MSc Thesis

Department of Computer Science

Gerth Stølting Brodal

gerth@cs .au.dk

September 2018

(original April 2014, Anders Møller)

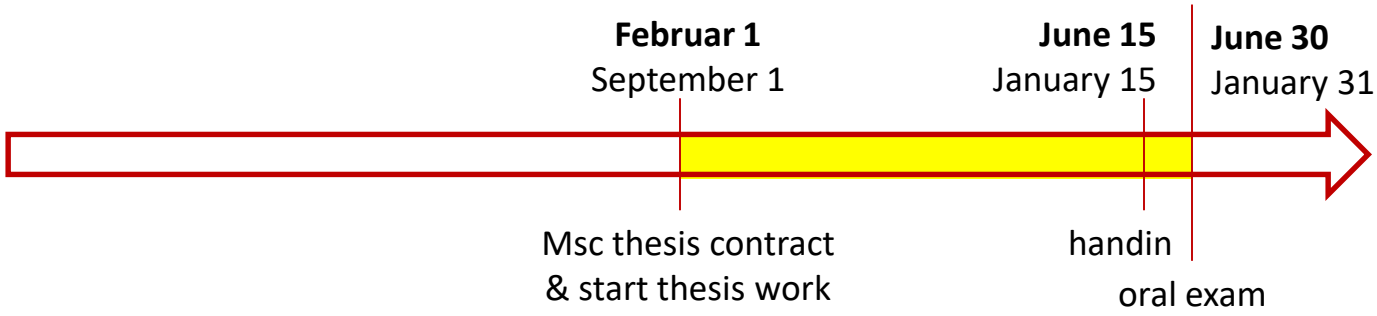
My background

- Chair of the Education Committee Department of Computer Science
- Research group *Algorithms and Data Structures*
- Advisor of 43 MSc and 14 PhD thesis
- Often external examiner at other Danish universities

Plan

- **Formalities**
- Selection of advisor and topic
- MSc process
- MSc thesis
- MSc thesis exam (oral)

you will be registered administratively to the MSc thesis without the possibility of cancelling the registration



Formalities

- 5 months work, incl. oral exam ~ 30 ECTS
  - Can be up to 11 months, if courses concurrently
- Thesis written in Danish or English
- Advisor: permanent faculty at the Department of Computer Science + possible (co)advisors
- Individually or in **groups** (2-3 persons)
  - for group work the thesis must state who is responsible for the different parts of the thesis
    (possibly “everybody is responsible for all of the thesis”)
  - From study environment study:
    “179 out of 331 believe it will be lonely to write the thesis”
  - ***Group thesis's are strongly encouraged!***

MSc Thesis Contract

kontrakt.scitech.au.dk

- Done jointly by the student and the advisor before the thesis work starts, and together with Gudmund S. Frandsen
- States who, general title, handin date e.t.c.
- **Short project description**

Reexam

- Missed handin deadline or failed exam
  - revised contract, 3 more months, new assignment
- As for other exams: max 3 exam tries

From Study Regulations

Read the study regulations for your MSc education:
https://kursuskatalog.au.dk/en?year=2019&department=15&search=thesis

"For the Master's thesis, the **student works independently** on an academic issue, on completion of which the graduate can:

- identify, define and formulate an academic issue on a scientific basis.
- define and present testable hypotheses within a subject-related topic.
- independently plan and complete a major academic project using the subject's scientific methodology.
- analyze, critically discuss and put into perspective an academic issue.
- assess, critically analyze and summarize the scientific literature within a defined topic area.
- relay academic results objectively and concisely to a scientific audience."

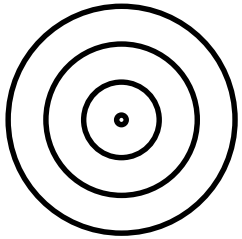
Plan

- Formalities
- **Selection of advisor and topic**
- MSc process
- MSc thesis
- MSc thesis exam (oral)

Selection of Advisor and Topic

- In principle it is the students job to find a project, but…
- Attend the Computer Science Day (May/June) e.t.c. Contact potential advisors, if they have a topic ready
  - but avoid advisor-surfing and “nothing better?”

