  - Run files separately



Larger projects: 3/3

- Adding a path:

. = this folder

.. = One folder up

/ = folder change

- **../ =** parent folder
- **./name/** = in the folder name
- **../../ting/tang/file.tex**
  - Two folders up
  - Then in the **ting** folder
  - Then in the **tang** folder
  - The file **file.tex**

TASK 3

Larger projects

- Make a folder structure
  - A main file in root
  - A docSetup file for the preamble
  - Two chapter files in the chapter folder
- Input the documents into the main file

TASK 3

Solution

- Use \input
- Use the folder system

Creating commands: 1/3

- You can create your own commands

\newcommand{\name}[1]{#1}

- \name = The name of the command
- **[1]** = Number of inputs
- **#1** = first input
  - #2, #3 ……

https://www.sharelatex.com/learn/Defining_your_own_commands

Creating commands: 2/3

```
\newcommand{\periode}{H16}
```



\periode = H16

```
\newcommand{\linje}[2]{\begin{equation} y = #1 + #2x \end{equation}}
```

```
\newcommand{\linje}[2]{
    \begin{equation}
        y = #1 + #2x
    \end{equation}
}
```



\linje{}{}

Creating commands: 3/3

```
\newcommand{\Innstilling}[5]{
    \vbox{
        \noindent \textbf{Referanse:} \tabto{6em}{\periode-#1} \\
        \noindent \textbf{Navn:} \tabto{6em}{#2} \\
        \noindent \textbf{Søker om:} \tabto{6em}{#3},- \\
        \noindent \textbf{Innstilling:} \tabto{6em}{#4},- \\
        \textbf{Begrunnelse:} \\
        #5~\\\vspace{1em}
    }
}
```



\Innstilling{}{}{}{}{}

Renewing commands:

- You can renew commands

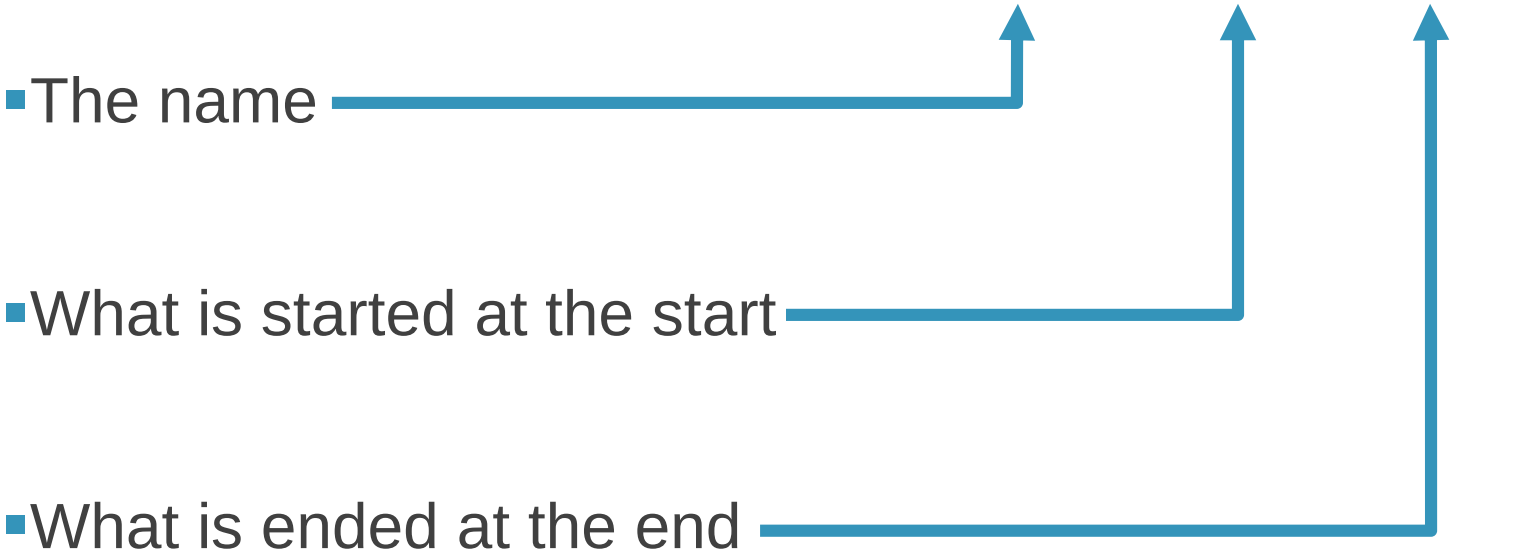
\renewcommand{\name**}{**newcommand**}**

