BACHELOROPPGAVE

Development of Makerspace Management System
Group BO17-G14
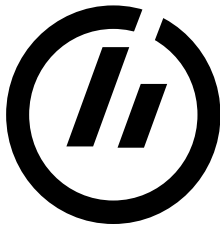
Nicolai Naglestad
Thomas Begby
Espen Ottar Skjeggestad

16.02.2017 (husk å oppdatere)

HØGSKOLEN I ØSTFOLD

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BACHELOROPPGAVE

Prosjektkategori:		X	Fritt tilgjengelig
Kategorien her			
Omfang i studiepoeng:		(30/12 2029)	Fritt tilgjengelig etter
20			
Fagområde:		(X)	Tilgjengelig etter avtale med oppdragsgiver
Fagområdet her			

Tittel:	Dato:
LaTeX mal for bacheloroppgaven	March 11, 2017
Forfattere:	Veileder:
Gunnar Misund	Børre Stenseth
Avdeling / Program:	Gruppenummer:
Avdeling for Informasjonsteknologi (alle programmer)	BO17-G14
Oppdragsgiver:	Kontaktperson hos oppdragsgiver:
HiØ/IT	Monica Kristiansen

Ekstrakt:
Det har vært en økende vektlegging på dokumentasjonen i bacheloroppgavene ved HiØ, slik at hoveddokumentet nå er grunnlaget for karaktersettingen. Formålet med dette prosjektet er å gjøre det enklere for studentene å produsere dokumentasjon med hensiktsmessig innhold, tradisjonell struktur, og profesjonell utforming. Rapporten starter med å redegjøre for generelle krav til vitenskapelige og tekniske rapporter. Det blir lagt spesielt vekt på kravene som stilles ved HiØ. Det gies en kort oversikt over hvordan man produserer og vedlikeholder dokumenter, både analoge og digitale. Deretter blir det utformet en mal som angir struktur og innhold i hoved-dokumentet. Etter en ha utviklet en sett med minimumskrav til programvarene som skal brukes, blir det klart at kun to verktøy er aktuelle: LaTeX og *OpenOffice Writer*. En selvforklarende mal blir implementert i dokumentverktøyet LaTeX (en mer eller mindre identisk mal for OpenOffice er beskrevet i prosjektet *OpenOffice mal for bacheloroppgaven*).

3 emneord:	Foo
	Bar
	FooBar

Forord[1]

Dette er en mal beregnet til bruk i Bacheloroppgaven ved HiØ/IT. Malen gir en pekepinn om både struktur og innhold, og hvordan ting kan løses rent skriveteknisk, typisk ved å klippe og lime.

Malen er utformet som dokumentasjon på et fiktivt prosjekt, der formålet er å gjøre det lettere og enklere å dokumentere en bacheloropppgave (og liknende prosjekter). De fleste kapitler er innledet med generelle retningslinjer for hva som skal med (dette er uthevet i grått).

Det er tenkt at malen skal kunne brukes i alle de ulike prosjekttypene: utvikling, utredning og medieproduksjon. Dermed er mange overskrifter generiske, og må selvfølgelig tilpasses de enkelte prosjektene. Det kan også være aktuelt å slå sammen enkelte deler av malen, eller legge til kapitler.

Det er ikke obligatorisk å bruke malen.

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[1]Dette forordet skal som du skjønner ikke med i det endelige dokumentet ☺

Sammendrag

Sammedraget er hele rapporten komprimert til max 1 side. Sammendraget skal gi leseren et godt og tilnærmet komplett bilde av innholdet i dokumentet. Akademiske sammendrag kalles på engelsk for "Abstract", og i mer kommersielle sammenhenger heter det gjerne "Executive Summary". I det siste tilfelle har sammendraget som hensikt å gi ledelsen i en bedrift nok informasjon til å ta økonomiske og/eller administrative avgjørelser. . . uten å lese hele rapporten (!). Tradisjonelt blir sammendraget formattert som et sammenhengende avsnitt. I et bachelorprosjekt, vil hovedformålet være å gi leseren (kanskje i første rekke sensor?) et informativt (og appetittvekkende) bilde av prosjektet. Det er ikke vanlig å bruke litteratur- eller kryssreferanser i sammendraget. Som en regel kan vi si at alt som står i sammendraget, kan det leses mer om i rapporten. Dermed blir utfordringen å belyse alle viktige hovedpunkter, kort og presist. For denne rapporten, kan det f.eks. bli som dette:

De nye retningslinjene for evaluering av bacheloroppgaver ved Høgskolen i Østfold/IT legger større vekt på hoveddokumentet enn før. Denne rapporten er resultatet av et prosjekt der formålet var å gi studentene en mulighet for å forenkle og forbedre dokumentproduksjonen. Rapporten er en selvforklarende mal som tar for seg innhold, struktur og layout av hoveddookumentet i bacheloroppgaven. I tillegg er den et konkret eksempel på hvordan man kan bruke LaTeX som dokumentverktøy. Dokumentet er en mal, dvs. et stilsett som brukes for å gi dokumentet ønsket layout. Det blir gitt eksempler på de viktigste teknikkene, slik som bruk av kryssreferanser, kildereferanser, figurer og tabeller, og eksempler på formattering av spesielle elementer, som lister, sitater, definisjoner og matematiske uttrykk. I de tilfellene eksemplene ikke er selvforklarende, blir det gitt råd om hvordan man skal få det til. Intensjonen er at malen kan brukes for alle de tre hovertypene av bachelorprosjekter ved HiØ/IT: Utredninger, mediaproduksjoner, og utvikling av programvare, maskinvare eller systemer. Der det er naturlig å differensiere innholdet i de enkelte kapitlene, blir det skissert mulige løsninger for alle typene prosjekt. Formgivingen er enkel, oversiktlig og tradisjonell. Utgangspunktet for strukturen er den generiske oppbyggingen av et teknisk-vitenskapelig dokument, slik det er beskrevet i *Mayfield Handbook of Technical & Scientific Writing*. Innholdet i denne rapporten er en (kanskje forvirrende) blanding av generiske retningslinjer og konkret eksemplifisering relatert til prosjektet med å utvikle malen.

Takk Til

Det er vanlig, men ikke nødvendig, å nevne personer og miljøer som har hatt en positiv betydning for prosjektet, f.eks. på denne måten:

Jeg ønsker å takke gode kolleger ved Høgskolen i Østfold, Universitet i Oslo, og Høgskolen i Oslo og Akershus for interessante og fruktbare diskusjoner om utforming, gjennomføring og evaluering av bachelor- og masterprosjekter. I tillegg retter jeg en varm takk til pansermallene Ole, Dole og Doffen for uvurderlig støtte under arbeidet med prosjektet.

Innhold

List of Figures

List of Tables

Kodeliste

Chapter 1

Introduction

Det som er markert med grått, er forklaringer på hva de enkelte delene av rapportene skal inneholde, og som er det minimum leseren bør skumme gjennom før malen taes i bruk. Det som ikke er markert med grått, er eksempeltekst som kunne tenkes brukt i et fiktivt prosjekt der formålet er å utarbeide en mal for hoveddokumentet i en bacheloroppgave ved HiØ/IT. Introduksjonen skal gi leseren et bilde av rammene rundt prosjektet, prosjektets formål, metoder og leveranser. Den bør også inneholde en oversikt over resten av dokumentet[1]. Husk at kapitler, sections etc. bør ha et par setninger med "innledning" før man starter på neste undernivå.

1.1 The Group

Det er vanlig å starte med å presentere prosjektgruppen, litt om hver enkelt av deltagerne, deres kompetanse og interesser, og litt om hvordan dere har kommet sammen, f.eks. om dere har jobbet sammen i andre fag.

The group consist of 4 third year students. 1 informatics 2 digital media production and 1 information-systems. Most of the group have worked with each other on multiple occasions. Be it in student organisation or school projects. 3 member of the group also share apartment. All member have a high interest in the project where they themselves have spent much time.

1.1.1 Thomas Magelssen Bergby

A student who has been interested in everything regarding IT and technology since he was a kid. Thomas has been a leader for "Lær Kidsa Koding" (A group of students who teach coding for kids) and a leader for student assistants in web-development and JavaScript courses.

Thomas studies Informatics, and has gained skills within JavaScript, Java, PHP, CSS, Linux and Python. During his studies, he has taken courses like

- Algorithms and data-structures

- Software Engineering

- Object Oriented Programming

- Android Programming

He also enjoys traveling, and hopes to eventually get a job in the United Kingdom or USA.

1.1.2   Nicolai Naglestad

Studied International Baccalaureate at Skagerak International School in Sandefjord. Nicolai has an above average interest in technology and is always looking for something new to learn. Beside his studies he works as a student assistant in the subjects introduction to programming, web development, object-oriented programming and lastly he works at the schools MakerSpace where the latter is a position where he helps students get started on projects and with the use of the 3D printers. Nicolai has great interest with most aspects the are to be found inside the MakerSpace and you will find him there mosty of the time.

Nicolai studies digital media production at Østfold University College, but has taken subjects such as OOP, Software Engineering and .NET. He also enjoys learning new systems and languages.