- Make the project flexible!
  - Avoid nothing-or-all (“goal is to prove [foo]”)
  - If everything goes fine, ambitions can be increased (or decreased in opposite case)



Idea Maturation

- From loose idea to concrete **problem statement** and draft of **working plan**
- Start in advance of official thesis work kick-off!
- “Individual project work” (5 or 10 ECTS) is one possible way to test out an area before the thesis

Different Thesis Types

- Popular types of thesis's:
  - experimental evaluation of theoretical result
  - new theoretical result
  - survey
  - …
- Many MSc projects originate from existing research projects
- 5-10% of MSc thesis lead to scientific publications

Courses while thesis work?

- The thesis deadline is fixed, but it is completely legal to start earlier on the thesis while still having courses

- Advantage:
  - variation from the thesis project
  - longer time
- Disadvantage:
  - “the urgent kills the important”
- Requires self-disciplin!

Plan

- Formalities
- Selection of advisor and topic
- **MSc process**
- MSc thesis
- MSc thesis exam (oral)

Challenges?

What will be the biggest challenges for you in the process of writting the necessary pages over a five month period?

Thesis work

- Be aware of the different process phases/activities:
  - stating the problem
  - reading the literature
  - collecting data (e.g. generating test cases)
  - programming
  - performing experiments
  - writing the report (start as early as possible!)
  - proofreading
  - …
- **Variation** is good for productivity
- Have a **work plan**, and revise whenever necessary
  - the work plan is not a strict plan one needs to follow, but increases awareness when one is *not* on schedule

Guidance

- Schedule weekly meetings
  - luxury compared to other departments!
- Focused feedback
  - be prepared, send questions and current thesis PDF 1-2 days ahead of meeting (including stating expected feedback)
  - *you* have the overview, not your advisor
  - in principle it is not the advisors job to ensure activity
  - *always* have a next meeting scheduled and plan until the next meeting
  - take notes at the meeting!
- Technical questions versus “meta-issues”
- Mutual expectations
  - “Is it sufficient to pass / get 7 / get 10-12?”

Procrastination and perfectionisme

- "Thesis swamp"
  - the progression reform and thesis contracts has essentially elliminated the problem
- Plan, plan, plan…
  - work plan, deadlines
  - office space – remember to apply: http://studerende.au.dk/studier/fagportaler/datalogi/studiemiljoe/studieomraader-og-kontorer/studenterkontorer/
- Have realistic ambitions

“My advisor does not understand me”

- Additional contact persons:
  - Gudmund S. Frandsen (education committee)
  - Gerth Stølting Brodal (education committee)
  - Søren Poulsen (education coordinator, IT)
  - Magnus Høholt Kaspersen (student counselor)
  - Andreas Birch Olsen (study environment coordinator)

- Always ready to help!

