CDT403 Research Methodology

in Natural Sciences and Engineering

COURSE INTRODUCTION

Gordana Dodig-Crnkovic

School of Innovation, Design and Engineering,
Mälardalen University

HISTORICAL NOTES

Course started in 1999 and it was organized by Jan Gustafsson.

Together with Jan, a number of researchers have contributed to the course and its development.

The course is organized as a ”smörgåsbord” (a buffet-style table laid out with many dishes from which one is allowed to choose)

Paper writing part of the course will mimic a real research conference procedure that will give you possibility to practice writing, presentation and reviewing of papers.

Strong Research Environments Support for Research Excellence

Research at the School of Innovation, Design and Engineering is organized in three research profiles:

Mälardalen Real-Time Research Centre (MRTC)

MRTC is a national leader in Embedded Systems research. Research at MRTC has a dominating focus on Embedded Software. MRTC's mission is to provide research excellence that enable industry to take advantage of the opportunity provided by software in products and production systems.

Strong Research Environments Support for Research Excellence

Intelligent Sensor Systems (ISS)

ISS is a research unit with research into Artificial Intelligence, Biomedical Engineering, Robotics, and Wireless Communication. The focus is on applied research on mobile and wireless sensor systems within the two application areas healthcare and industrial systems.

Strong Research Environments Support for Research Excellence

Innovation and Product Realization (IPR)

IPR is a multidisciplinary research unit, with a unique combination of research on art and design, engineering, and innovation/entrepreneurship. The research is united in a common focus on Design Science and by the shared Centre for Product Realization which is hosting a variety of multidisciplinary projects and cooperation with industry and society.

CDT403 Research Methodology in Natural Sciences and Engineering

Course Lecturers

Gordana Dodig-Crnkovic

Jan Gustafsson

Hans Hansson

Björn Lisper

Ivica Crnkovic

Mats Björkman

Lars Asplund

Diane Pecorari

Tomas Backström

Vincent C. Müller

Peter Funk

Kristina Lundqvist

Course Assistants

Abilash Thekkilakattil

Svetlana Girs

Mini-Conference Review Committee

Assignment 4 Grading


Jan Gustafsson


Hans Hansson


Björn Lisper


Paul Petterson


Sasi Punnekkat


Ning Xiong


Maria Lindén


Lars Asplund


Radu Dobrin

Course Description (1)

The course contains the following main parts:

- Theory of science/ Philosophy of science
- History of science
- Research methods for different research fields within computing
- Writing, presentation and reviewing of a research paper

The course can also be taken as a graduate (PhD) course, and adapted to students from other research fields upon agreement with the course leader and organizer.

Course Description (2)

The course will mix lectures with several assignments and discussions. The purpose is to put the learned into practice, deepen your understanding, and prepare you for your future research. The most important part of the course is to write a research paper.

No final written exam (“tentamen”) is needed if you are taking part in at least 80% of course activities. Instead a Mini Conference is organized at the end of the course which will let students practice presentation and discussion of papers.

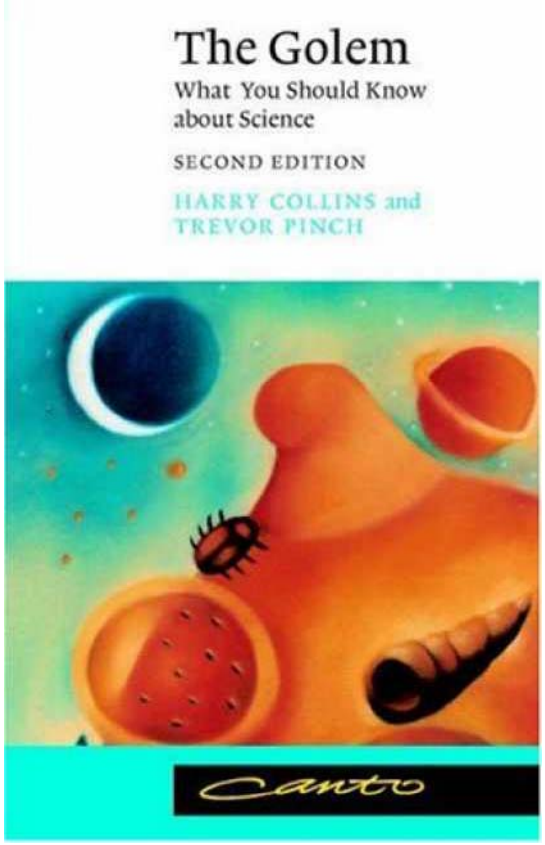
Besides, it is possible to follow CDT403 as the distance course, in which case there is special examination.

