The Master Thesis Proposal

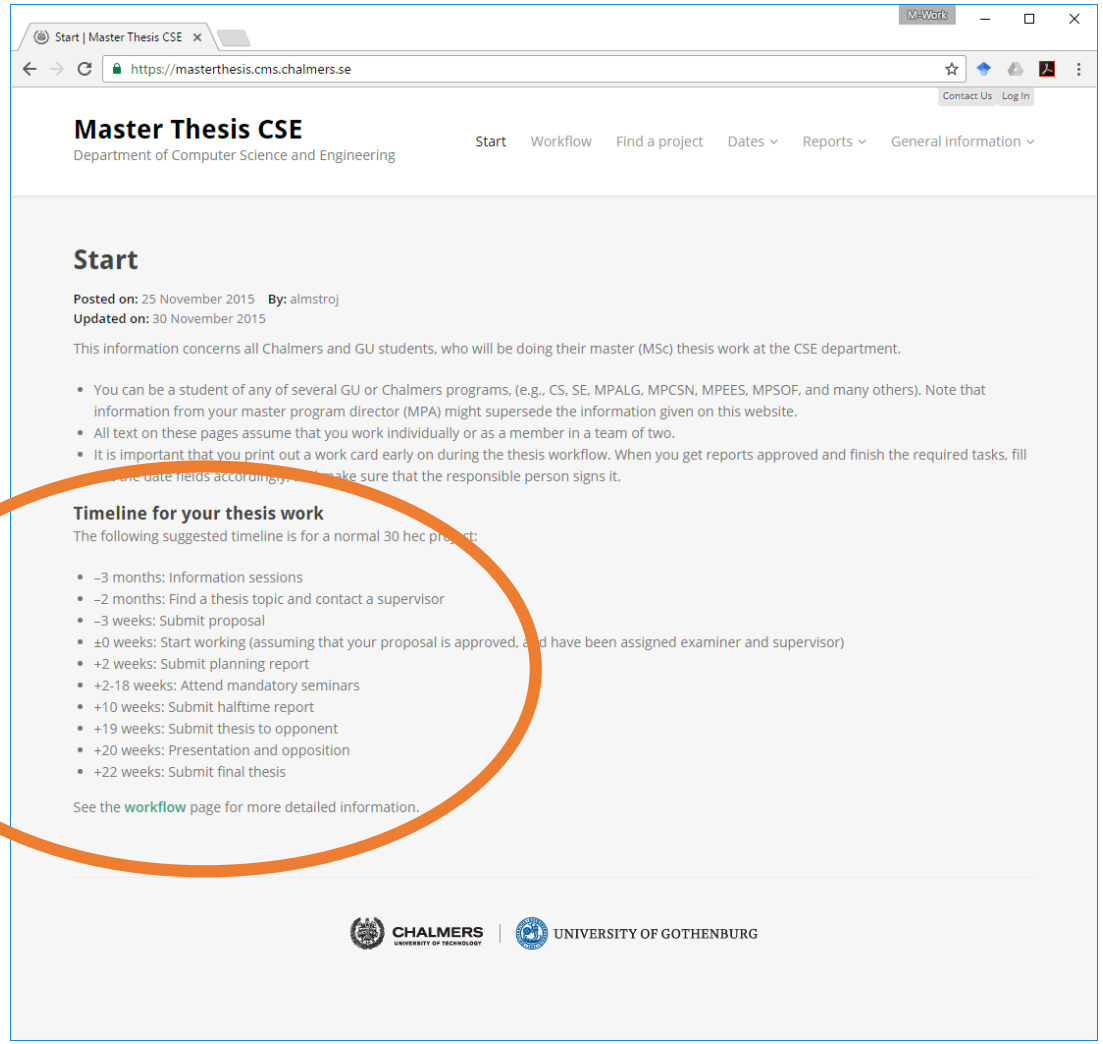
Outline for Today

- Overview
- Chalmers Requirements
- The Thesis Proposal

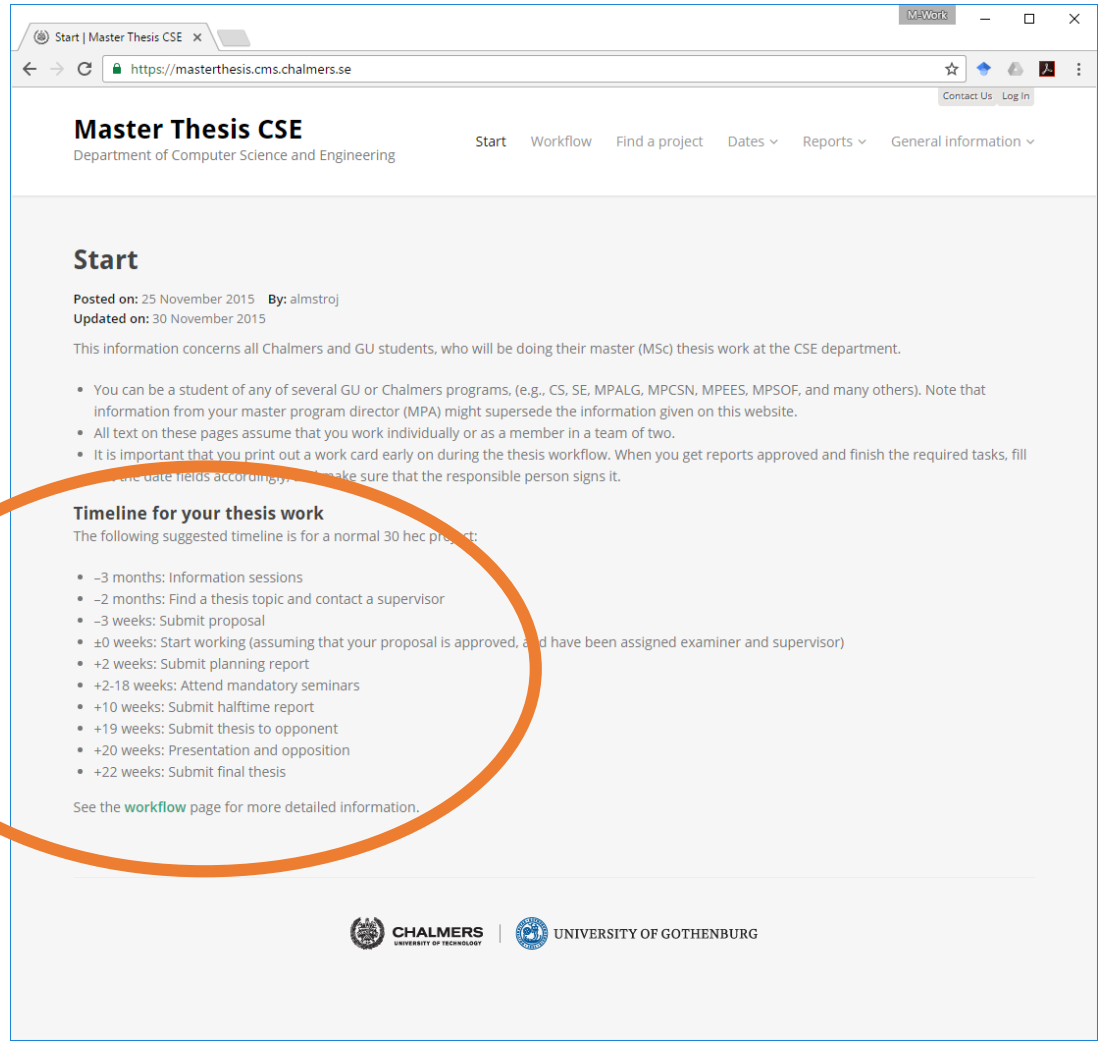
- Break

- Do and Don’t in the proposal
- Next steps for you
- Conclusions and Questions