1.1.3   Espen Ottar Skjeggestad

He has a broad field of interest, but the main one is IT and Biology. He is an active person that likes jogging, training, diving and trips. He is also politically active in the student politics and has roles as elected representative for the class, member of the student counsel and member of the executive committee for the student-democracy. He is currently a student vara-member of the University College Board. In work roles he was a student assistant for GRIT and is now working at the school library.

Espen studies Information Systems with focus on IT and code, but also includes business leadership and classes about economy.

1.1.4   Simon Chen Dybvik

Simon has been interested in technology his whole life. As a curious child, he often disassembled products to see what's inside and how it worked. He is over average interested in Apple and their products. During his studies at Østfold University College he has exchanged a semester abroad to California State University, Monterey Bay, where he focused on web development using CMS, JavaScript, jQuery, HTML and CSS, and graphic design. He is former vice-president of NITO Studentene Halden. NITO is a union for engineers and technologists.

Simon studies Information Systems with emphasis in web development. He has taken courses like project management, marketing, business economics and graphic design.

1.2   Employer

Beskriv oppdragsgiver, både firma og kontaktpersoner.

The employer for this project is MakerSpace (MS) which is a room located in Østfold University College (HiØ). The MakerSpace is a playroom for creating all types of technology, everything from electronics and robotics, to programming and 3D-printing. The room is currently funded and managed by the IT department.

Here, students and lecturers can use the rooms equipment to experiment with technology to further educate themselves within topics that they find interesting, and that are not necessarily related to any ongoing subject at the university college. The space is open for all students and staff

of the university college, but is mainly used by the IT department.

The employers for this project are Staff Engineer Espen Teigen and University College Teacher Michael Andersen Lundsveen.

1.3 Task

Forklar hva slags problem oppdragsgiver ønsker å løse, og hvordan det er tenkt gjort. Dette skal ikke være en inngående analyse, men en utvidet og oppdatert versjon av det som opprinnelig fantes i prosjektbeskrivelsen, f.eks. slik:

The task of this project is to develop an inventory- and loan-system for Østold University College's MakerSpace. The purpose of this is to make it easier for employees at MakerSpace to keep track of inventory at all times. A full inventory-system will help both students and staff to find equipment when a student assistant or department Engineer is not available. The system should preferably be able to know where equipment is in MakerSpace at any time. Simultaneously the employers of this project want to have a system for users of the MakerSpace to be able to loan out the equipment in the MakerSpace.

1.3.1 Purpose

The purpose of this system we are creating is to make maintaining the MakerSpace easier for all parties, but mainly for the University College employees of the MakerSpace. This means that less time is used for maintaining inventory, and helping to find different equipment. It also benefits the school in saving money, as the student assistants don't need to be used as often. They currently help with mundane tasks like finding equipment and counting inventory, and decide what needs to be ordered to fill up stocks.

1.3.2 Project delivery / Prototype

This group aims to supply the employer a website (front-end) and server (back-end) that is both user tested, and to the employers and users specification.

The website will support the following features:

- View all items (Name, Location, Description, Amount in stock)

- Create/Update/Delete items (CRUD)

- Register/Modify/Delete/View users

- User registration either via custom system or via OAuth 2.0

- The ability to loan set items defined by admins (list editable)

- See currently loaned items (all items or based on user)

Additionally to this there will be a REST API based on Node.js and MongoDB to provide a system for storing the information for the website and possible future apps or other systems.

Documentation

Each separate prototype/system will also include full documentation on how the system is to be used and in the case of the REST API, how it can be used in other systems. This documentation will be hosted on the same location as where the code is stored (GitHub). As with our main project page the document will be a web page generated by Jekyll hosted by GitHub Pages.

1.3.3   Method

We will be using the incremental method for development of the system. This method focuses on development piece by piece and works really well for modular systems. It also works for quantitative and qualitative testing of the parts that are done. These parts can also be used, and delivered to the employer.

The method is that you work on one piece of the system at a time. E.g you make the database-system first, and finish it. You can then move on to the next part.

This method has a lower risk of total failure and no delivery, because of the fact that is made up by working pieces.

