MAT-70906 Software Science Project

Lecture 1: about writing a scientific report

Tampere University of Technology
periods III–IV, 2013-2014

Antero Kangas
antero.kangas@tut.fi

(Start the subject of your emails concerning the course to me by
MAT-70906)
Organisation of These Slides

1. About the Course Bureaucracy
2. Why Writing Is Trained
3. Approach to Report Writing
4. How a Scientific Report Is Built
   - Compare the introduced structure to the article you will review.
   - Was it similar? You can use the same structure in your own report.
5. Instructions for reviewing a text
   - Also your article will be reviewed with these arguments.
6. A Glimpse of \LaTeX
Goals of the Course

In this course we learn knowledge and skills needed for research work in software science. They are practised by

- writing a review (one page) of some scientific article
- carrying out some individual software science project (e.g. implementation of an algorithm, making of measurements or other kinds of experiments, or comparing methods presented in the literature)
- reporting of the findings in scientific style written form (about 10 pages), including the abstract (at most 150 words) and the references
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<th>Schedule 2014</th>
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<tr>
<td><strong>January 2014</strong></td>
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<td><strong>W Mon Tue Wed Thu Fri</strong></td>
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| **February 2014** |
| **W Mon Tue Wed Thu Fri** |
| 6 | 3 | 4 | 5 | 6 | 7 | [Planning the research work and searching of material] |
| 7 | 10 | 11 | 12 | 13 | 14 | [Research work and writing of the 1. version] |
| 8 | 17 | 18 | 19+ | 20 | 21 | Deadline 19.2. The report must have |
| | | | | | Introduction, Background, and References sections |
| 9 | 24 | 25 | 26 | 27 | 28 | [Research work and repairing the beginning of the report] |

| **March 2014** |
| **W Mon Tue Wed Thu Fri** |
| 10E | 3 | 4 | 5 | 6 | 7 | Exam week |
| 11 | 10 | 11 | 12 | 13 | 14 | [Research work, the results must be ready] |
| 12 | 17 | 18 | 19+ | 20 | 21 | Deadline: 19.3. All the facts must be in place |
| 13 | 24 | 24 | 26 | 27 | 28 | [Repairing the work and the report] |
| 14 | 31 | | | | | [Repairing the work and the report] |
March 2014
W Mon Tue Wed Thu Fri
10E 3 4 5 6 7 Exam week
11 10 11 12 13 14 [Research work, the results must be ready]
12 17 18 19+ 20 21 Deadline: 19.3. All the facts must be in place
13 24 24 26 27 28 [Repairing the work and the report]
14 31 [Repairing the work and the report]

April 2014
W Mon Tue Wed Thu Fri
14 1 2 3 4 [Repairing the work and the report]
15 7 8 9+ 10 11 [Deadline: 9.4. The appearance must be finished]
16 14 15 16 |- -- [Personal feedback on weeks 16-18, 1-2h. Reserve time!]
17 -- -- |- 24 25 [Repairing the report]
18 28 39 30 [Repairing the report]

May 2014
W Mon Tue Wed Thu Fri
18 -- 2 [Repairing the report]
19 5 6 7+ 8 9 Deadline 7.5. Returning the reviewable (=final) version of the article
20E 12 13 14 15 16 Exam week
21 26 27 28 29 30
Grading

• The review of the article is graded as accepted / rejected
• The course is graded mainly by the report of the findings
Publicity of the Works

- Works made in this course may interest even wider readership than just the teacher of the course
- The student owns all rights of her/his work, thus the teacher cannot give the work forward for reading without permission
- It is recommendable that students publish their work for example using an applicable Creative Commons -license
- More information:
  http://creativecommons.org/license/?lang=fi
  (in English without “/?lang=fi”)
1 Questions about the bureaucracy?

(For those who were scared by the content of the course: now is a good time to leave :) .)

Next: About writing a report.
2 Why Writing Is Trained

- Precise expression is an important skill that brings you power and respect.
- In many situations speech is not precise enough.
  
  What have I accepted in the terms of service (what the salesman said on the desk or what is in the contract)? Can I repeat a scientific experiment (a presentation in a conference or a scientific article)? What kind of system the client actually wants (a conversation in a phone or a specification document)?

