

## SOLUTION

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This chapter describes the details how the project is implemented. Note that algorithms and codes listed here are written in Ruby programming language, which is the main language of the project.

### 1.1 NAME MATCHING ALGORITHMS

We will start off by detailing bundled matching algorithms here.

#### 1.1.1 *Levenshtein distance*

This algorithm measures the difference between two strings. It tells the minimum number of operations needed to change string to another. These operations are insertions, deletions, or substitutions. Consider these following examples.

- Smith → Smyth  
the minimum operation to change is 1, which is to substitute *i* to *y*, therefore Levenshtein distance for these two strings is 1.
- Gowan → McGowan  
2 insertions of *M* and *c* is required.
- Smithe → Smyth  
1 deletion of *e* and 1 substitution of *i* to *y* are required.

The implementation used in the project is done by Battley [1]<sup>1</sup>.

#### 1.1.2 *Soundex*

Soundex encodes a string into a 4 character code representing an essence of its sound as pronounced in English. It operates in the following steps.

1. Take the first letter of a string.
2. Encode each remaining letters into a group following table 1. Discards A, E, I, O, U, H, W, and Y
3. Remove two adjacent same characters.

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<sup>1</sup> levenshtein.rb

GROUP	LETTERS
1	B, F, P, V
2	C, G, J, K, Q, S, X, Z
3	D, T
4	L
5	M, N
6	R
-	A, E, I, O, U, H, W, Y

Table 1: Soundex letter group.

4. If a group of a first letter is the same as the second letter, remove the second letter.
5. Trim or pad with zeros as necessary, making the result 4 characters long.

Let us follow these steps by step, consider we are going to encode the string *PFISTTER*.

1. Take first letter of *PFISTTER*.  
PFISTTER → P
2. Encode remaining letter *FISTTER*.  
PFISTTER → P1-233-6 → P12336
3. Remove two adjacent same characters.  
PFISTTER → P12336 → P1236
4. P is also in group 1, so remove the second 1 letter.  
PFISTTER → P1236 → P236
5. P236 is 4 characters long, so it does not need to be trimmed.  
PFISTTER → P1236 → P236

Therefore, soundex of *PFISTTER* is P236.

The implementation of soundex (listing 1) in this project is adapted from [Winstanley Irish soundex](#) implemented in Visual Basic<sup>2</sup>. The code is commented following the same aforementioned steps.

<sup>2</sup> [2] Appendix 3.

```

def self.soundex(name)
  # Take the first letter of a string.
  result = name.first

  # Encode remaining letters
  name[1..name.length].split('').each do |n|
    result = result + category(n).to_s
  end

  # Remove two adjacent same characters
  result.gsub!(/([0-9])\1+/, '\1')

  # If category of 1st letter equals 2nd character, remove 2nd
  # character
  if result.size >= 2 && category(result[0]).to_s == result[1]
    result.slice!(1)
  end

  # Trim or pad with zeros as necessary
  result = if result.size == 4
    result
  elsif result.size > 4
    result[0..3]
  else
    result.ljust(4, '0')
  end
end

```

Listing 1: Soundex implementation.

The category function implements soundex grouping table (table 1) as in listing 2.

```
def self.category(c)
  if c.match(/[AEIOUHWY]/).present?
    ""
  elsif c.match(/[BPFV]/).present?
    1
  elsif c.match(/[CSKGJQXZ]/).present?
    2
  elsif c.match(/[DT]/).present?
    3
  elsif c.match(/[L]/).present?
    4
  elsif c.match(/[MN]/).present?
    5
  elsif c.match(/[R]/).present?
    6
  else
    ""
  end
end
```

Listing 2: Soundex grouping table implementation.

### 1.1.3 Irish soundex

Irish soundex is another variant of traditional soundex. It determines characteristics of Irish names and normalised them to modern names. This algorithm also follows [Winstanley Irish soundex](#)<sup>3</sup>.

