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

Hans Hansson
Mälardalen University

MRT
MÄLARDALEN REAL-TIME RESEARCH CENTRE

RPC Lecture 1 (WS1)

- Welcome
- Presentation of participants
- Planning the course (scheduling)
- Intro to course
- Presentations (assignment 1; Ana)
- Distinguished guest (11-14)
  - Ivica Crnkovic, Prof. Software Engineering, MdH
- Presentations (assignment 1)
- What is a research plan?
- Assignment 2 (presentation/discussion)
Presentation of participants

1. Federico Ciccozzi
2. Sara Dersten
3. Petra Edhoff
4. Juraj Feljan
5. Luka Lednicki
6. Andreas Ljungberg
7. Josip Maras
8. Saad Mubeen
9. Ana Petričič
10. Mehrdad Saadatmand

Planning the course

• Workshop 1
  – Today (full day)
• Workshop 2
  – October 5, 8-9, 16 or 26-29?
  – Lunch to lunch; starting at 1:15 Day 1?
  – (Assignment deadline: 4 work-days before WS)
• Workshop 3
  – November 2, 5-6, 13?
  – Lunch to lunch; starting at 1:15 March 17
  – (Assignment deadline: 7 work-days before WS)
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 to 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 => positive/negative evidence
  – If contradiction: modify theory

• “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
Computer Science Research Approaches

- Classification:
  - Applied
    - Formal correctness proof for algorithm
  - Experiment
    - Evaluation of the use of a specific algorithm

Theory
- Complexity Theory
- Theory for Parallel Systems

Basic
- Study of the dynamics of internet traffic

The academic Career

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

PhD-track

Lic+PhD

Lic-track

Courses
S-o-t-A
Dept. duties
Courses
Research

Department:

Courses
S-o-t-A
Dept. duties
Courses
Research

Courses
S-o-t-A
Dept. duties
Courses
Research

Students:

- Ana Petričić
- Josip Maras
- (Federico Ciccozzi)
- (Petra Edhoff)
- Juraj Feljan
- Luka Lednicki
- Andreas Ljungberg
- Saad Mubeen
- Mehrdad Saadatmand
- Sara Dersten

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)

Student presentations
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

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....