- Useful for:
  - Lengths
  - Dates
  - Headings
  - +++

Creating environments:

- Create your own environments:

\newenvironment{name**}{**start**}{**stop**}**



- The name
- What is started at the start
- What is ended at the end

TASK 4

Commands and environments

- Create a function that:
  - Makes an equation environment
  - And makes the label for the equation

- Create an environment that does:
  - Centres the text
  - Makes the text bold
  - Makes the text large

TASK 4

Solution

```
\newcommand{\likning}[2]{
    \begin{equation} \label{eq:#2}
    #1
    \end{equation}
}


\newenvironment{stor}{
    \begin{center}
    \bfseries
    \large
    \bfseries
}{
    \end{center}
}
```

Code:

- Using the **listings** package
- Input code directly:

\begin{lstlisting}[language=Python**]**

[your code]

\end{lstlisting}

- Input code from file:

\lstinputlisting[language=Matlab**]{**file.m**}**

```
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
```

https://www.sharelatex.com/learn/Code_listing
https://en.wikibooks.org/wiki/LaTeX/Source_Code_Listings

Algorithms:

- Combination of two packages:
  - \usepackage{**algorithm**}
  - \usepackage{**algpseudocode**}

```
\begin{algorithm}
    \caption{text}
    \label{alg:name}
    \begin{algorithmic}[1]
        [your pseudocode]
    \end{algorithmic}
\end{algorithm}
```

Algorithm 2 Z(σ_a) from Ice Core

```
1:  procedure Z(σ_a)
2:      Input Core information [T(Z), S(Z) and Z]
3:      Calculate σ(Z)
4:      for (Z_tot = 0, 1...5m) do
5:          σ(Z) = flatIceScaling
6:          RunMarcoAir
7:          Calculate σ_a
8:      end for
9:      fit σ_a(Z_tot)
10:     invert σ_a(Z_tot) → Z_tot(σ_a)
11:     return D_n
12: end procedure
```

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

TASK 5

Code

- Add the following code to the document using the listings package:

ExampleCode.pippidis.no

- Hint: Use **listings**

TASK 5

Solution

\usepackage{**listings**}

\lstinputlisting[language=Matlab]{Code_example.m}

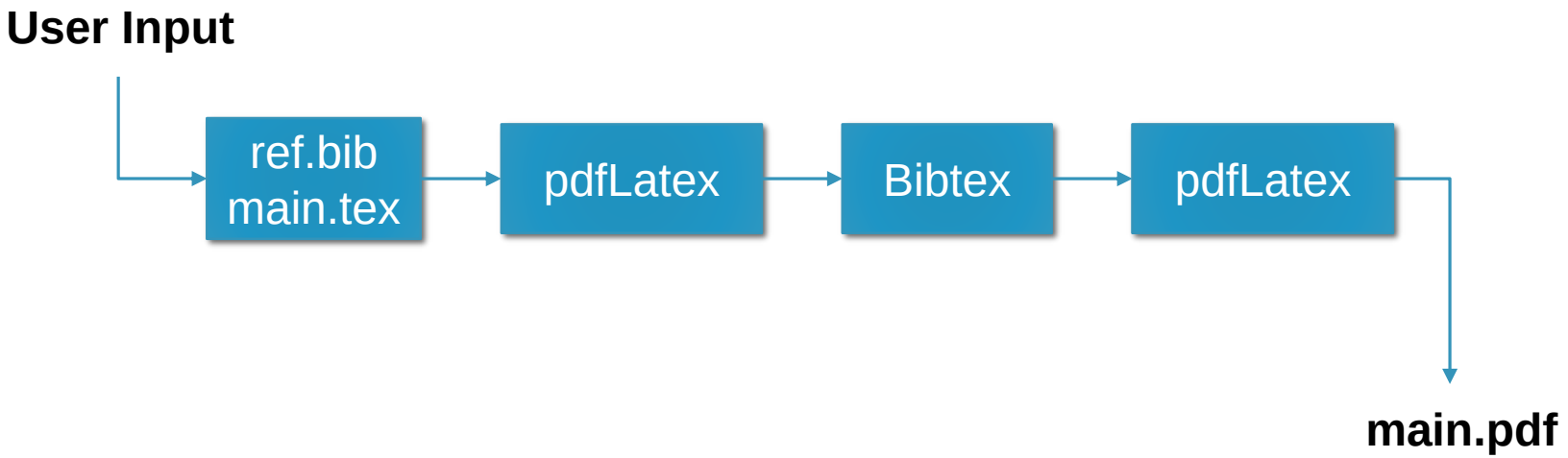
Citation: 1/5

- Different versions:
  - Bibtex
  - Natbib
  - Biblatex
- Uses a .bib file
  - @ = entry
  - Different kinds of entry
- **\cite{**label**}**