https://masterthesis.cms.chalmers.se/



Good resource



- Going elsewhere?
  - Make sure you complete the obligatory steps before!

Thesis Timeline

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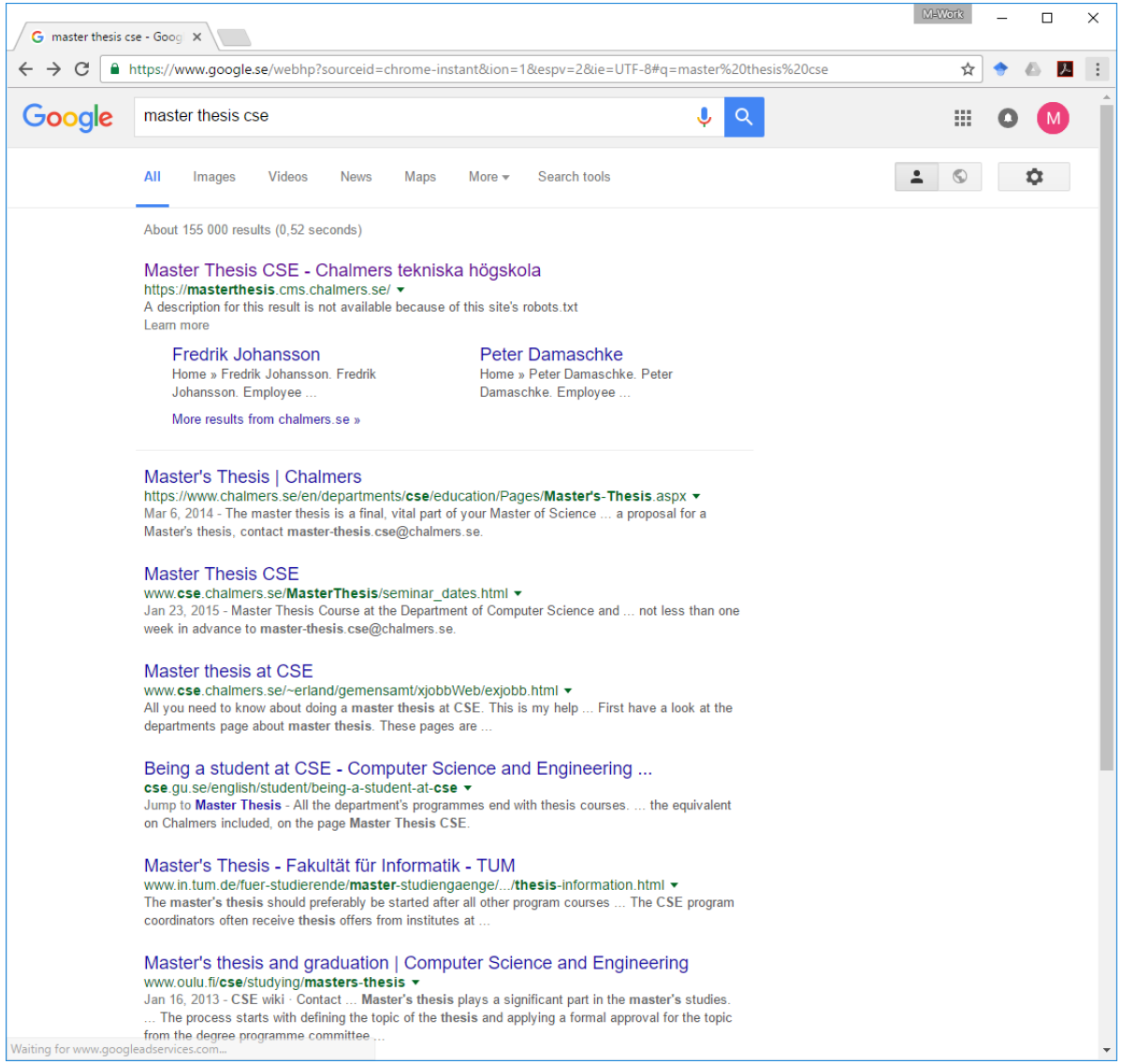
Use the "**doodle**" signup!
(more about this later)