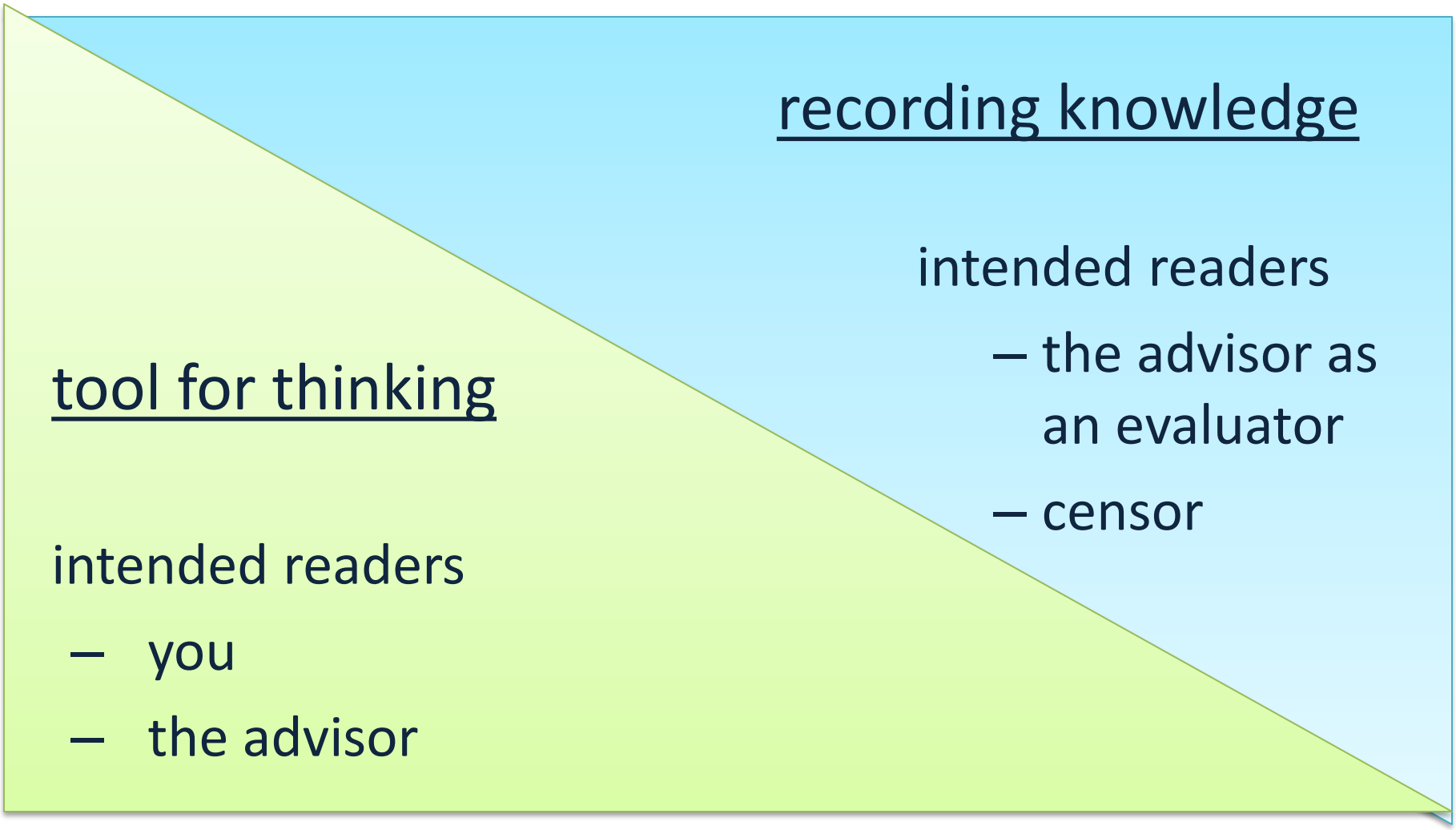
Plan

- Formalities
- Selection of advisor and topic
- MSc process
- **MSc thesis**
- MSc thesis exam (oral)

Ways of writing

- Work **top-down**
  - early on make a skeleton (titles, keywords, …)
  - "stepwise refinement" (like programing)
- Work **iteratively**
  - scientific text is rarely perfect on the first writing
- Use the report as a **working document**
  - mark ideas, keywords, to-do's using colors, margin notes, etc. (e.g. using LaTeX macros)

Two understandings of the writing process



Two understandings of the writing process

Use both !

Often just write your ideas down: *recording thoughts*

- new ideas might arise
- feeling of progress
- avoid only writing ”final text” since this can result in a writer’s block

Go over all text again from the beginning: *product phase*

- enforce terms never used without prior definition, polish text
- adjust text and examples to intended reader
- can be done throughout the writing process
  (should not be postponed to last minute!)

