



UiO • **Department of Informatics**
University of Oslo

INF3490 - Biologically inspired computing

Lecture 16 November 2016

Summary & Questions

Kai and Jim



INF3490/4490 Exam

- Format: **Written**
- When: **November 29, at 09:00 (4 hours)**
- “Closed book exam”: **No materials are permitted on the exam**
- **Location: See StudentWeb and**
<http://www.uio.no/studier/emner/matnat/ifi/INF3490/h16/eksamen/index.html>
- <http://www.uio.no/studier/emner/matnat/ifi/INF4490/h16/eksamen/index.html>
- Same exam in INF4490 as in INF3490

Multiple-choice Questions on Parts of the Exam

The exam text consists of problems 1-35 (multiple choice questions) to be answered on the form that is enclosed in the appendix and problems 36-38 which are answered on the usual sheets (in English or Norwegian, please write clearly and sort sheets according to the problem numbers). Problems 1-35 have a total weight of 70%, while problems 36-38 have a weight of 30%.

About problem 1-35:

Each problem consists of a topic in the left column and a number of statements each indicated by a capital letter. Problems are answered by marking true statements with a clear cross (X) in the corresponding row and column in the attached form, and leaving false statements unmarked. Each problem has a variable number of true statements, but there is always *at least one* true and false statement for each problem. 0.5 points are given for each marked true statement and for each false statement left unmarked. **Further, -0.5 points are given for each marked statement not being true and for a correct statement not being marked.** Thus, resulting in a score of max 70. If you think a statement could be either true or false, consider the most likely use/case.

You can use the right column of the text as a draft. The form in the appendix is the one to be handed in (remember to include your candidate number).

Problem 1

Biologically inspired computing	A	Topic for a course at IFI	
	B	Is mostly relevant for safety-critical systems	
	C	Evolutionary computing is included in this field	
	D	Must be programmed in a specific language	

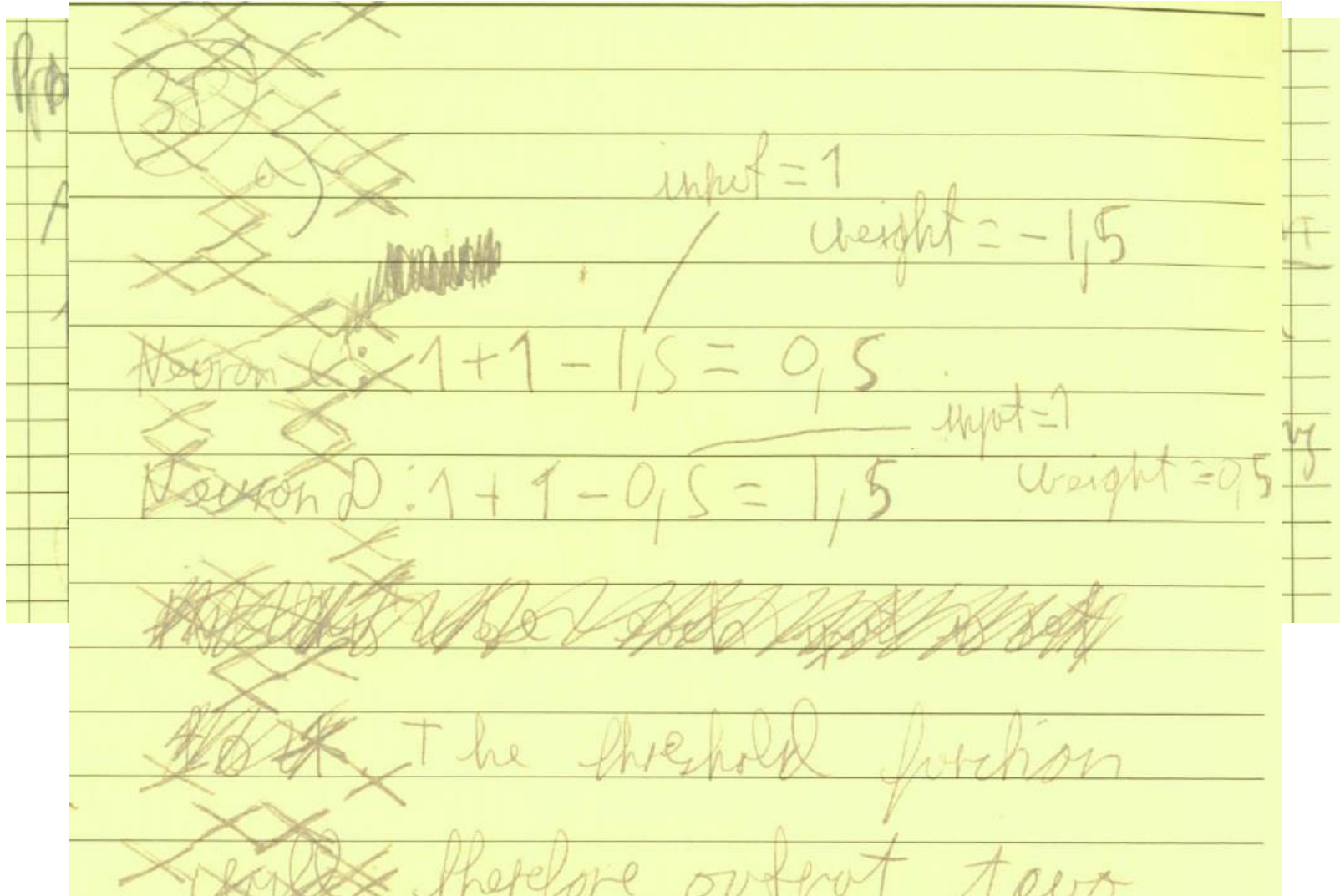
Reply on Multiple-choice Questions on Attached Form