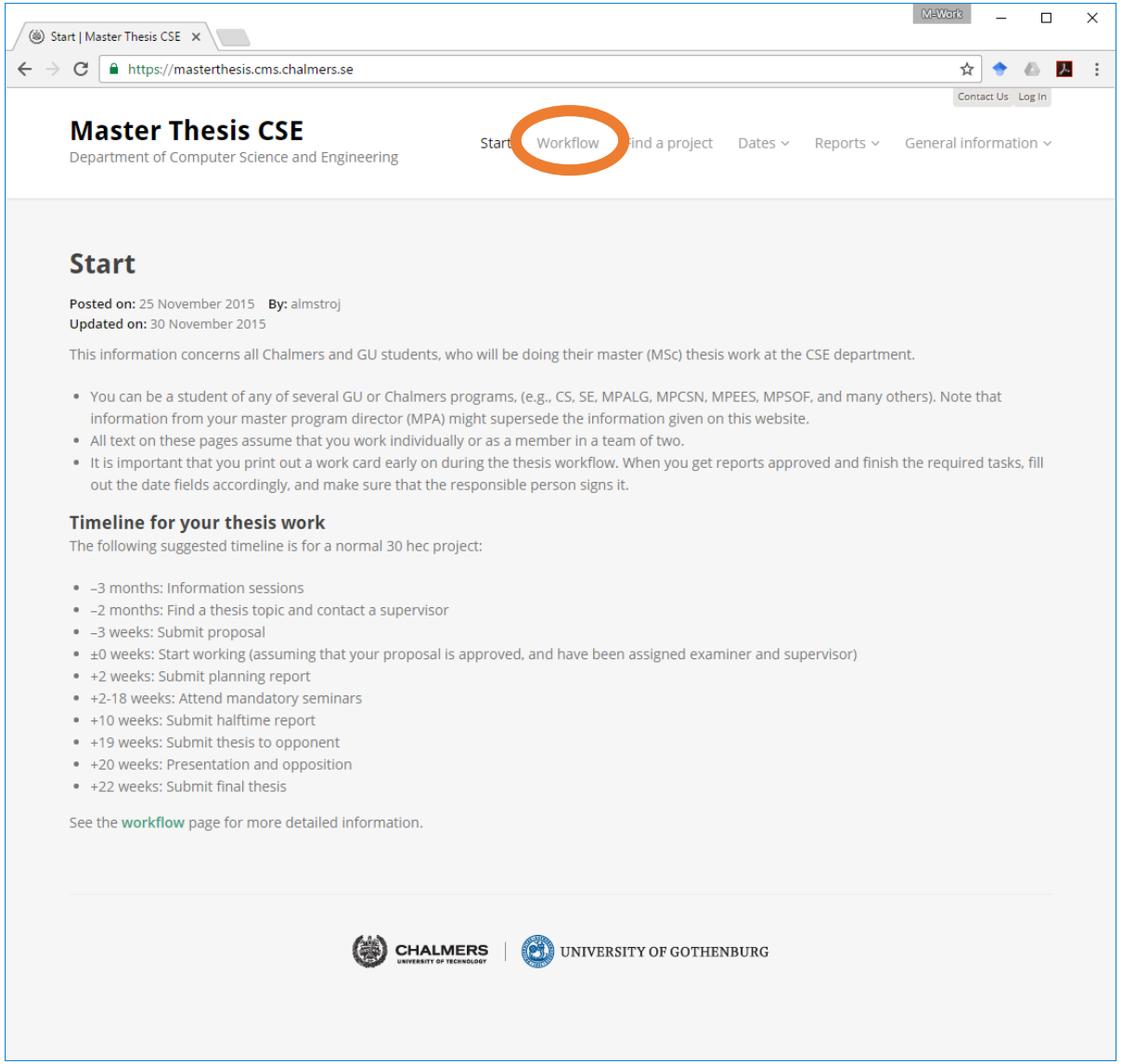
–2 months
Find a thesis topic and contact a supervisor