Course Material

All course material (including the course archives) can be found at the course web page:

http://www.idt.mdh.se/kurser/ct3340/

Course Material



The book used in History of Science:

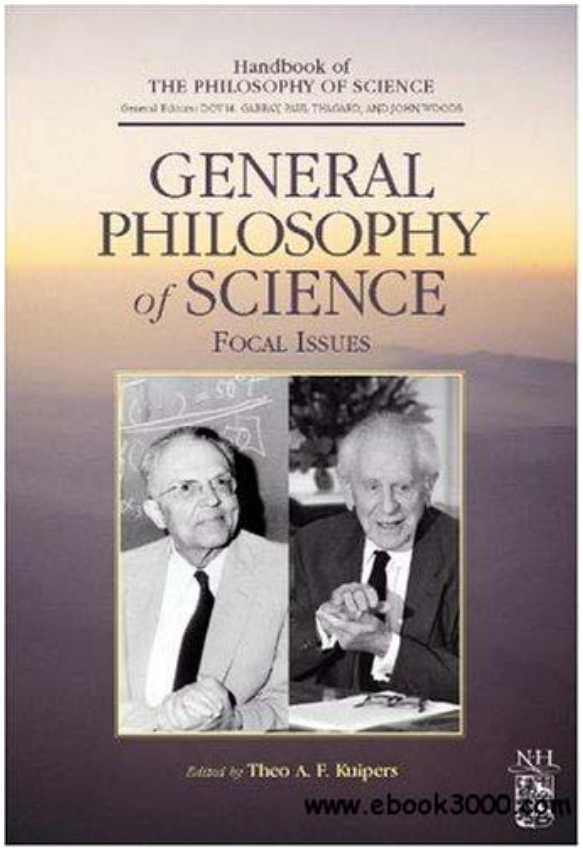
The Golem: What You Should Know about Science

Harry M. Collins & Trevor Pinch

Can be found in Google Books:

http://books.google.com/books?id=t5wovH0l-bcC&printsec=frontcover&dq=trevor+pinch&hl=sv#v=onepage&q=&f=false

Additional Reading Material



The book used in Theory of Science for more advanced study of philosophical aspects:

General philosophy of science: focal issues

Theo A. F. Kuipers

Can be found under Google Books:

http://books.google.com/books?id=qUMuFaXjNjEC&pg=PP1&dq=General+Philosophy+of+Science:+Focal+Issues&hl=sv#v=onepage&q=&f=false

Goals

"Perfection of means and confusion of goals seem, in my opinion, to characterize our age."

Einstein, 'Out of My Later Years'

Goals: Learning Outcomes (1)

- Understanding of major paradigms in scientific and engineering research, their central concepts and problems.

- Ability to analyze scientific and pseudo-scientific texts and do a critical review of these.

- Ability to review scientific papers.

Goals: Learning Outcomes (2)

- Skill of impartial argument developed during the discussions of science, pseudo-science and history of science.

- Research paper which will be presented on a mini-conference.

- Skill to oppose other presentations

- Familiarity with number of characteristic research methods within several research fields of Computing*

*Computing can be replaced by other topic of interest.