Irish names might contain some prefix, e.g. *Mc* or *O*, which are obstructive to soundex result. These prefixes are to be discarded. Moreover, there is no initial soft *C* in Irish names, instead *K* is used. So the first letter *C* is changed to *K*. It is implemented as in listing 3.

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<sup>3</sup> [2] Appendix 3.

```

def self.soundex(name)
  # Change initial ST. to SAINT
  name = name.match(/^ST./).present? ? "SAINT"
    #{name[3..name.length]} : name

  # Discard Irish prefixes
  name = if name.match(/^O /).present?
    name[1..name.length].gsub(' ', '')
  elsif name.match(/^O' /).present?
    name[2..name.length].gsub(' ', '')
  elsif name.match(/^MC /).present?
    name[2..name.length].gsub(' ', '')
  elsif name.match(/^M' /).present?
    name[2..name.length].gsub(' ', '')
  elsif name.match(/^MAC /).present? && name != 'MAC'
    name[3..name.length].gsub(' ', '')
  else
    name
  end

  # Change initial C to K
  name = name.strip.gsub(/^C/, 'K')

  # Call to traditional soundex.
  Soundex.soundex(name)
end

```

Listing 3: Irish soundex implementation.

Irish soundex algorithm in this project calls traditional soundex described in section 1.1.2 to minimise repeated code.



## Part I

### THE SHOWCASE

You can put some informational part preamble text here. Illo principalmente su nos. Non message *occidental* anglo-romanian da. Debitas effortio simplificate sia se, auxiliar summarios da que, se avantiate publicationes via. Pan in terra summarios, capital interlingua se que. Al via multo esser specimen, campo responder que da. Le usate medical addresses pro, europa origine sanctificate nos se.





INTRODUCTION

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This template for L<sup>A</sup>T<sub>E</sub>X has two goals:

1. Provide students with an easy-to-use template for their Master's or PhD thesis (though it might also be used by other types of authors for reports, books, etc.).
2. Provide a classic, high-quality typographic style that is inspired by "*The Elements of Typographic Style*".

The bundle is configured to run with a *full* MiK<sub>T</sub>E<sub>X</sub> or T<sub>E</sub>XLive installation right away and, therefore, it uses only freely available fonts.

People interested only in the nice style and not the whole bundle can now use the style stand-alone via the file `classicthesis.sty`. This works now also with "plain" L<sup>A</sup>T<sub>E</sub>X.

As of version 3.0, `classicthesis` can also be easily used with L<sub>Y</sub>X<sup>1</sup> thanks to Nicholas Mariette and Ivo Pletikosić. The L<sub>Y</sub>X version of this manual will contain more information on the details.

This should enable anyone with a basic knowledge of L<sup>A</sup>T<sub>E</sub>X<sub>2</sub><sub>ε</sub> or L<sub>Y</sub>X to produce beautiful documents without too much effort. In the end, this is my overall goal: more beautiful documents, especially theses, as I am tired of seeing so many ugly ones.

The whole template and the used style is released under the GNU General Public License.

If you like the style then I would appreciate a postcard:

Andre Miede  
Detmolder Strasse 32  
31737 Rinteln  
Germany

The postcards I received so far are available at:

<http://postcards.miede.de>

So far, many theses, some books, and several other publications have been typeset successfully with it. If you are interested in some typographic details behind it, enjoy Robert Bringhurst's wonderful book.

*Web service for 19<sup>th</sup>  
century  
Irish personal name  
matching version 0.2*

*A well-balanced line  
width improves the  
legibility of the text.  
That's what typography  
is all about, right?*

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<sup>1</sup> <http://www.lyx.org>

**IMPORTANT NOTE:** Some things of this style might look unusual at first glance, many people feel so in the beginning. However, all things are intentionally designed to be as they are, especially these:

- No bold fonts are used. Italics or spaced small caps do the job quite well.
- The size of the text body is intentionally shaped like it is. It supports both legibility and allows a reasonable amount of information to be on a page. And, no: the lines are not too short.
- The tables intentionally do not use vertical or double rules. See the documentation for the `booktabs` package for a nice discussion of this topic.<sup>2</sup>
- And last but not least, to provide the reader with a way easier access to page numbers in the table of contents, the page numbers are right behind the titles. Yes, they are *not* neatly aligned at the right side and they are *not* connected with dots that help the eye to bridge a distance that is not necessary. If you are still not convinced: is your reader interested in the page number or does she want to sum the numbers up?