- Go to the information page about Master Thesis at the department



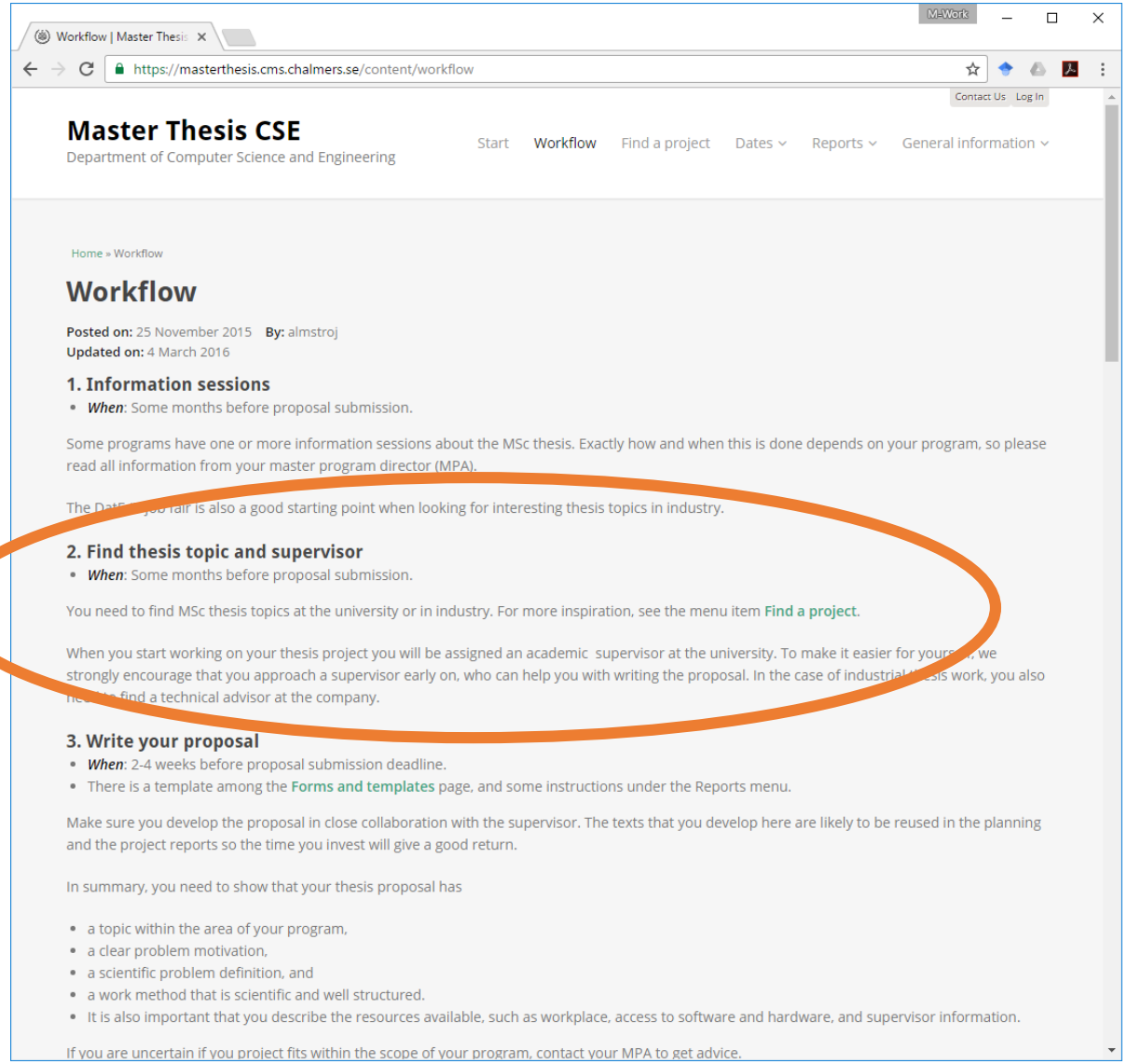
–2 months
Find a thesis topic and contact a supervisor

- Go to the information page about Master Thesis at the department
- Read all(!) information
- Here, go to workflow.



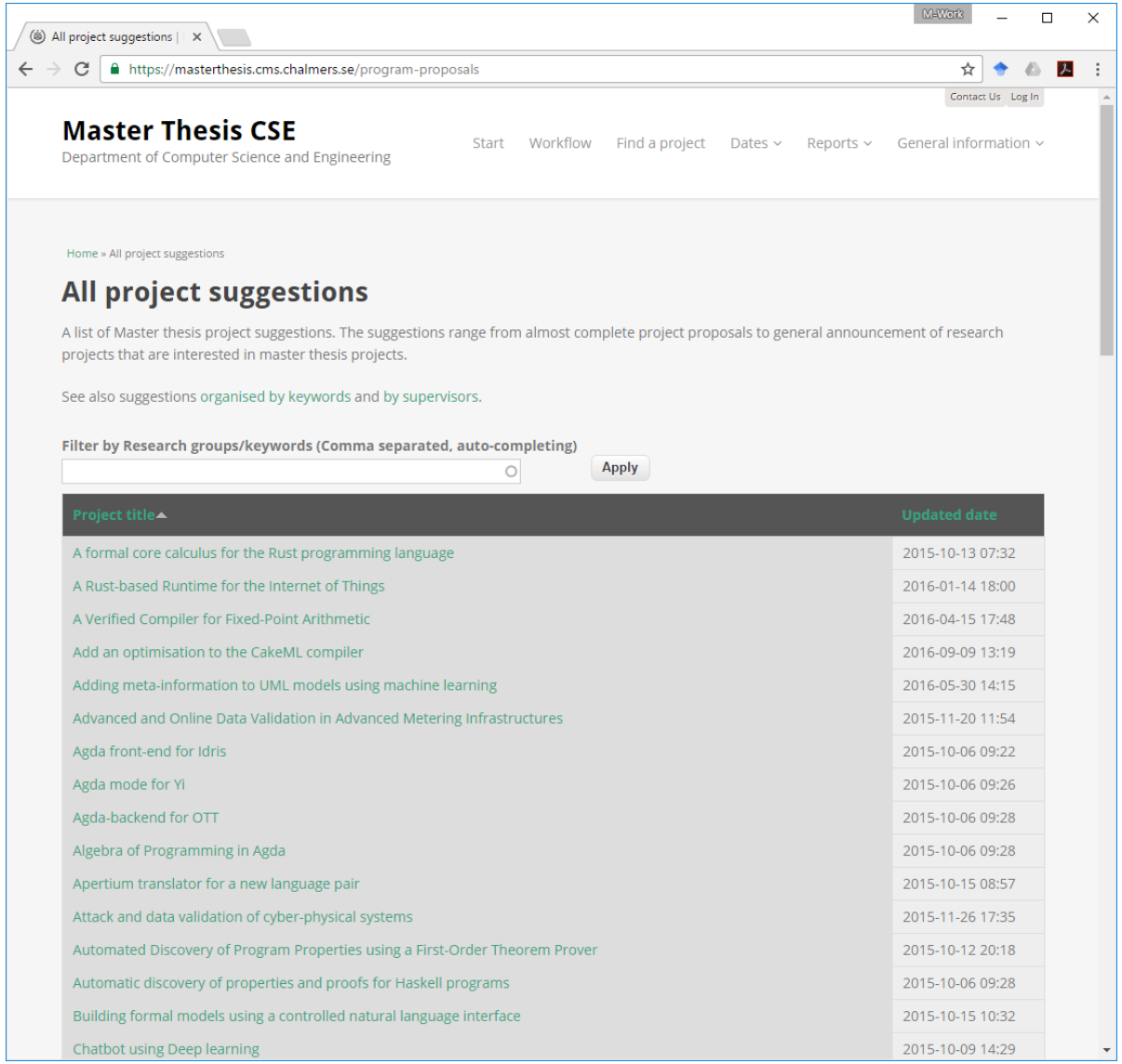
–2 months
Find a thesis topic and contact a supervisor