Goals: Learning Outcomes (3)

- Understanding of organization of research education, research communities, and research politics.

- Critical thinking about knowledge generation process, science and research values and their roles in the contemporary society.

Assignments (1)

Assignment 1

Assignment 1A: Review three scientific papers
(Research methodology)

- Read three published scientific papers (of varying quality) and write a short report for each of them.
- Individual work. You will assess each others review results.
- Teachers will check both the review and its assessment.

Assignment 1B: Assess your colleague's review (done individually)

NOTE: Successful completion of this assignment is mandatory in order to be allowed to do the rest of the course.

Assignments (2)

Assignment 2: Demarcation: Pseudoscience vs Science
(Theory of science/Philosophy of science)

Read selected texts, write a summary and answers to questions.
Work preferably in groups of two.

The Assignment 2 will be followed by in-class discussion.
If you miss the discussion, you will have to do both Assignment 2 and an additional Assignment 2-extra.

Assignments (3)

Assignment 3: Study three events in history of science

(History of science)

Read three chapters in the “Golem” book, write summaries and answer a few questions.

The Assignment 3 will be followed by in-class discussion.

Work preferably in groups of two.

If you miss the discussion, you will have to do both Assignment 3 and an additional Assignment 3-extra.

Assignments (4)

Assignment 4: Write a research paper

Write a research paper describing a topic of interest within your research field to be presented at the Mini conference workshop.

Work preferably in groups of two.

Assignments (5)

Assignment 5: Review research papers of your colleagues

Review other student's papers, and discuss your views at a review meeting lead by a senior researcher.

Write your reviews together with your co-author.

If you miss the review meeting you will have to do extra reviews.

Assignments (6)

Assignment 6: Present a research paper at a Mini conference

Present together with your co-author your paper at the mini conference /workshop.

Assignments (7)

Assignment 7: Review presentations of your colleagues at the workshop/Mini conference.

Prepare and ask questions to at least one paper at the mini conference/workshop.

Give feedback on presentations (anonymously).

This assignment is done individually.

Assignments (8)

Assignment 8: Take home exam

For those who do not have at least 80% of class attendance, a take home exam will be made covering knowledge you are expected to acquire in this course.

Assignments (8)

Assignment 8: Take home exam

The exam includes 1A4 page for each of the fields:

1. Theory of Science 1-4 (G Dodig Crnkovic)
2. Research Methods in Computer Science and Engineering (H Hansson)
3. Artificial intelligence (P Funk)
4. AI without Representation (V Müller)
5. Research Methods for Software Engineering (K Lundqvist)
6. Research in Robotics (G Spampinato/L Asplund)
7. Complexity (T Backström)
8. Measurement-based Research Methods in Computer Engineering (M Björkman)
9. Research Methods - Deductive Methods and Proofs (B Lisper)

Grading of Assignments

Assignments 1 - 3 (if passed) are graded 3, 4 or 5 (E-A)

Assignment 4 (research paper)

(if passed) is graded Accepted, Good or Excellent which means 3, 4 or 5 or (E-A)

Assignments 5 - 7 are not graded.

Assignment 8 (take home exam)

(if passed) are graded 3, 4 or 5 (E-A)

Submission of Assignments

In order to be able to submit your assignments 1-3, you will be given identity (user ID and password) in the beginning of the course, sent to you on your MDH student mail address.

Deadlines

Deadlines are defined at the course web page.

There is a deadline for each assignment and a definitive deadline for the whole course (Mini Conference).

Grading Policy (1)

The course is graded (3, 4, 5) (E-A).

To pass the course, i.e. to get grade 3 (C-E), you are expected to have *finished (passed) all course assignments before the end of the course**. Thereafter, no assignments are corrected until the next time scheduled for exams - "omtentaperiod". After that you must wait for the new course occasion.

At most one repeated attempt to pass any assignment is allowed. This includes research paper and its presentation.