- Often you must be precise or face the consequences.
A citation of a specification document costing about 100 000 euros of which has been implemented a project costing about 500 000 euros (the subject is changed):

**Case study:** Update information for capital tax

A typical flow of events:

1. The user activates the Update information for capital tax – action
2. The system opens the Information of Capital tax – counter in update state
3. The user makes changes and saves them (C1)
4. The system saves the information

**Comments:**

C1 Tax information: "The interest of debts are deductible in some cases"
3 Approach to Report Writing

Your writing is useless if nobody reads or understands it. Consider always your reader: i) lure, ii) serve and iii) reward her.

i) Tell why the reader gets benefit of reading your text.

ii) Tell the essential background. Don’t let the reader fall behind. Don’t force her to read other texts.

ii) Tell only the essential facts. Don’t bore the reader by rambling. E.g. a reader of a scientific report is usually not interest in the writer’s opinion.

ii) Guide the reader straight to the target. Don’t make her browse your texts back and forth.

iii) Tell the important fact.
4 Structure of a Scientific Text

There are differences in structures but usually all the facts below are presented somewhere in the text. The following is a common structure.

1. Introduction. This popularly written section answers shortly the following questions:
   - What is the purpose of the research topic?
   - What kind of problems can be met in the research topic?
   - Why this text is written? (Contribution)
   - What else – related to the topic – has already been written?
   - How the rest of the text is organised?
• A common way to organise the introduction section:
  (a) Research topic (lead your reader to the topic)
  (b) Some interesting problems (explain why this topic is
      “the most important thing in the world”)
  (c) What other researchers have already published
      (show your knowledge)
  (d) State your research problem
  (e) Describe your solution
  (f) Reveal your most significant results (sell the report
      for the reader)
  (g) How your paper is organised (section by section)

• popularly written = not for specialists, ie. (usually) not too
  detailed, no formulas, no special terms, etc. (this depends on
  your target audience)

• it is common that the introduction will be rewritten several times
2. Background. This section is targeted for specialists and gives the background needed to understand the actual issue. E.g.

- presentation of terms,
- mathematical definitions, and
- essential theorems.

- the proofs of theorems have to be verifiable,
- algorithms must be described so that other people’s implementations can run in same way, and
- experiments and measurements must be described so accurately that they can be redone.

This may take more than one section: among other things theory (e.g. descriptions of algorithms) and their comparisons (measurements when the algorithm has been compared to other algorithms that solve the same problem) are described in own sections.
4. Summary and Conclusions.

- Tell – popularly – what has been done and bring up the most significant results.
- Analyse the effect they have, can have, or are hoped to have for the research topic.
- It is reasonable to present things that can limit the applicability of the results, and other problems.
- You can also mention the present status of the research and its future directions.
5 Reviewing a Text

The written results of the course are reviewed by the principles presented in this section. Peer review is an essential part of scientific work.
5.1 Heading

- Did the headings tell about the contents of the text and its sections?
- If there is no abstract part then the shortest way to get a high-level understanding of the text is browsing the headings.
- The organisation of the text is not the same as heading.

A Fast Algorithm for Generating Test Cases in Black-box Testing

1. Introduction
2. Research Problem
3. Previous Solutions
4. The New Method
5. Results of Measurements and Their Comparison
6. Summary

1. Introduction
2. Models as Sources of Test Cases
3. Previous Algorithms Are Slow For Large Models
4. Coverage-controlled Generation Algorithm
5. The Errors Were Found Earlier Than Previously
6. Summary
5.2 Style

- Is the style of the article neutral and analytical?
- A scientific text is not an advertisement.
- Neutral is not the same as boring.

I. Introduction

We stand today on the brink of a revolution in cryptography. The development of cheap digital

5.3 Clarity of Expression

- Does the reader understand the sentences at first reading? Good sentences are simple, unambiguous and lead the text forward step by step.