- Go to the information page about Master Thesis at the department
- Read all(!) information
- Here, go to workflow.
- Read the details:
  - Find a project



–2 months
Find a thesis topic and contact a supervisor

- Go to the information page about Master Thesis at the department
- Read all(!) information
- Here, go to workflow.
- Read the details:
  - Find a project
- Check the project database
- Find what you like but …
  - Do you have the prerequisites?
  - (more on that later)



Instructions for Theses on the Master of Science

https://student.portal.chalmers.se/en/chalmersstudies/masters-thesis/Documents/Instructions_for_Theses_2016.pdf

In force for theses initiated from 29 August 2016

Aim and Learning Objectives

- Develop in-depth knowledge, ability and approaches
- Deepening and synthesis of previously acquired knowledge.

1. Apply significantly specialized knowledge related current research and development work in a scientifically correct way,
2. Choose and justify the choice of methods,
3. Contribute to R&D work: relate the work to the relevant scientific and technical/industrially contexts
4. Deal with complex issues critically and creatively,

Aim and learning objectives

5. Plan, perform and critically evaluate highly qualified tasks,
6. Create, analyse and critically evaluate technical solutions,
7. Integrate knowledge critically and systematically,
8. Present solutions in English, as well as the knowledge and the arguments on which these are based
9. Identify relevant societal, ethical and ecological aspects
10. Ethical aspects of the research and development work
11. Identify and discuss the need for additional clarification of various aspects of the project prior to implementation

Examiner

- The examiner bears the scientific and quality-related responsibility for the thesis, as well as for compliance with the learning objectives.
- The examiner sets the grade for the thesis.
- Only persons who hold a post and who have a permanent association with Chalmers may be appointed as examiner.
- The examiner may appoint one or more supervisors.
- The supervisor then provides scientific and technical support for the student and assists the student/s with the practical processes.

Preconditions for starting work on the thesis

- In order to start work on the thesis, students must have earned at least 225 credits on the programme.
- Students who have only been enrolled on the Master's programme must have earned at least 45 credits within the programme.
- Also, the courses provided necessary prior knowledge for the specific thesis shall have been completed.
- The examiner formulates and checks such prior knowledge requirements.

Initiation of work on the thesis

The thesis is normally initiated in one of the following ways:

- The student contacts a company or a department with a thesis proposal. The student contacts at the same time an examiner at Chalmers.
- A company contacts Chalmers and suggests a thesis topic.
  - We do have such thesis with Volvo cars and ABB
- A department suggests a thesis.

https://masterthesis.cms.chalmers.se/program-proposals

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You have a Topic

- Assume you have found an interesting topic
  - Either from academia or industry

- Now, you need to write the proposal

Thesis Proposal

- Length goal: 2 - 3 pages
  - This compactness does not make writing the proposal easier

    “I didn't have time to write a short letter, so I wrote a long one instead.” (Mark Twain)

  - It does not mean that you can be fuzzy or unclear just because you don’t have space... the extra details can go to the appendix.
- Note: The exact content highly depends on
  - Your thesis topic and its focus
  - Your supervisor --- this is my way...

Thesis Proposal: Outline

1. Introduction
2. Context
3. Goals and Challenges
4. Approach
5. References

Introduction

- Describe your project:
  - What will you do?
- Motivate your project:
  - Why do you do what you do?
  - Why does it matter?
  - Why does it make the world a better place?
  - What does your work enable? How does it improve today’s knowledge?
  - …

Context

- Discuss the state of the art / related work
- Two goals here
  - How does your project relates to today's knowledge?
    - This is the state-of-the-art knowledge you improve
    - Show that the problem / application / challenge addressed in your thesis have not been solved by others
    - This is the research front
  - What can you base on?
    - This is background knowledge you use
    - On which established knowledge etc., will you leverage?
    - "Standing on the shoulders of giants"
    - Research, open source projects, …

Goals and Challenges

- What will you do?
  - Be concrete: We will build the first rocket to land on Mars
- What features will your result have?
  - Be concrete
    - It can fly, land on Mars and return to planet earth
  - Make sure your objectives can be evaluated and measured:
    - The round-trip is no longer than 10 years
    - Consume X litre of rocket fuel per mile
    - Hold 10 astronauts
    - …
- What are the challenges?
  - Which questions need to be answered to reach above goals?
  - Why is this worth a full master thesis?
  - What can go wrong?

Approach

- How will you realize your goals?
  - Outline the ingredients
    - Design, implementation, formal methods, data, evaluation, …

Approach: Design

- Discuss your design
  - Incl. concept, algorithms, formal methods, data …
- The big picture
  - What components does your solution have and why?
- Discuss each key component
  - Goals
  - Concepts
  - Algorithms

Approach: Implementation

- How will you implement your project?

- Platforms
- Tools
- Libraries
- Languages
- …

Approach: Evaluation

- Do not forget: Evaluation
  - How will you show that you reached your goals?
  - Example micro-benchmarks:
    - How will you test each component of your rocket? What do you measure?
    - Evaluate the impact of different configurations / parameters on the performance of your system
  - Example: Macro benchmarks
    - Will you fly your rocket to Mars and back? Do you plan to consider fuel consumption? Ability to produce energy on board? How do you measure these?
    - Compare your system to the state of the art: other rockets, other fuel consumption / production system. Read the literature and see how do they evaluate their systems.
  - What platform/ testbed/ environment will you use?