Appendix 1

INF3490/INF4490 Answers problems 1 – 35 for candidate no: _____

Problem	A	B	C	D
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

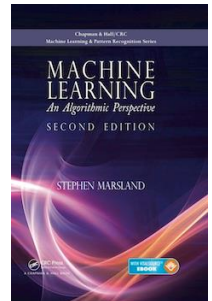
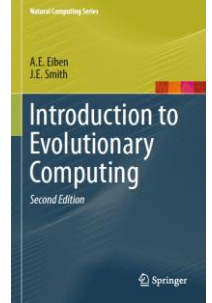
Please Make Sure you can Read what you Write...



INF3490/INF4490

Syllabus:

- Selected parts of the following books (details on course web page):
 - A.E. Eiben and J.E. Smith: Introduction to Evolutionary Computing, Second Edition (ISBN 978-3-662-44873-1). Springer.
 - S. Marsland: Machine learning: An Algorithmic Perspective. ISBN: 978-1466583283
 - On-line papers (on the course web page).
- The lecture notes.



Obligatory Exercises:

- Two exercises on evolutionary algorithms and machine learning.
- Students registered for INF4490 will be given additional tasks in the excercises.

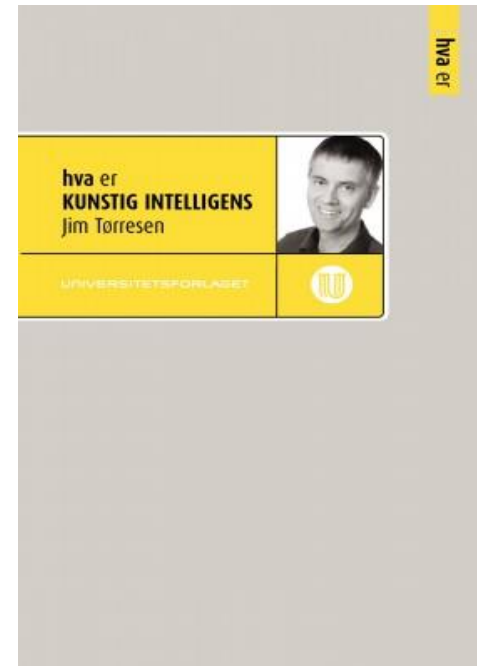
Supporting literature in Norwegian (not syllabus)

Jim Tørresen: hva er KUNSTIG INTELLIGENS

Universitetsforlaget Nov 2013, ISBN: 9788215020211

Topics:

- Kunstig intelligens og intelligente systemer
- Problemløsning med kunstig intelligens
- Evolusjon, utvikling og læring
- Sansing og oppfatning
- Bevegelse og robotikk
- Hvor intelligente kan og bør maskiner bli?