1.4   Report structure

Det er vanlig å avslutte innledningen med en oversikt over resten av rapporten, f.eks. slik som dette:

In chapter analyse will we go through what how the Østold university college define the task. How the discussion with employer and consoler changed the development direction. After that we will look at how different sites solved the issue. We will also look at the theory on development of item organisation sites and the tools we need to use, and why we choose to use these tools. We will present our design choices in the design chapter, and will show our implementation prosses in the Implementation chapter. The evaluation of the system will be addressed in the evaluation chapter, and the report win end with a conclusion chapter

Chapter 2

Analysis

2.1 Program tools

2.1.1 MongoDB

(add informastion here on why we use node.js)

2.1.2 Node.js

(add informastion here on why we use node.js)

2.1.3 Git

We use git as version control

2.1.4 Latex

Latex for documentation

Chapter 3

Design

DB model
    classe modell?
    site map?

Chapter 4

Evaluation

Chapter 5

Discussion

Chapter 6

Conclusion

Bibliography

[1] David H Douglas and Thomas K Peucker. Algorithms for the reduction of the number of points required to represent a digitized line or its caricature. *Cartographica: The International Journal for Geographic Information and Geovisualization*, 10(2):112–122, 1973.

[2] Linda Cecilie Kjeldsen. Combining Orthogonal Range Search and Line Simplification Using Priority Search Trees. Master's thesis, Østfold University College, School of Computer Sciences, Halden, Norway, 2005.

[3] Leslie Lamport. *LATEX : A Document Preparation System: User's Guide And Reference Manual*. Addison-Wesley Pub. Co., Reading, Mass., 1994.

[4] Leslie Perelman and Edward Barrett. *The Mayfield Handbook of Technical and Scientific Writing*. McGraw-Hill, Inc., New York, NY, USA, 1. edition, 1997.

Appendix A

How to use this template

Here we briefly explain how to use this template. The template is designed to be rather self-explanatory, and all of the features you need are present somewhere in the source code, so you will come a long way by cutting and pasting.

It is assumed that the user has (or provides herself with) basic knowledge of LaTeX. There are numerous good tutorials online[1], but we warmly recommend the original documentation: "LaTeX: A Document Preparation System" (Figure A.1) [3]. LaTeX is basically a collection of macros written in TeX. This system, which is a low level tool for digital typesetting, is known for producing scientific documents of unprecedented quality. It was developed by Donald Knuth, one of the giants of computer science.
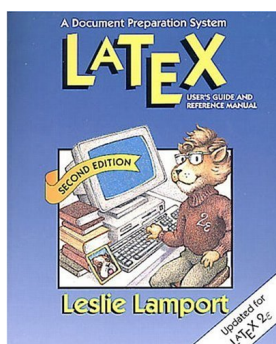
Figure A.1: The LaTeX "bible", 2. edition

There are plenty of good LaTeX editors, and of course, there are many possibilities for the Emacs users[2]. Personally, I use *texmaker*[3] for OSX, and *Kile*[4] for Ubuntu (and *WinEDT*[5] for MS, before I abandonded that platform for good).

---

[1] `latex-project.org` is a good starting point
[2] `www.gnu.org/software/emacs`
[3] `www.xm1math.net/texmaker/`
[4] `kile.sourceforge.net`
[5] `www.winedt.com`

A.1   Compilation

Making documents with LATEX is basically like writing software. This document is produced by compiling a collection of files, all in the same folder. There is a top level file called `main.tex`, which contains all commands that decide the format, layout etc., or in other words, the *style*[6]. It also includes the files containing the actual text (in general one file for each chapter).

To compile the document to produce a pdf file, use your terminal/command window (or use the build function in your editor), go to the document folder, and issue this command twice:

```
pdflatex main
```

This process produces a pdf file, `main.pdf`. When printing the document, remember to select the double page option.

However, as you may have experienced when compiling source code, there might be syntax errors, missing files etc. to be fixed. LATEX is quite verbose when compiling, and does a lot of complaining (warnings), which you most often can ignore. However, it can be a bit tricky to find the source for an error. You sholud typically search backwards from the end of the compilation output. Listing A.1 is an example from compiling this document, where the error is misspelling of the LATEX macro (should be `\LaTeX`, not `\LateX`). The key error message is `! Undefined control sequence`, followed by a quotation of the line where the error has occurred, along with the line number. The name of current file is found a couple of lines above: `(./how-to.tex.`

Kode A.1: LATEX error output

```
...

Overfull \hbox (6.0pt too wide) in paragraph at lines 43--44
[][][][][][][]

Underfull \hbox (badness 10000) in paragraph at lines 43--44

) (./conclusion.tex [20]
Chapter 7.
[21]) (./main.bbl [22]) [23] [24]
No file main.ind.
(./how-to.tex
Appendix A.
[25]
! Undefined control sequence.
l.48 misspelling of the  \LateX
                          \  macro (should be \verb|\La...

?
}
```

A.2   Chapters/sections/paragraphs

LATEX lets you break the document down into chapters, sections, subsections, subsubsections and paragraphs. By default subsubsections and paragraphs are not numbered or included in the table of contents.