References

- References to the state of the art & background & motivation …
  - As needed
  - Cite key references only
  - Make sure you cite high quality references
    - E.g., Book chapters, ACM/IEEE journals & conferences

Notes

- Writing a thesis proposal is a challenging task
  - You need to show that you fully understand your problem
    - Incl. goals, approach, the state of the art in the field, its evaluation, …
  - This is challenging
    - Use help from (industry) supervisor
  - This is rewarding
    - You can recycle some of your thoughts into the planning report

- Discuss with (industry) supervisor
  - Define goals, approach etc.
  - Identify state of the art
  - Discuss evaluation

Getting Started

This is general for Chalmers, CSE requires more

- The student shall write the thesis proposal using the provided guidelines.
  - It is best practice that the student approaches the relevant examiners and / or supervisors and ask whether they would like to supervise this these.
- The student then follow in submission instructions https://masterthesis.cms.chalmers.se/content/workflow

Behind the Scenes

This is general for Chalmers, CSE requires more

- The examiner shall assess and approve that implementation of the proposed thesis leads to the student developing the knowledge, abilities and approach included in the thesis learning objectives.
- The Director of Master's Programmes (MPA) shall assess and approve that the proposal is within the main area of the Master's Programme.
  - The MPA may make a decision on whether a specific thesis is within the main area of the Master's Programme, even if the department where the thesis is performed does not belong to the main area.
  - The MPA shall also assess and approve that the thesis is relevant as regards the technological scientific field.

Behind the Scenes

This is general for Chalmers, CSE requires more

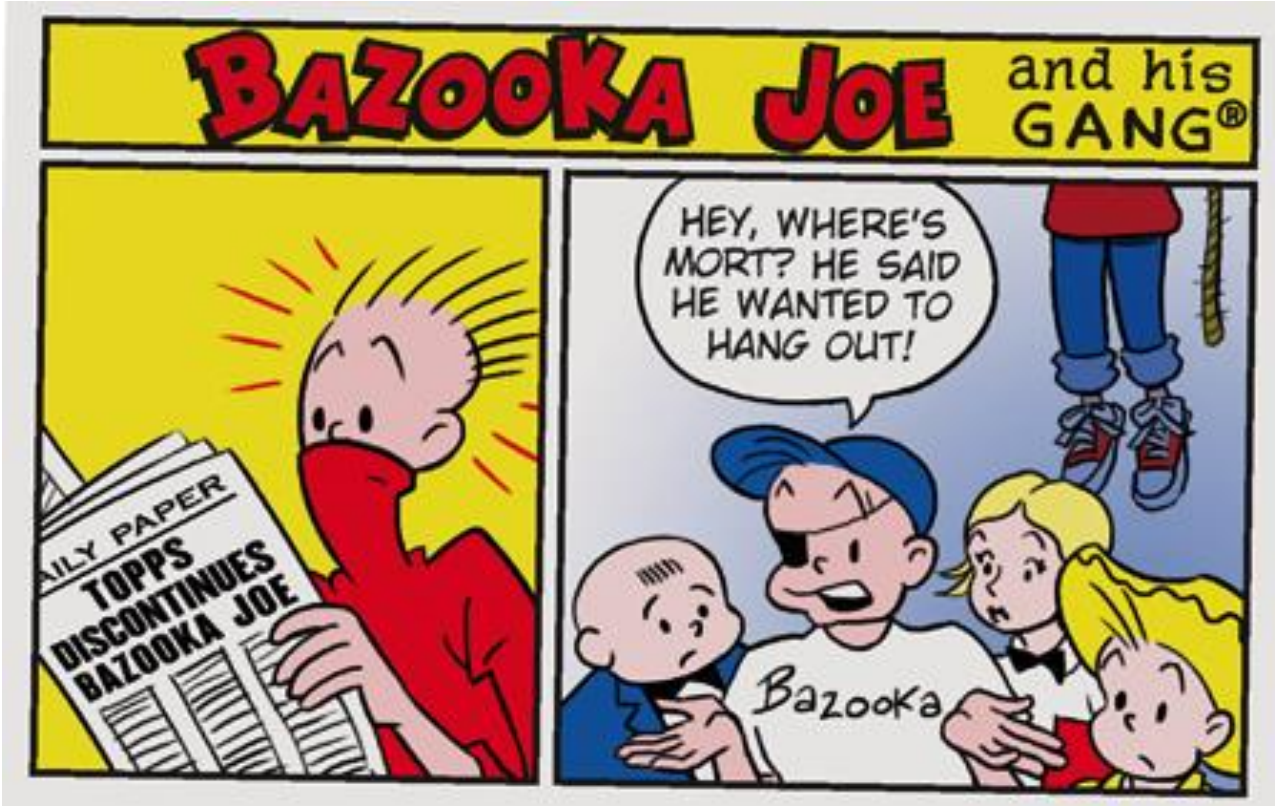
- The education office registers the student in LADOK.
- The student/students is issued a work card from the Student Portal which is to be retained throughout the thesis period.
- The examiner signs for the compulsory components of the thesis course when these have been approved.

- Then, everything set to go!

How did Bazooka Joe got his Master Thesis Proposal Rejected 8 Times

Meet Bazooka Joe

- Bazooka is a student that wanted to get his master thesis proposal approved.
- He found a copamy that was ready to host his project.
- He read send in his proposal and got it rejected ten times.
- This is how it all happened...



Bazooka Cloned the Company Advertisement

- Until several years ago, the civilingenjör degree required a 15 pt vocational training called examensarbete via industrial engineering projects.
- It was decied that all Chalmers civilingenjör programs will also provide a degree in master of science with a 30 points research thesis.
- The company advertisement have these 15 pt vocational training in mind rather than a thesis project for a degree in master of science.