* The exception is Take home exam for those who haven't got 80% attendendance. The deadline for Take home exam is one week after the Mini conference.

Grading Policy (2)

In order to get grade 4 (B), you are expected to *respect all the deadlines for the assignments, and* the average *grade for* assignments *above 3.25*, and an excellent paper (5), or you must have the total average grade above 4.0.

If you miss a deadline, the highest grade you can get is 3. (Exception: if you missed only *one* deadline, have average above 3.5 and the grade *excellent (5)* for your paper, you will get grade 4).

Grading Policy (3)

For the grade 4, you are allowed to submit an assignment only once. Repeated attempts to improve your grade on the assignments are not allowed.

(Exception: if you made only *one* repeated attempt, have average above 3.5 and the grade *excellent (5)* for your paper, you will get grade 4).

To get grade 5 (A), in addition to fulfilling all required for grade 4, you must have an average grade *of at least 4.25* on assignments 1-3 and the grade *excellent (5)* for the paper, or you must have the total average grade above 4.5.

Maximum grade one can get for an repeated attempt on an assignment is 4.

COURSE POLICIES (1)

Keeping Up

You are expected to visit the course web site regularly to read Latest News and to see if other changes have been made.

COURSE POLICIES (2)

Doing Your Own Work

When you turn in an assignment, it is expected to be the result of your work (individual or a group of two). Do not copy anyone else's work or let anyone else copy yours. In contrast, working together to understand lecture material and problems is encouraged.

COURSE POLICIES (3)

In-Class Activities

Class is divided in groups during assignment discussion meetings. You are supposed to be well prepared and actively take part in the discussions.

COURSE POLICIES (4)

Environmental Policy

Please save paper and make two-sided print outs of the course material.

Print as many pages on each side as practically possible (readable).

COURSE POLICIES (5)

Equity Policy

Our commitment is to confront and eliminate discrimination whether by reason of gender, ability, race, religion, ethnic origin, creed, color, social status, age, or sexual orientation.

COURSE POLICIES (6)

Statement on Students with Disabilities

Students with a documented disability needing academic adjustments are advised to speak with the course leader during the first two meetings of the class.

COURSE POLICIES (7)

Case of Illness

Students are expected to attend lectures, formal assessments, presentations and examinations. In case of illness, you must submit a personal sickness certificate whenever illness may have affected ability to attend lectures, discussions and presentations or a submission deadline.

It is important to keep in mind that medical practices are unable to provide a medical certificate unless they are consulted during the illness. In case of sickness you are advised to contact medical practitioner as soon as possible when a medical certificate is expected.

Taking the course as distance learners

If you do not attend at minimum 80% of lectures, you will have to make a take-home exam (at the end of the course) which should demonstrate that you have acquired knowledge corresponding to course lectures that you missed.

Even as a distance student you are expected to send the assignments in the course before the deadlines (given on the course web page). If you miss the discussion, you make an extra assignment.

Taking the course as distance learners

In this course we learn how to write a research article, how to review and act as a conference Program Committee (PC) member, and other procedures related to a research conference. This means that you should either attend the review committee meeting or be available via telephone on the day your group discusses conference articles.

You are supposed to be here for the Mini conference, to present your paper and to take part in the discussions and opposition.

Taking the course the second time

You are supposed to hand in the Assignments 1-3 before the Mini Conference which is the official end of the course.

If your paper did not pass the first Mini Conference, there will be a second (and last) chance in January next year.

If you did not pass the course after the second attempt, you start the next time **from the beginning**.

Course Schedule

CDT403, Research Methods in Natural sciences and Engineering

http://www.mdh.se/schema/visa.jsp?kurs=CDT403.44008.-.-&slutdatum=20120122&startdatum=20110829

Those of you who are not able to attend at least 80% of all lectures, (16 lectures) please contact course leader (by email). You will be assigned compensatory tasks, including written take-home exam at the end of the course.