\bibliographystyle{**[Citation style]**}

\bibliography{**[Name of reference file]**}

Citation: 2/5


User Input
ref.bib
main.tex
pdfLatex
Bibtex
pdfLatex
main.pdf

Citation: 3/5

- Consists of:
  - Type of entry
  - Label
  - Title
  - Name of author
  - Year
  - ect

```
@article{label1990,
    author = {Peter Adams},
    title = {The title of the work},
    journal = {The name of the journal},
    year = 1993,
    number = 2,
    pages = {201-213},
    month = 7,
    note = {An optional note},
    volume = 4
}
```

Citation: 4/5

- Good labeling convention is important

Not: “Boka” or “textbook” or “Denbokasomjegik…”

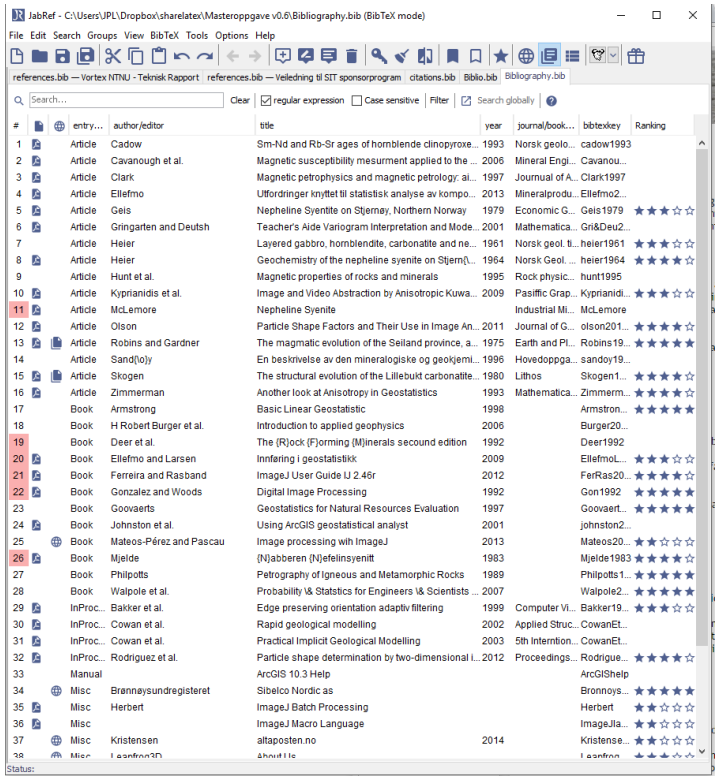
Do: “Normann2015” or “Normann2015cake”

Convention:

[last name of principle author][year][keyword]

Citation: 5/5

- Citation management is important
  - Almost impossible when more than 20 references
- **JabRef** is a good alternative
  - http://www.jabref.org/
  - Simple
  - Uses the .bib file
  - Good with LaTeX