---

[6]Think of HTML and stylesheets ... guess where that idea came from ...

A *chapters* may contain plain text, elements like figures and tables, and *sections*. Plain text is commonly structured by *paragraphs*. Paragraphs are separated by one or more *empty lines*[7]. A section may contain *subsections*, and the next level is *subsubsection*. Finally we have a special type of *paragraph*.

Below follows examples of all these constructs.

A.3   Section

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A.3.1   Sub section

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[7]Correspondingly, when there are two or more consecutive whitespaces in the text, these will be ignored

Sub sub section

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Paragraph This is a titled paragraph. Please note the difference between the standard paragraphs produced by blank lines, and this type, which is the lowest level of elements with titles.

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A.4   Figures, tables, equations, etc.

Please see the source code (`how-to.tex`) for details on the implementation of these elements.

In general, figures and tables shall be numbered, and have a caption. Figures and tables *must* be referenced to at least once in the text. Equations and similar elements should also be numbered, but they are not always referred to.

Figures, tables, equations, and similar constructs are so-called *floats*. This means that LATEX will place them in a position that is "best", taking many aspects into consideration. The result is that the elements may not be positioned exactly where the writer wants (in particular when you have many floats near each other, like in text you are reading now), and this is in my experience very frustrating for the novice user . . . see Section A.11.

Figure A.2: Input and result from running the Douglas-Peucker line simplification algorithm [1] (from [2])

Figures are most often produced from files on common graphics formats (like pdf, png, jpg, etc). You can use a single image file, as in Figure A.1, or you can combine several images, see Figure A.2, consisting of Figures **??** and **??**.

Mastering tables has a relatively steep learning curve. Still, simple tables, like Table A.1, are relatively easy to make. A more complex example is demonstrated in Table A.2.

Table A.1: Simple table

Combination	Included Optional Steps			
	1	2	3	4
1	X			
13			X	X
14				X
15	Nano Particles Deposited, Not Sintered			
16	Only Grinded Wafer 1, No Particles Deposited, Not Sintered			
17	Only Grinded Wafer 2, No Particles Deposited, Not Sintered			

Table A.2: Complex table

Within mathematics and natural sciences there is a common belief that LaTeX is unrivaled when it comes to typesetting formulas, equations, and complex specialized notation, as the following examples demonstrate.

You can have inline equations, like this: $\alpha = \beta\gamma\delta$, or you can formulate them as numbered floats, as in Equation A.1.

$$\alpha = \beta\gamma\delta \tag{A.1}$$

Equation A.2 is a bit more complicated:

$$I_{zz} = \int_{-b/2}^{b/2} \int_{-h/2}^{h/2} y^2 \, dy \, dx = \frac{bh^3}{12} \tag{A.2}$$

There are loads of special characters, like $\approx$, $\pm$, $\times$, $\div$, $\propto$, $\leq$, $\geq$, $\ll$, $\gg$, $\neq$, ∇, $\Re$, $\Im$, $\flat$, $\sharp$, ∂, ∞, and $\heartsuit$.

Here is a chemistry related example:
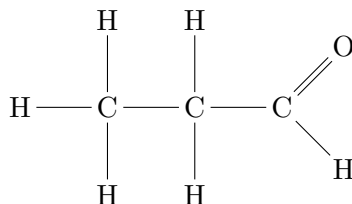
See the next section for a complete example of a mathematical proof.

A.5 Proof of the area of a circle formula $A = \pi r^2$

Theorem 1 *The area of circle with radius r is πr^2.*

Proof: The equation of a circle centered at the origin is

$$x^2 + y^2 = r^2,$$

where r is the radius. We write y in terms of the variable x and the constant r:

$$\frac{x^2}{r^2} + \frac{y^2}{r^2} = 1$$

$$\frac{y}{r} = \sqrt{1 - \frac{x^2}{r^2}}$$

$$y = r\sqrt{1 - \frac{x^2}{r^2}}$$

By symmetry, the area of a circle centered at the origin is four times the area of the circle between $(0,0)$ and $(r,0)$ above the x-axis. We can integrate to find the area (A):

$$A = 4r \int_0^r \sqrt{1 - \frac{x^2}{r^2}}\, dx$$

To evaluate the antiderivative of $\sqrt{1 - \frac{x^2}{r^2}}$, we make the substitutions:

$$x = r\sin\theta$$

$$\theta = \arcsin\frac{x}{r}$$

$$dx = r\cos\theta\, d\theta$$

Thus, our integral becomes:

$$A = 4r \int_0^r \sqrt{1 - \frac{x^2}{r^2}}\, dx = 4r \int_0^{\pi/2} r\sqrt{1 - \sin^2\theta}\cos\theta\, d\theta$$