Therefore, please do not break the beauty of the style by changing these things unless you really know what you are doing! Please.

## 2.1 ORGANIZATION

A very important factor for successful thesis writing is the organization of the material. This template suggests a structure as the following:

*You can use these margins for summaries of the text body...*

- `Chapters/` is where all the “real” content goes in separate files such as `Chapter01.tex` etc.
- `FrontBackMatter/` is where all the stuff goes that surrounds the “real” content, such as the acknowledgments, dedication, etc.
- `gfx/` is where you put all the graphics you use in the thesis. Maybe they should be organized into subfolders depending on the chapter they are used in, if you have a lot of graphics.
- `Bibliography.bib`: the Bib<sub>T</sub><sub>E</sub>X database to organize all the references you might want to cite.
- `classicthesis.sty`: the style definition to get this awesome look and feel. Bonus: works with both L<sub>A</sub>T<sub>E</sub>X and PDF<sub>L</sub>A<sub>T</sub>E<sub>X</sub>...and L<sub>Y</sub>X.
- `ClassicThesis.tcp` a T<sub>E</sub>XnicCenter project file. Great tool and it’s free!

<sup>2</sup> To be found online at

<http://www.ctan.org/tex-archive/macros/latex/contrib/booktabs/>.

- `ClassicThesis.tex`: the main file of your thesis where all the content gets bundled together.
- `classicthesis-config.tex`: a central place to load all nifty packages that are used. In there, you can also activate backrefs in order to have information in the bibliography about where a source was cited in the text (i. e., the page number).

*Make your changes and adjustments here.* This means that you specify here the options you want to load `classicthesis.sty` with. You also adjust the title of your thesis, your name, and all similar information here. Refer to [Section 2.3](#) for more information.

This had to change as of version 3.0 in order to enable an easy transition from the “basic” style to  $\text{LyX}$ .

In total, this should get you started in no time.

## 2.2 STYLE OPTIONS

There are a couple of options for `classicthesis.sty` that allow for a bit of freedom concerning the layout:

- General:
  - `drafting`: prints the date and time at the bottom of each page, so you always know which version you are dealing with. Might come in handy not to give your Prof. that old draft.
- Parts and Chapters:
  - `parts`: if you use Part divisions for your document, you should choose this option. (Cannot be used together with `nochapters`.)
  - `nochapters`: allows to use the look-and-feel with classes that do not use chapters, e. g., for articles. Automatically turns off a couple of other options: `eulerchapternumbers`, `linedheaders`, `listsseparated`, and `parts`.
  - `linedheaders`: changes the look of the chapter headings a bit by adding a horizontal line above the chapter title. The chapter number will also be moved to the top of the page, above the chapter title.
- Typography:
  - `eulerchapternumbers`: use figures from Hermann Zapf’s Euler math font for the chapter numbers. By default, old style figures from the Palatino font are used.
  - `beramono`: loads Bera Mono as typewriter font. (Default setting is using the standard CM typewriter font.)