Matlab figures: 1/3

- Use **.eps** – Not .jpg
  - Vector format
- Might need to trim the figure
  - trim={1cm 0.7cm 1cm 0.7cm},clip
- Script **EVERYTHING!**
  - A master script is nice

```
PlottingTemp()       % Plotting the temprature
PlottingSalinity()   % Plotting the Salinity
PlottingCond()       % Plotting the Conductivity

% Calculating the C, D and RMS from the level ice fit.
[C, D, RMS] = Calc_Haas_Cooeficents()


% The EM31-Walkabout
[ em31, gps] = EM_import();
EM_interpol(em31, gps)

% Plotting the rigde thickness:
PlotRigdeThickness();

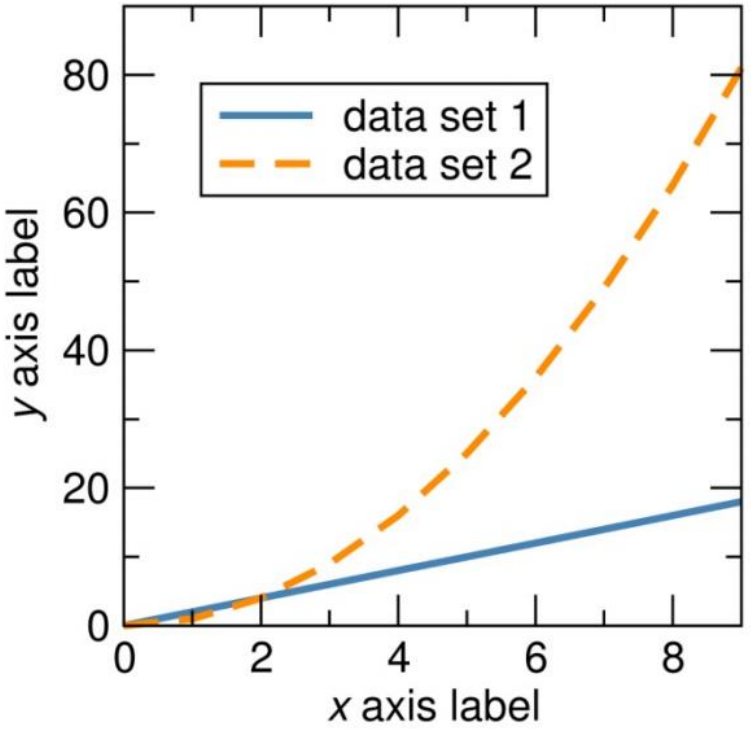
% Plotting the section in Sveabukta
PlottingSveaSection();
PlottingSveaSection_EM31();


% Plotting the Coefficients:
Calc_Haas_Cooeficents__Plot()

```

Matlab figures: 2/3

- General figure advice:
  - No gridlines
  - Do not cluster
  - People print in black and white
    - Do not use colour as the only separation
  - Don’t mix **Red** and **Green**
  - Not to many ticks on the axis
  - Have a good and descriptive caption
  - Have units on axis



http://flyingv.ucsd.edu/azad/Matlab_LaTeX_Figures.pdf

https://www.mrl.ucsb.edu/~seshadri/PreparingFigures.pdf

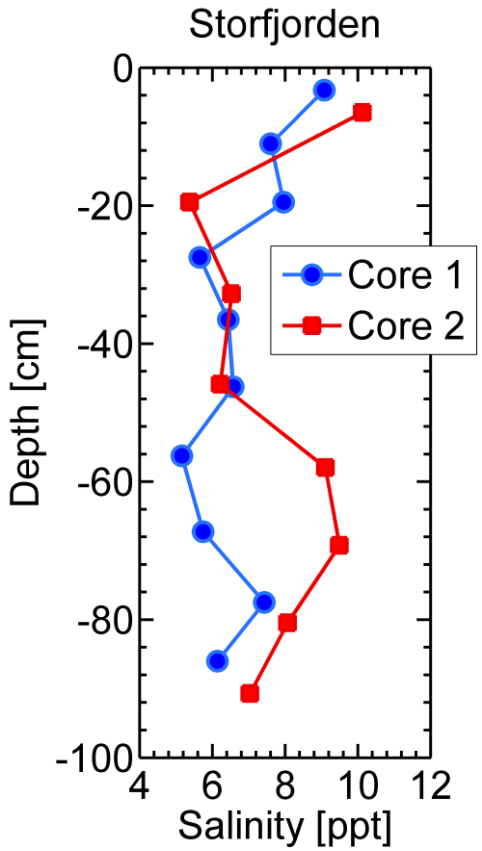
http://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1003833

Matlab figures: 3/3

- Use **PlotPub**
  - Functions to make plotting better
  - Gives better control of the figures

```
opt.XTick = [-12,-8,-4, 0]; %[tick1, tick2, .. ]
opt.XLim = [-12, 0]; % [min, max]
opt.Resolution = 600;
opt.BoxDim = [2, 5];
opt.Markers = {'o','s'};
opt.LineWidth = [2, 2];
```

- Use the **print** function
  - print('BarPlot','-depsc')



http://masumhabib.com/projects/publication-quality-graphs-matlab/

Templates:

- No template for everything
- Use them for inspiration
- Many different practises
- They evolve

- Know what you are looking for

Look at my Template

MASTER.PIPPIDIS.NO

Links:

- Slides and all information on:

pippidis.no

➔ LaTeX folder