We can use the trigonometric identity $1 - \sin^2\theta = \cos^2\theta$:

$$A = 4r \int_0^{\pi/2} r\sqrt{1 - \sin^2\theta}\cos\theta\, d\theta = 4r^2 \int_0^{\pi/2} \cos^2\theta\, d\theta$$

We then apply $\cos^2\theta = \frac{1}{2}(1 + \cos 2\theta)$:

$$
\begin{aligned}
4r^2 \int_0^{\pi/2} \cos^2\theta\, d\theta &= 4r^2 \int_0^{\pi/2} \frac{1}{2}(1 + \cos 2\theta)\, d\theta \\
&= 2r^2\theta \Big|_0^{\pi/2} + 2r^2 \int_0^{\pi/2} \cos 2\theta\, d\theta \\
&= \pi r^2 + 2r^2(\sin 2\theta)\Big|_0^{\pi/2} \\
&= \pi r^2
\end{aligned}
$$

Thus, the area of a circle with radius r is πr^2. ∎

A.6   Listings and other *environments*

You can apply specialized layout by using *environments*. Environments are constructed like this:

```
\begin{some-environment}
The text and other contents goes here
\end{some-environment}
```

The most common environments are the following three different list types[8]. First, the bullet list:

- First item
- Second item
- Third item

Then, the enumerated list:

1. First item
2. Second item
3. Third item

And finally the decription list:

First item First description Fusce mauris. Vestibulum luctus nibh at lectus. Sed bibendum, nulla a faucibus semper, leo velit ultricies tellus, ac venenatis arcu wisi vel nisl. Vestibulum diam. Aliquam pellentesque, augue quis sagittis posuere, turpis lacus congue quam, in hendrerit risus eros eget felis. Maecenas eget erat in sapien mattis porttitor. Vestibulum porttitor. Nulla facilisi. Sed a turpis eu lacus commodo facilisis. Morbi fringilla, wisi in dignissim interdum, justo lectus sagittis dui, et vehicula libero dui cursus dui. Mauris tempor ligula sed lacus. Duis cursus enim ut augue. Cras ac magna. Cras nulla. Nulla egestas. Curabitur a leo. Quisque egestas wisi eget nunc. Nam feugiat lacus vel est. Curabitur consectetuer.

Second item Second description

Third item Third description

Needless to say, as anything else in LATEX, these lists can be customized to your liking.

A.7   Source code

Large chunks of code should be placed in an appendix, but smaller pieces can be listed in the main part. We here demonstrate two ways of doing this.

In Listing A.2 we have included code from a separate file.

In Listing A.3 we have copied and pasted from the same file:

A.8   Cross-references and bibliography

As mentioned earlier, all non-text elements should be numbered, and should be referenced to at least once in the text. This is what is called *cross-referencing*, and is easily accomplished. First we need to attach a label to the element: `\label{type:name}`. Then we use this label in the reference: `\ref{type:name}`. The reference is only a number, so we usually add the element type as a capitalized prefix, for instance like his: `Figure \ref{fig:lamport}}`, which produces: Figure A.1.

---

[8]Here we are using compact versions of the standard lists, which tend to produce to much "air"

Kode A.2: Recursive solution of Towers in Hanoi

```
/* ***********************************************************************
 *  Compilation:   javac Hanoi.java
 *  Execution:     java Hanoi N
 *
 *  Solves the Towers of Hanoi problem on N discs. The discs are labeled
 *  in increasing order of size from 1 to N and the poles are labeled
 *  A, B, and C.
 *
 *********************************************************************** */

public class Hanoi {

    // move n smallest discs from one pole to another, using the temp pole
    public static void hanoi(int n, String from, String temp, String to) {
        if (n == 0) return;
        hanoi(n-1, from, to, temp);
        System.out.println("Move disc " + n + " from " + from + " to " + to);
        hanoi(n-1, temp, from, to);
    }

    public static void main(String[] args) {
        int N = Integer.parseInt(args[0]);
        hanoi(N, "A", "B", "C");
    }
}
```

Kode A.3: Core of the recursive solution of Towers in Hanoi

```
// move n smallest discs from one pole to another, using the temp pole
public static void hanoi(int n, String from, String temp, String to) {
    if (n == 0) return;
    hanoi(n-1, from, to, temp);
    System.out.println("Move disc " + n + " from " + from + " to " + to);
    hanoi(n-1, temp, from, to);
}
```

When you need a reference to an item in your bibliography (books, articles, web sites etc), you need to use one or more "database" files, which are plain texts files with bibliography items formatted according to certain rules. These files have the extension `.bib`, and must be included in the main file. An example of a correctly formatted bibliography item is found in A.4.