- Does the reader understand which fact was explained in the paragraph she has just read? The thumb rule is that each paragraph handles exactly one fact.
5.4 Ordering the Facts

- Does the reader quickly understand the reasons why the article is important for her? (Motivation)
- Does the reader know and does she remember everything that is yet coming in the text?
- Does the reader understand why the paragraph she has just read is written specially in this place (or why it is written at all...).
- Does the reader run into undefined terms? **Terms must be defined before use or at latest when they are used the first time.**
- Has the same thing been explained in several paragraphs here and there in the text?
- Does the reader have to jump to and fro?
5.5 Content

Does the text convey a consistent message? Or does the issue seem as

- holey (the reason can be inaccuracy: something essential is not told or is told unclearly. E.g. a proof is impossible to follow)
- contradictory (e.g. it has been first argued that \( X \) is in practice impossible and later that \( X \) is not a problem)
- irrelevant (some of the results are clearly useless)
- disconnected (research made by others is not introduced, the significance of the text for the research is not told)?
5.6 References

- Are the references reasonable? (Are the cited documents for sure carefully chosen and easily available sources of knowledge.)
- Is the usage of references uniform?
- Is it possible to find a cited book or article using the reference list?
- Are all items in the reference list cited somewhere in the text and are all the cited books and articles in the reference list?
- Is it clear how the content of each reference is related to the article?
6 **LaTeX**

- **Installation**
  1. **Linux (Ubuntu):** `sudo apt-get install tetex-base tetex-bin tetex-extra`
     [http://www.xm1math.net/texmaker/](http://www.xm1math.net/texmaker/) or  
     [http://www.tug.org/texworks/](http://www.tug.org/texworks/) (e.g.)
  3. **On-line:** [http://www.sharelatex.com](http://www.sharelatex.com)
• Usage

1. Write with your favourite editor a text file. something.tex
2. Compose the text by the command latex something.
3. Look the result by the command xdvi something, make it a PDF by the command dvipdf something or a PS by the command dvips something.
4. You can also generate the PDF directly by command pdflatex but then some packages do not work.
5. Nnotice: if you have references you may have to compile the tex file two or sometimes even three times.
Text file something\texttt{.tex}:

\documentclass[a4paper]{article}
\usepackage[latin1]{inputenc} % assume iso-8859-1
\usepackage[finnish]{babel} % or \usepackage[english]{babel}

\title{Heading Comes Here}
\author{Author’s name}
\begin{document}
\maketitle

\begin{abstract}
At most 150 words.
\end{abstract}

\section{Introduction}
Type text here.
Emphasize the first appearing of a \texttt{\textbf{term}} and explain it
either just before or immediately after it.

Empty line starts a new paragraph.
Otherwise the linebreaks
do not have much importance.
\end{document}
6.1 Style of references in this course

- use \textit{thebibliography} environment (or you can use \textit{bibtex}), example:

\begin{thebibliography}{99}
\end{thebibliography}
References

Notice:

- write references in alphabetical order of the first author, then the second etc., the last criterion is the publishing date

- ordering: author(s): “Title of the (possible) article”, Publication. Publishing information, year, pp. first–last page.

- if authors $\geq 2$, add word “and” between the last names

- if authors $> 2$ add comma after their names except the last one

- **journal**: volume issue year page numbers, e.g. “99 (1992), 403–422.”

- **book**: publisher, location, and year of publication.
- **proceedings or collections**: the title and author/editor of the book in which the article appeared; the publisher; the year and place of publication; and, in case of a conference proceedings, the location and date of the conference.

- if a web page is cited then add the last citing date

- **usually all publishers have their own style!**
6.2 About writing URLs and email addresses

• difficulties: may contain long words causing overfull lines, and tilde “∼”

• solution: use package `url` and enclose any web and email addresses in the document in “\url{...}”:

\package{url}
...
\url{http://www.math.drofnats.edu/~gauss}
\url{gauss@math.drofnats.edu}

• result: http://www.math.drofnats.edu/~gauss
  gauss@math.drofnats.edu
Bibliography

In Finnish


In English

Next Meeting

• Lecture about publishing, and reviewing an article.

• Subjects for exercises
  – Some proposed subjects by the teacher, but
  – You may, and are encouraged to, propose your own subjects.
  – A typical project could be an analysis of an algorithm, or a comparison of several algorithms that solve the same problem.