Research Planning, 3p
www.mrtc.mdh.se/han/FoPlan/

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MÅLARDALEN REAL-TIME RESEARCH CENTRE
**RPC Lecture 1 (meeting 1+2)**

1. **Welcome**
2. **Presentation of participants**
3. **Intro to course**
4. **Distinguished guest (15:30-16:30)**
   - Ivica Crnkovic, Prof. Software Engineering, MdH
5. **Planning the course (scheduling)**
6. **Presentations (assignment 1)**
7. **What is a research plan?**
8. **Assignment 2 (presentation/discussion)**
Presentation of participants

1. Dejan Baca, Ericsson&BTH, dejan.baca@ericsson.com
2. Moris Behnam, MDH, moris.behnam@mdh.se
3. Stefan Björnander, MDH, stefan.bjornander@telia.com
4. Annette Böhm, HH, annette.bohm@ide.hh.se
5. Fredrik Ekstrand, MDH, fredrik.ekstrand@mdh.se
6. Jimmie Hagblad, MDH, jimmie.hagblad@mdh.se
7. Kristina Kunert, HH, kristina.kunert@ide.hh.se
8. Jimmie Wiklander, Kalix Electropolis&LuTH, jimmie@sm.luth.se
9. Fredrik Österlind, SICS, fros@sics.se
10. Jayakanth ”JK” Srinivasan, jksrini@MIT.EDU
Houston, we have a problem...

• The group is a bit too big…
  – Interactions and discussions are essential elements of this course
  – Everyone should be on stage at least three times (totally about an hour)
  – The course will be given also after the summer (this time as an ARTES course)

• Anyone, that wants to wait until then?
• … on the other hand, practical problems can be solved
Research planning

• Is not a course about scientific methods
• Is not a course about a specific scientific/engineering topic
• ... and a few other "Is not a"
• ... It may not even be a course;-)
Research planning

• Is an exercise in formulating a research plan
• Intended as "kick-start" for PhD-studies
• **Shared experiences are multiplied experiences!**
• Will give perspectives (by realizing that there are substantial **differences and similarities** between studies of different students)
Research planning

• It is up to you!
• Active participation required!
• Will provide an important part of your thesis (but not your main contributions;-)
• If you haven’t done this already:
  – ask your supervisor for 10 theses in relevant areas
  – Identify the different elements of the theses
  – Is there a common pattern?
  – This should have been assignment 0
    • You should do this before completing the course
A PhD/Lic thesis

• Generic structure (not always in this order and structuring into sections/chapters varies)
  – Motivation (why?)
  – Problem definition (what?)
  – Contributions (what’s new?)
  – Related work (what’s already done?)
  – Approach/Methodology (how?)
  – Organization of thesis (how presented?)
  – YOUR WORK (← this is why you need at least 4 years)
  – Conclusions (this is what I think I’ve done)
  – Future work (this is what I didn’t have time to do)
  – References
Overview of course

1. Assignment 1
   – You know all about it; presentations and discussions expected.

2. Assignment 2
   – Research area overview (state of art and practice).
   – Report + review of reports

3. Assignment 3
   – Research overview and plan
   – Report + review of reports

4. Guest lectures
   – My experiences (a former PhD give his/her story)
   – My research (a senior researcher presents a research area)
   – Specific topics (if needed; any suggestions?)
Research Method

• Ad hoc homebrew not enough
• Must be based on and related existing knowledge
• Different approaches:
  – Deductive methods.
  – Inductive methods.
  – Building models. Simulation.
  – Qualitative Methods

Positivistic (facts)
“Science or Interpretation”

• “Science” (*naturvetenskaplig* approach)
  – Theory
  – Derive a hypothesis (from theory)
  – Formulate experiment to test hypothesis
  – Perform experiment (test hypothesis)
  – Evaluate results =&gt; positive/negative evidence
  – If contradiction: modify theory
“Science or Interpretation”

• “Interpretation” (social sciences)
  – Perform investigation (collect data)
  – Develop model (theory) that explains
  – Integrated development of theory and data collection

• Social scientists are explorers!
• Scientists are “looking for oil”!
Research Results

• What is a result?
  – Knowledge!!! E.g. negative results (publications)
  – algorithms and methods

• Experimental results/evaluations
  – not always proper set-up (see what happened when we tested X)
  – exhaustive experiments and comparisons important
  – evaluation methodology (statistical methods)
  – reproducibility (often forgotten in CS)
Deductive methods

• Theoretic methodology:
  Def. - Theorem - Proof
• Theoretical Computer Science
Inductive methods