Kode A.4: BibTex entry

```
@book{perelman97mht,
author = {Perelman, Leslie and Barrett, Edward},
title = {{The Mayfield Handbook of Technical and Scientific Writing}},
year = {1997},
edition = {1},
publisher = {McGraw-Hill, Inc.},
address = {New York, NY, USA},
}
```

This format is called *bibtex*, and all the academic search engines, including *Google Scholar*, exports to this format. When referencing, you use this command: `\cite{perelman97mht}` and you get: [4].

To include a newline added reference, you run the following sequence:

```
pdflatex main
bibtex main
pdflatex main
```

Bibtex generates the final bibliography only from the references in the document (and not from all the items in the `.bib` files).

The different scientific communities have their own guidelines for how to format the entries in the bibliography, and how to format the references in the document. You decide which style to use with the command `\bibliographystyle{somestyle}` in the main file.

There are several tools for creating and maintaining bibliography databases that export bibtex files, both standalone programs, plugins to editors and browsers, and cloud based services[9].

A.9 Index

You may also make an index page. For instance, in this chapter, every time the word LaTeX occurs, I have put the command `\index{LaTeX}` close to the occurrence. The index page is produced by including `\printindex` in the main file, and running the following sequence:

```
pdflatex main
makeindex main
pdflatex main
```

The result is an entry on the index page, something like this: "LaTeX, 27, 28, 30, 31, 35".

A.10 Fonts

Fore every LaTeX distribution, there is a default set of fonts. It is possible to customize this setup. Don't[10].

---

[9]For instance, check out `zotero.org`

[10]It's by all means possible, but if you get this urge, you most likely suffer from a stroke of extreme procrastination ... ah ... well, then, check out the very last part of the preamble (that is everything before `begindocument` in the main file).

You can do it locally like this (but use it with extreme care):

Etiam pede massa, dapibus vitae, rhoncus in, placerat posuere, odio. Vestibulum luctus commodo lacus. Morbi lacus dui, tempor sed, euismod eget, condimentum at, tortor. Phasellus aliquet odio ac lacus tempor faucibus. Praesent sed sem. Praesent iaculis. Cras rhoncus tellus sed justo ullamcorper sagittis. Donec quis orci. Sed ut tortor quis tellus euismod tincidunt. Suspendisse congue nisl eu elit. Aliquam tortor diam, tempus id, tristique eget, sodales vel, nulla. Praesent tellus mi, condimentum sed, viverra at, consectetuer quis, lectus. In auctor vehicula orci. Sed pede sapien, euismod in, suscipit in, pharetra placerat, metus. Vivamus commodo dui non odio. Donec et felis.

However, size, weight, style and font family may be manipulated using the following standard commands.

Font size   First of all, you decide in the preamble the default font size for your document. The `documentclass` takes the parameters `10pt`, `11pt`, or `12pt`. Locally, you can change the style by the following commands, that resizes the font *relatively* to the default size:

_{tiny}

scriptsize

footnotesize

small

Default: normalsize

large

Large

LARGE

huge

Huge

Font weight (Font series)   You can locally change the font weight:

Default: Medium

Bold

Font style (Font shape)   You can locally change the font style:

Default: Normal (Upright/Roman)

Italic

Slanted

Small caps

Font family   You can locally change the font family:

Default: Roman (serif)

Sans serif

`Typewriter (monospace)`

A.11   Best practice

- First: Focus on *content* and *structure*
- Later: Decide on layout and style

- Use mostly the default settings
- If you need special functionality, look for packages covering your needs
- If you do not find suitable packages, make your own macros
- Learn by 1) asking fellow students, 2) google and cut'n paste, and 3) by sending me an email or come to my office
- Compile frequently
- Commit frequently to your versioning system[11]
- Run spell checks when things start to get complete[12]
- Last: perform minor fine-tuning (typically to sort out bad placements of floats). Remember that every fix you apply may affect the subsequent layout.

---

[11]SVN is a good choice, or use any of the many free online services.

[12]Most editors provide built-in spell check functionality (which ignores the mark up commands). On Linux platforms you have the ispell and aspell command line tools which can be configured for LaTeX. There are also stand-alone tools around.