- The examiner said that that Bazooka’s proposal was cloned and rejected it.

He Had Not Promised to Provide Analys

In Computer Science and Engineering, we either

- provide new theory (Theorems, Lemmas, etc.) or
- conduct experiments (compare numbers and graphs)

- Companies consider other kinds of work, such as user manuals, literature reviews, planning reports, etc.

- The examiner said that Bazooka's proposal was empty and rejected it.

He Focused Only On the Soultion

- The examiner rejected Bazooka's proposal and said that the problem was not defined.
- There is a need to define the problem by stating clearly the goals and challenges.
- It cannot be only engineering challenges because there is a need to explain the science behind.
- It cannot be a trivial problem or a problem that has already been solved.
- Bazooka then revised his proposal and resubmitted.

He has not Discussed the Problem Relevance

- The examiner rejected the proposal and said that Bazooka has not explained the importance of the proposal to study a problem.
- The examiner suggested to explain what is important with respect to:
  - the practice
  - the existing or future of the applications, or
  - other people's work trying to solve the problem.
- There is a need to explain the new knowledge gained and the applications of this new knowledge.
- Bazooka then revised his proposal and resubmitted.

He Assumed that the Novelty is Obvious

- The examiner rejected Bazooka's proposal and said that there is no novelty.
- This does not mean that there is indeed no novelty, it is just that Bazooka has not highlighted what is new.
- There is a need to use the word new next to any claim of novelty and to explain why.
- The related work (the Context section) is a great place to do so.
- Bazooka then revised his proposal and resubmitted.

He Wrote All he Had and Told his Story

- Bazooka highlighted more than just one problem.
  - He offered to solve problem X, Y, Z,...
  - The examiner said that there is no focus
  - *Sometimes there is a need to consider more than one finality*
- He also provided all the details about the company in which the thesis will be done, their products, how he found the project, who are the people working there…
  - The examiner said that the proposal included irrelevant details
  - *Sometimes there is a need to describe the available competence*
- Bazooka then revised his proposal and resubmitted.

Bazooka Had not Considered Testing

- There is a need to list the:
  - design properties,
  - key functionalities,
  - performance goals,
  - evaluated system vulnerabilities,
    - e.g., with respect to scalability, memory, energy.
- There is a need to point out the test environment and/or testbed.
- The examiner rejected Bazooka's proposal and said that the project consider a system but does not include an implementation
- Bazooka then revised his proposal and resubmitted.

Bazooka Focused Only On the Content

- There were many typos, grammar mistakes, missing references, style, etc.
- He also wrote many more pages than two.
- The examiner rejected Bazooka's proposal and said that it premature.

- Examiner usually divide their pile of proposals to group A and B
  - A --- reject immediately
  - B --- read more carefully

don't be like Bazooka Joe ;-)

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Thesis Timeline: https://masterthesis.cms.chalmers.se/

Next steps for you …

–3 months
- Information sessions

↓

–2 months
- Find thesis topic and contact a supervisor

- Attend Information Sessions
  - This one …
  - Others
- How to contact supervisors and find topics?
  - Sign up for doodle slots
    - Round 1: Sign up week (week 38); negotiation weeks (weeks 39 to 41); relevant deadline 22 October 2017
    - Round 2: (week 42); negotiation weeks (weeks 43 to 45); relevant deadline 11 December 2017
    - Round 3: (week 46); negotiation weeks (weeks 47 to 49); relevant deadline 10 December 2017
    - Round 4: (week 50); negotiation weeks (weeks 51 to 03); …

Contacting a supervisor

Do your homework

Check the project database to find proposals.

Do you know the research of the supervisor?

- Check the homepage?
- What are the projects, are there any links with information for thesis workers?

Have you taken the course of the supervisor?

- ***Did you do well in the course?***

Contact: doodle (email / class)

What are you interested in?

Give a background of yourself, and please indicate whether you have taken the relevant courses.

Please **always** include a transcript in the first email.

Start early

I have a limited number of slots for thesis students

Sometimes my workload is quite high
→ it might take me a while to answer you

I probably prefer to work on ”my suggested projects” (instead of yours);
my topics might be what I need to do in my research

–2 months
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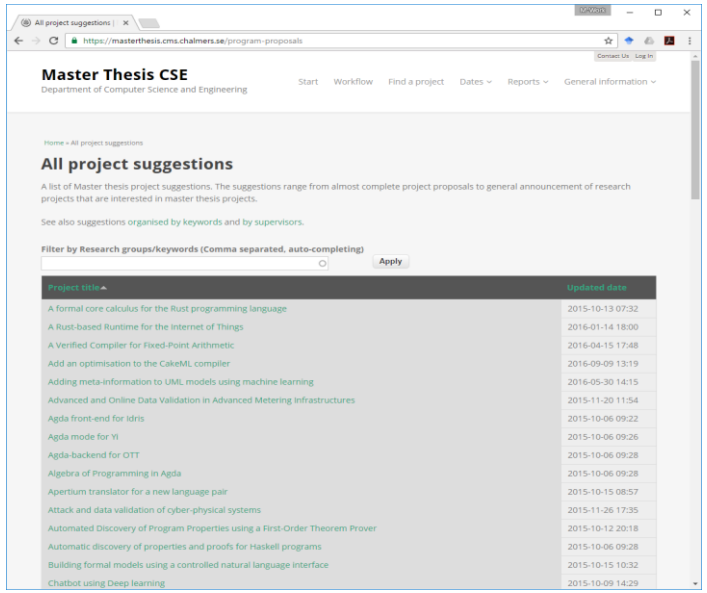