*...or your supervisor  
might use the margins  
for some comments of  
her own while reading.*

- `eulermath`: loads the awesome Euler fonts for math. (Palatino is used as default font.)
- `pdfspacing`: makes use of `pdftex`' letter spacing capabilities via the `microtype` package.<sup>3</sup> This fixes some serious issues regarding math formulæ etc. (e. g., “ß”) in headers.
- `minionprospacing`: uses the internal `textssc` command of the `MinionPro` package for letter spacing. This automatically enables the `minionpro` option and overrides the `pdfspacing` option.
- Table of Contents:
  - `tocaligned`: aligns the whole table of contents on the left side. Some people like that, some don't.
  - `dottedtoc`: sets pagenumbers flushed right in the table of contents.
  - `manychapters`: if you need more than nine chapters for your document, you might not be happy with the spacing between the chapter number and the chapter title in the Table of Contents. This option allows for additional space in this context. However, it does not look as “perfect” if you use `\parts` for structuring your document.
- Floats:
  - `listings`: loads the `listings` package (if not already done) and configures the List of Listings accordingly.
  - `floatperchapter`: activates numbering per chapter for all floats such as figures, tables, and listings (if used).
  - `subfig(ure)`: is passed to the `tocloft` package to enable compatibility with the `subfig(ure)` package. Use this option if you want use `classicthesis` with the `subfig` package.

The best way to figure these options out is to try the different possibilities and see, what you and your supervisor like best.

In order to make things easier in general, `classicthesis-config.tex` contains some useful commands that might help you.

## 2.3 CUSTOMIZATION

This section will give you some hints about how to adapt `classicthesis` to your needs.

The file `classicthesis.sty` contains the core functionality of the style and in most cases will be left intact, whereas the file `classicthesis-config.tex` is used for some common user customizations.

---

<sup>3</sup> Use `microtype`'s `DVIoutput` option to generate DVI with `pdftex`.

The first customization you are about to make is to alter the document title, author name, and other thesis details. In order to do this, replace the data in the following lines of `classicthesis-config.tex`:

*Modifications in  
classic-  
thesis-config.tex*

```
\newcommand{\myTitle}{A Classic Thesis Style\xspace}
\newcommand{\mySubtitle}{An Homage to ...\xspace}
\newcommand{\myDegree}{Doktor-Ingenieur (Dr.-Ing.)\xspace}
```

Further customization can be made in `classicthesis-config.tex` by choosing the options to `classicthesis.sty` (see [Section 2.2](#)) in a line that looks like this:

```
\PassOptionsToPackage{eulerchapternumbers,listings,drafting,
  pdfspacing, subfig,beramono,eulermath,parts}{classicthesis}
```

If you want to use backreferences from your citations to the pages they were cited on, change the following line from:

```
\setboolean{enable-backrefs}{false}
```

to

```
\setboolean{enable-backrefs}{true}
```

Many other customizations in `classicthesis-config.tex` are possible, but you should be careful making changes there, since some changes could cause errors.

Finally, changes can be made in the file `classicthesis.sty`, although this is mostly not designed for user customization. The main change that might be made here is the text-block size, for example, to get longer lines of text.

*Modifications in  
classicthesis.sty*

## 2.4 ISSUES

This section will list some information about problems using `classicthesis` in general or using it with other packages.

Beta versions of `classicthesis` can be found at the following Google code repository:

<http://code.google.com/p/classicthesis/>

There, you can also post serious bugs and problems you encounter.

#### *Compatibility with the glossaries Package*

If you want to use the glossaries package, take care of loading it with the following options:

```
\usepackage[style=long,nolist]{glossaries}
```

Thanks to Sven Staehs for this information.

#### *Compatibility with the (Spanish) babel Package*

Spanish languages need an extra option in order to work with this template:

```
\usepackage[spanish,es-lcroman]{babel}
```

Thanks to an unknown person for this information (via Google Code issue reporting).

#### *Compatibility with the pdfsync Package*

Using the pdfsync package leads to linebreaking problems with the graffito command. Thanks to Henrik Schumacher for this information.

## 2.5 FUTURE WORK

So far, this is a quite stable version that served a couple of people well during their thesis time. However, some things are still not as they should be. Proper documentation in the standard format is still missing. In the long run, the style should probably be published separately, with the template bundle being only an application of the style. Alas, there is no time for that at the moment. . . it could be a nice task for a small group of L<sup>A</sup>T<sub>E</sub>Xnicians.