• Experimental methods:
  » Hypothesis
  » Experiment/Evaluation => +/- evidence

• “Science”
Building Models; Simulation

• Build a model
• Validate that the model faithfully captures the relevant aspects of the modelled system
• Treat simulation model as “reality”
  » Hypothesis
  » Experiment/Evaluation => +/- evidence
• Generalize the results to the real system
Qualitative (Hermeneutic) Methods

• Interpretation (social sciences)
• Observation
• Build model to explain (theory)
• Refine … Test…Discuss…Deeper understanding
  – “Hermeneutic circle” (hopefully converging;-)
Computer Science Research Approaches

- Classification:
  
  **Applied**
  - Evaluation of the use of a specific algorithm

  **Theory**
  - Formal correctness proof for algorithm
  - Complexity Theory
  - Theory for Parallel Systems

  **Basic**
  - Study of the dynamics of internet traffic

  **Experiment**
The academic Career

- Undergraduate exam
- Graduate education => Lic and/or PhD
- PostDoc.
- Lecturer (Teacher/Researcher)
- Docent
- Professor
- Professor emeritus
Guidelines for Graduate Education

- General:
  - research plan before admission
  - publication plan
    - one conference paper/yr from yr. 2
    - journal paper on PhD-topic
  - TA-duties and co-advisor to MSc-students
  - conference trips and summer schools
  - int’l visits: 2-3 weeks (lic); 2-3 months (PhD)
Planning the course

• Workshop 1
  – Meeting 1 (Today 1:30-17)
  – Meeting 2 (Tomorrow 8:30-12)

• Workshop 2
  – Meeting 1 (Mon Dec 10 – 13:30-17)
  – Meeting 2 (Tue Dec 11 – 8:30-12)
    – (Assignment deadline: 7 days before WS)

• Workshop 3
  – Meeting 1 (Mon Jan 21 – 13:30-17)
  – Meeting 2 (Tue Jan 22 – 8:30-12)
    (Assignment deadline: 10 days before WS)
Student presentations

1. Dejan Baca, Ericsson&BTH, dejan.baca@ericsson.com
2. Moris Behnam, MDH, moris.behnam@mdh.se
3. Stefan Björnander, MDH, stefan.bjornander@telia.com
4. Annette Böhm, HH, annette.bohm@ide.hh.se
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Second meeting of WS 1

• Call for dropouts was not successful ;-)  
  – 14 students + one sit-in  
  – Too large group  
    • Everyone should participate in all discussions  
  – Let’s split in two groups  
    • How?  
      – Similar together?  
      – Similar apart?  
    • Any suggestions?  
  – I’ll decide off-line
What is a research plan?

• From dictionary:  
  PLAN = "A scheme, program, or method worked out beforehand for the accomplishment of an objective"

• There are many ways of writing a plan

• This course provides one example  
  [which I think provides a good introduction to what research is all about and helps you focus on the objective: writing a thesis]

• The plan may even save you a year or so!
But remember

• A plan is just a plan...
• The only thing you know is that you will not follow the plan (at least not in detail)
• The nice thing is that you can always revise the plan ;-}
So......

• What is a research plan in this course?
  – Research problem
  – The platform on which you build your research
    – State of the art (results, publications)
    – Research community (conferences, researchers)
  – Your plan of activities
    – From now to completion of thesis
    – Activities and milestones
    – Time plan

A PhD/Lic thesis

• Generic structure (not always in this order and structuring into sections/chapters varies)
  – Motivation (why?)
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  – Approach/Methodology (how?)
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  – YOUR WORK
  – Conclusions (this is what I think I’ve done)
  – Future work (this is what I didn’t have time to do)
  – References
Only one thing remains after the course

- To execute the plan....
Assignment 2

• Updated version of assignment 1 (considering today’s discussions etc.)
• Research overview
  – Current research issues and hot topics
  – State of practice (key industrial players, type of "technology" available, etc.)
  – State of art (central literature, including seminal papers)
  – The research community (key conferences and leading research groups)
  – Relation to and relevance for own research
  – References
Assignment 2

• How do you find
  – Current research issues and hot topics
  – State of practice (key industrial players, type of “technology” available, etc.)
  – Central literature, including seminal papers
  – Key conferences and leading research groups
  – Relation to and relevance for own research
  – References ?

• With a little help from your friends
  • Supervisor(s)
  • Fellow students
  • Colleges
  • Literature and web
  • (some of you have already written state-of-art overviews; reuse is fine, but spend an extra effort on the weak parts, possibly contacting leading researchers, industry, etc.)
Questions/Discussion

- About assignment(s)
- About course
- Special requests
  - Lectures by guests etc.
Thank you!

• See you next time....
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