Appendix B

Meeting notes

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B.1 Meeting 24-1-17

BO17-G14 Guidance meeting

Minutes for January 24, 2017

Present: S. Børre (Chair), S. Espen, N. Nicolai B. Thomas

Absent:

Reports

The pre-report is delivered and approved

Last meeting points

1. Create pre-report

2. Create project contract
   The minutes of the previous meeting were approved.

New Business

1. Define tools we are going to use

2. Have perimeter meeting with employer.

Next Meeting: Thursday, January 31, at 10:30

,

B.2 Meeting 31-1-17

BO17-G14 Guidance meeting

Minutes for February 31, 2017

Present: S. Børre (Chair), S. Espen, N. Nicolai B. Thomas

Absent: B. Thomas *(Travelling)*

Reports

Nothing notably to report.

Last meeting points

1. Create high fidelity wireframes

   The minutes of the previous meeting were approved.

New Business

1. Create wireframes

2. Define work roles

3. Meeting with employer to discuss wireframes

Next Meeting: Thursday, February 07, at 10:30

,

B.3   Meeting 7-2-17

BO17-G14 Guidance meeting

Minutes for February 07, 2017

Present: S. Børre (Chair), S. Espen, N. Nicolai B. Thomas

Absent:

Reports

Wireframes

Landingpage and Itempage — We have created wireframes of landingpages and itempages. These pages have also been discussed with employer.

Last meeting points

1. Create wireframes

2. Have meeting with employer on what the system should contain.

   The minutes of the previous meeting were approved.

New Business

1. Create web page usable for user testing

2. Define therms

Next Meeting: Thursday, February 14, at 10:30

,

B.4   Meeting 14-2-17

BO17-G14 Guidance meeting

Minutes for February 14, 2017

Present: S. Børre (Chair), S. Espen, N. Nicolai B. Thomas

Absent:

Reports

Webpage

Database — We now have a server. MongoDB is no created and with some dummy-data. It used Json files.

HTML page — The HTML landing page is now created and show dummy data and has a standard navigation menu that follow on all pages.

Last meeting points

1. Check the webpage

2. Defining therms

New Business

1. Start to fill out main report.

2. continue a prototype webpage so we can start user-testing.

3. Start to create a user-test.

Next Meeting: Thursday, February 21, at 10:30

,

B.5 Meeting 21-2-17

BO17-G14 Guidance meeting

Minutes for February 14, 2017

Present: S. Børre (Chair), S. Espen, N. Nicolai B. Thomas

Absent:

Reports

Site

HTML page —

- The page now speaks with the API

- Created item page and admin page

  Database — Continud working on the API

- Fix database form by empty items.

- Fix models

- tarted working on authentication for API

Main report

Added some parts form pre-report to main-report. Gone through the main structure for the template. Checked existing hall of fame reports to se best practise for the main-report.

Last meeting points

1. Start to fill out main report.

2. continue a prototype webpage so we can start user-testing.

3. Start to create a user-test.

New Business

1. Make a design on the webpage to make it ready for user testing.

2. Create the structure and fill out what we can on the main report. Add discussion of why we chose to focus on a easy to update site rather then a heavy administrated site.

Next Meeting: Thursday, February 28, at 10:30

,

B.6   Meeting 28-2-17

BO17-G14 Guidance meeting

Minutes for October 5, 2011

Present: S. Børre (Chair), N. Nicolai, B. Thomas

Absent: S. Espen *(Travelling)*

Reports

Website

- We now have a detailed item view (not all info included)

- Search implemented (still testing)

Meeting discussions

New group member

We have been asked by a member of another bachelor group if he can join our group. We discuss this matter during the meeting, where our supervisor states that this decision is up to us te members of the group. Between now and next meeting we will make a decision if he will join our group or not.

Website / System

We discussed different aspects of the website, what it still needs and how we will solve different issues.

We discussed the following points that we need to implement on the website:

- Items

    - View (done)
    - Item out of stock / messaging system
    - New items (semi done) / Edit items
    - Tags on item page and in search

- Messaging system

    - Item out of stock
    - Loaned item
    - General messages
    - Need assistance

- Box location

,

B.7 Meeting 28-2-17

- Users

  - Unauthenticated

    * View items
    * Send messages

  - Authenticated

    * Same as Unauthenticated
    * CRUD items

  - Admin

    * Same as Authenticated
    * CRUD news
    * CRUD users

- Login System
  Here it was discussed if we need a complicated login system as the majority of users on the system are unauthenticated users.

  ### *Report*

  The deadline for the report is March 9, but our supervisor states that this date is not that important as we can review the report every meeting.

Until next meeting

1. Continue work on website, to prepare it for user testing

2. Continued work on the report.

Next Meeting: Tuesday, March 7, 10:30