Please do not send me email with questions concerning L<sup>A</sup>T<sub>E</sub>X or the template, as I do not have time for an answer. But if you have comments, suggestions, or improvements for the style or the template in general, do not hesitate to write them on that postcard of yours.

## 2.6 LICENSE

GNU GENERAL PUBLIC LICENSE: This program is free software; you can redistribute it and/or modify it under the terms of the GNU General Public License as published by the Free Software Foundation; either version 2 of the License, or (at your option) any later version.

This program is distributed in the hope that it will be useful, but *without any warranty*; without even the implied warranty of *merchantability* or *fitness for a particular purpose*. See the GNU General Public License for more details.





## EXAMPLES

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## 3.1 A NEW SECTION

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Examples: *Italics*, ALL CAPS, SMALL CAPS, LOW SMALL CAPS<sup>1</sup>.

## 3.1.1 Test for a Subsection

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*Note: The content of this chapter is just some dummy text.*

<sup>1</sup> Footnote example.

tae enim. Pellentesque tincidunt purus vel magna. Integer non enim. Praesent euismod nunc eu purus. Donec bibendum quam in tellus. Nullam cursus pulvinar lectus. Donec et mi. Nam vulputate metus eu enim. Vestibulum pellentesque felis eu massa.

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### 3.1.2 *Autem Timeam*

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## 3.2 ANOTHER SECTION IN THIS CHAPTER

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quis congue purus metus ultricies tellus. Proin et quam. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Praesent sapien turpis, fermentum vel, eleifend faucibus, vehicula eu, lacus.

Sia ma sine svedese americas. Asia representantes un nos, un altere membros qui.<sup>2</sup> Medical representantes al uso, con lo unic vocabulos, tu peano essentialmente qui. Lo malo laborava anteriormente uso.

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This statement requires citation.

### 3.2.1 *Personas Initialmente*

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<sup>2</sup> De web nostre historia angloromantic.

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Table 2: Autem timeam deleniti usu id.

suscipit ac, varius vel, egestas non, eros. Praesent malesuada, diam id pretium elementum, eros sem dictum tortor, vel consectetur odio sem sed wisi.

#### *A Subsubsection*

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A PARAGRAPH EXAMPLE Etiam euismod. Fusce facilisis lacinia dui. Suspendisse potenti. In mi erat, cursus id, nonummy sed, ullamcorper eget, sapien. Praesent pretium, magna in eleifend egestas, pede pede pretium lorem, quis consectetur tortor sapien facilisis magna. Mauris quis magna varius nulla scelerisque imperdiet. Aliquam non quam. Aliquam porttitor quam a lacus. Praesent vel arcu ut tortor cursus volutpat. In vitae pede quis diam bibendum placerat. Fusce elementum convallis neque. Sed dolor orci, scelerisque ac, dapibus nec, ultricies ut, mi. Duis nec dui quis leo sagittis commodo.

- A. Enumeration with small caps
- B. Second item

Another statement requiring citation but this time with text after the citation.

#### 3.2.2 *Figure Citations*

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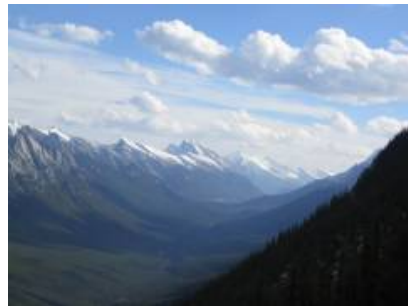
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o uno, nos al.



(a) Asia personas duo.



(b) Pan ma signo.



(c) Methodicamente o uno.



(d) Titulo debitas.

Figure 1: Tu duo titulo debitas latente.