Typical structure of a thesis

- Introduction
  - problem statement / hypothesis
  - methods and overview
- Background, previous work and related work
- [Technical content…]
- Implementation and experiments
- Conclusion (relative to the introduction) and possible future work (documents you know the context)
- References
- (Appendix with technical details, experimental results not in the main part of the thesis, ...)
- (Webpage with programs and data)

About the introduction

- *What is the goal?*
  - background and topic (general introduction)
  - specific problem and hypothesis
  - definition of key concepts
- *Why is this important?*
  - motivation
  - relevance
- *How do you address the problem?*
  - the theory
  - methods (proofs / experiments / case studies / …)
  - outline of the structure of the thesis

Readability

Have particular attention to:

- Introduction
- Main arguments of the paper
- Meta-communication (continuously guide the reader through the text)
  - ”In this chapter we analyze X, that will be used in the analysis of Y in chapter Z”
- Try to use a clear language (avoid cryptic sentences and words not generally known)

Using references

- Credibility of sources ?
  - book (monograph)
  - PhD thesis
  - journal paper
  - conference paper
  - workshop paper
  - MSc / BSc thesis
  - Technical report (e.g. arxiv.org)
  - webpage
  - personal communication

…I have read it on the internet

…it is stated in the paper [foo]

…[authors] state in [reference] published in [journal name] that...

- Cite the most credible source !
- Layout (e.g. BibTeX)
- Curriculum for exam, possibly “secondary literature”

Literature search

- DBLP dblp.uni-trier.de
  - online database based on publishers publication lists, +4 M entries
  - from au.dk network (possibly using VPN) full access to most papers
- Google Scholar scholar.google.com
  - comprehensive and updated
  - states number of *citations* as a measure of impact
  - good for finding other papers citing a given paper
- The library (Nygaard 1) library@cs.au.dk
  - in case you need a particular book or (old) paper not available using Google Scholar or DBLP
  - … but Google Scholar and DBLP will likely cover 99% of your literature

Thesis front page

Must include

- Study id number(s)
- Name(s)
- Thesis title
- Name(s) of thesis advisor(s)
- Month and year
- The text “Master’s Thesis”

LaTeX template

Handin of thesis report

- 2 bound copies (for advisor + censor)
  1 unbound copy (for the library)
  - information office (Ada-116)
  - only 2 copies if thesis content is confidential
- PDF to thesis@cs.au.dk and the advisor

The above is old procedure for handing in the thesis.
In the future we are moving”Digital exam” for this.

Plan

- Formalities
- Selection of advisor and topic
- MSc process
- MSc thesis
- **MSc thesis exam (oral)**

MSc thesis exam

- Question
  - given to the student one week before the exam
  - typically stated so that the student has the possibility to shine
- Presentation (30 min)
  - starting point is the question given one week earlier
- Examination (30 min)
  - pleasant discussion (well, mostly…)

MSc thesis exam

- Preparation:
  - read the question given (!)
  - read the thesis (!)
  - read the curriculum (= references)
  - test talk
  - feedback from advisor on drafts of slides, structure of presentation, ...

MSc thesis exam

The advisor's change of role:

- "why did you not state this earlier?"
- probably the first time the advisor has seen the complete report
- focused guidance meetings are the key to avoid surprises

Grading

- In principle the grade is given relatively to the learning goals in the study regulations (see slide 7)
- Reality:
  - **results** according to the problem statement
  - **ambition level** in problem statement
  - **readability** of the thesis
  - **coherence** between problem statement, selected methods, content, and conclusion (“the red thread”)
  - description of **related and future work**
  - **the presentation**
  - **the examination**
- Program code counts 0 % - but is a prerequisite for writing a good report

Some statistics…

- 68 graduated MSc's during Oct. 2011 - Sept. 2013 (CS + IT Product Development)
- 25 % did group thesises (most frequently 2 persons)
  - lowest grade 7
  - average 10,18
  - everybody passed 1st exam
- 75% did individual thesises
  - lowest grade 02
  - average 9,06
  - 90,2% passed 1st exam with an average of 9,35