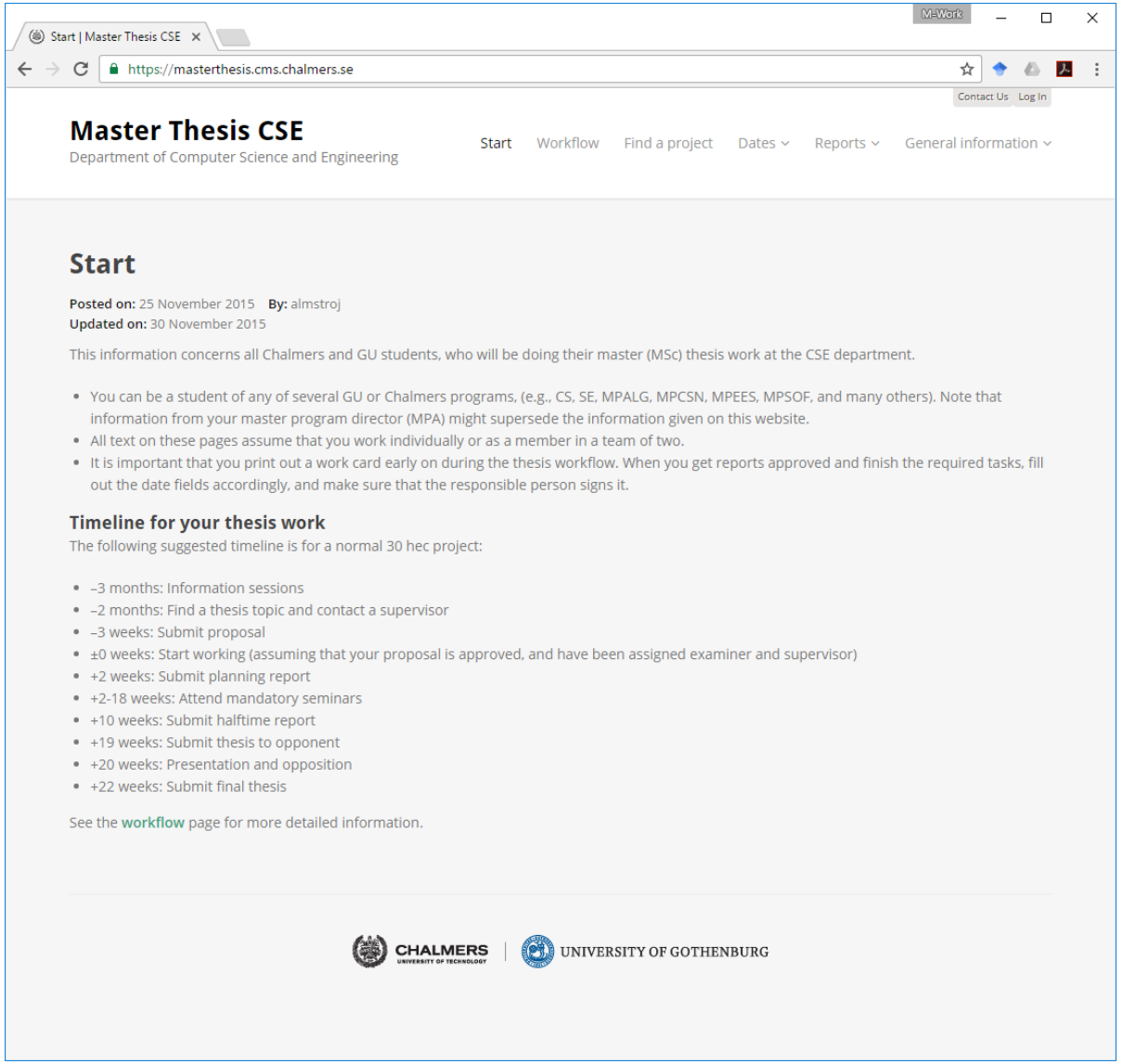

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Contacting a supervisor (emails)

Hi Magnus,

I have looked in the project database, and I am very interested in the thesis proposal “Attack and data validation of cyber-physical systems.”

I am a student of the Master’s program “Computer Systems and Networks” at Chalmers (GU). I followed the security track and have passed Computer Security, Network Security, and Cryptography. However, even more useful for the requirements of this topic is that I have substantial background in embedded systems and assembly programming. I am also well aware of mutation-based fuzzing. I also regularly attend OWASP in Göteborg.

I have finished all my courses, so the only thing left is the Master thesis and I would like to start in November.

I think this particular thesis topic would fit me well, but if it is already taken by other students, I would like to discuss other opportunities in security.

Let me know when you have time to meet for discussion. My grade transcript is attached.

Best regards,
student X

Hi Magnus!

I am looking for a Master thesis and would like to meet with you. Do you have any times this afternoon?

Best regards,

Student x

- Hi Magnus,
- I have looked in the project database, and I am very interested in the thesis proposal “Attack and data validation of cyber-physical systems.”
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- Let me know when you have time to meet for discussion. My grade transcript is attached.
- Best regards,
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Be specific, show me that you have thought about this **before** you contact me.

- Hi Magnus,
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- Best regards,
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Tell me about you: which program and background. Are you Chalmers/GU?

I want to know you have the required background: if you have not taken my courses, my (specialized) master thesis is probably not for you.

Also, if you can tell me that this is a personal interest I will be even more interested.

- Hi Magnus,
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- Best regards,
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I like to know how much other activities you have at the same time you do your thesis.

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If you have reasons why the thesis fits you, please tell me.

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- Let me know when you have time to meet for discussion. **My grade transcript is attached.**
- Best regards,
  student X

My days at Chalmers are quite busy, so contact me early. It might take me at least a week to meet. Always include your transcript.

Contacting a supervisor

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Contact: doodle (email / class)

What are you interested in?

Give a background of yourself, and please indicate whether you have taken the relevant courses.

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Start early

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my topics might be what I need to do in my research

Conclusions

- Thesis is a fun and nice way to complete your studies
- It is a bridge between your life as a student and your next step
  … be it PhD student, working in industry or startup

- BUT start early!
  - Find a topic
  - Write your proposal