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#### 4.1 SOME FORMULAS

Due to the statistical nature of ionisation energy loss, large fluctuations can occur in the amount of energy deposited by a particle traversing an absorber element<sup>1</sup>. Continuous processes such as multiple scattering and energy loss play a relevant role in the longitudinal and lateral development of electromagnetic and hadronic showers, and in the case of sampling calorimeters the measured resolution can be significantly affected by such fluctuations in their active layers. The description of ionisation fluctuations is characterised by the significance parameter  $\kappa$ , which is proportional to the ratio of mean energy loss to the maximum allowed energy transfer in a single collision with an atomic electron:

$$\kappa = \frac{\xi}{E_{\max}} \quad (1)$$

$E_{\max}$  is the maximum transferable energy in a single collision with an atomic electron.

$$E_{\max} = \frac{2m_e\beta^2\gamma^2}{1 + 2\gamma m_e/m_x + (m_e/m_x)^2} ,$$

where  $\gamma = E/m_x$ ,  $E$  is energy and  $m_x$  the mass of the incident particle,  $\beta^2 = 1 - 1/\gamma^2$  and  $m_e$  is the electron mass.  $\xi$  comes from the Rutherford scattering cross section and is defined as:

$$\xi = \frac{2\pi z^2 e^4 N_{Av} Z \rho \delta x}{m_e \beta^2 c^2 A} = 153.4 \frac{z^2}{\beta^2} \frac{Z}{A} \rho \delta x \quad \text{keV},$$

where

<sup>1</sup> Examples taken from Walter Schmidt's great gallery:  
<http://home.vrweb.de/~was/mathfonts.html>

*You might get unexpected results using math in chapter or section heads. Consider the pdfspacing option.*

$z$	charge of the incident particle
$N_{Av}$	Avogadro's number
$Z$	atomic number of the material
$A$	atomic weight of the material
$\rho$	density
$\delta x$	thickness of the material

$\kappa$  measures the contribution of the collisions with energy transfer close to  $E_{max}$ . For a given absorber,  $\kappa$  tends towards large values if  $\delta x$  is large and/or if  $\beta$  is small. Likewise,  $\kappa$  tends towards zero if  $\delta x$  is small and/or if  $\beta$  approaches 1.

The value of  $\kappa$  distinguishes two regimes which occur in the description of ionisation fluctuations:

1. A large number of collisions involving the loss of all or most of the incident particle energy during the traversal of an absorber.

As the total energy transfer is composed of a multitude of small energy losses, we can apply the central limit theorem and describe the fluctuations by a Gaussian distribution. This case is applicable to non-relativistic particles and is described by the inequality  $\kappa > 10$  (i.e., when the mean energy loss in the absorber is greater than the maximum energy transfer in a single collision).

2. Particles traversing thin counters and incident electrons under any conditions.

The relevant inequalities and distributions are  $0.01 < \kappa < 10$ , Vavilov distribution, and  $\kappa < 0.01$ , Landau distribution.

#### 4.2 VARIOUS MATHEMATICAL EXAMPLES

If  $n > 2$ , the identity

$$t[u_1, \dots, u_n] = t[t[u_1, \dots, u_{n-1}], t[u_n, \dots, u_n]]$$

defines  $t[u_1, \dots, u_n]$  recursively, and it can be shown that the alternative definition

$$t[u_1, \dots, u_n] = t[t[u_1, u_2], \dots, t[u_{n-1}, u_n]]$$

gives the same result.



## Part II

### APPENDIX



APPENDIX TEST

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## A.1 APPENDIX SECTION TEST

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*More dummy text*

## A.2 ANOTHER APPENDIX SECTION TEST

Your own text.

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suscipit instructor	titulo	personas
quaestio philosophia	facto	demonstrated

Table 3: Autem usu id.

```

for i:=maxint to 0 do
begin
{ do nothing }
end;

```

Listing 4: A floating example

#### A.2.1 Sub

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## BIBLIOGRAPHY

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- [1] Paul Battley. *Text, Collection of text algorithms*. 2015. URL <https://github.com/threedaymonk/text>. accessed <sup>th</sup>, 2015.
- [2] Adam Winstanley. *Identifying People on the Morpeth Roll*. July 2014. Postgraduate Diploma in Genealogical, Palaeographic & Heraldic Studies 2013-14.