Lecture Plan Autumn 2016

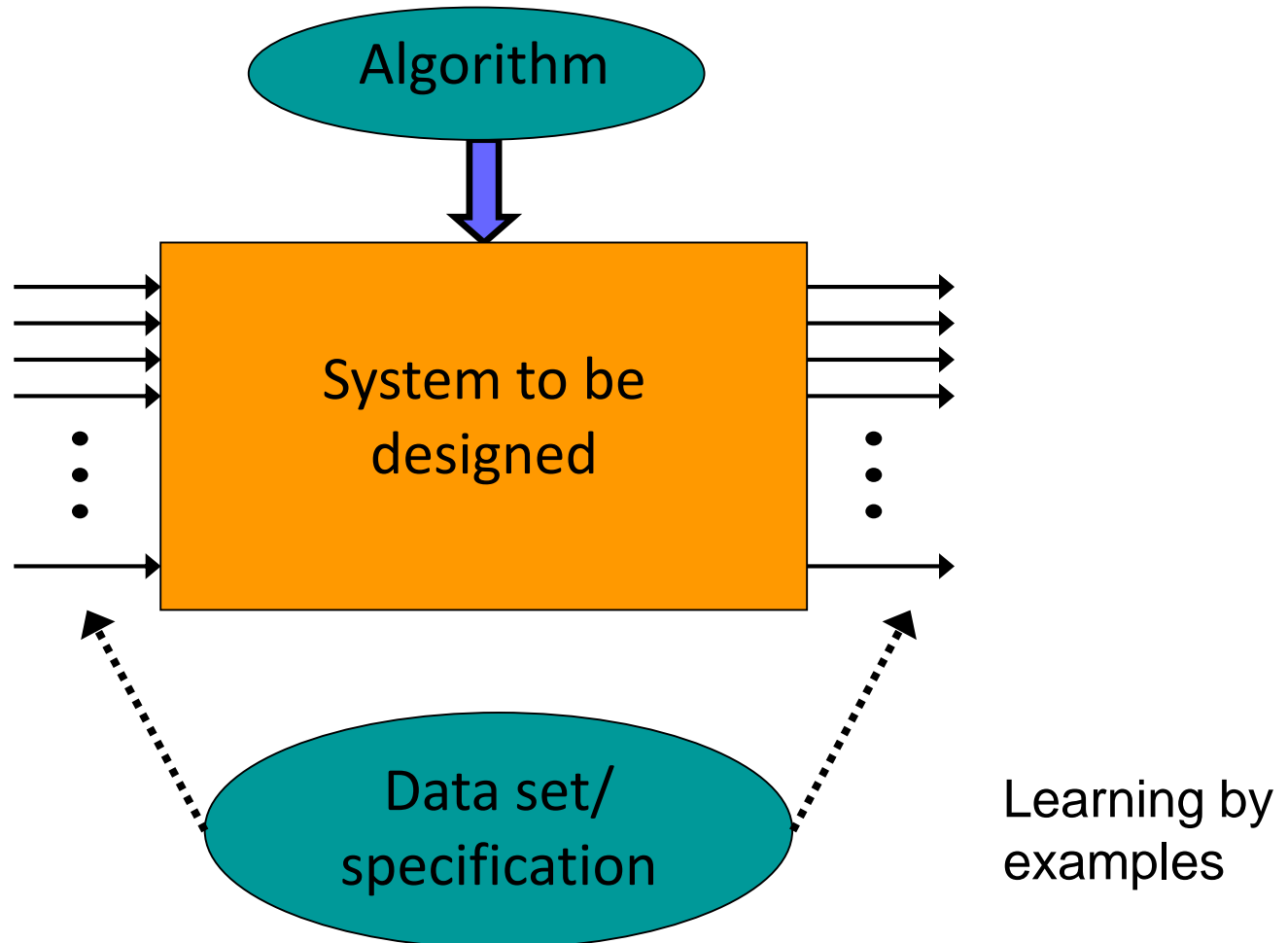
Date	Topic	Syllabus
24.08.2016	Intro to the course. Optimization and search.	Marsland (chapter 9.1, 9.4-9.6)
31.08.2016	Evolutionary algorithms I: Introduction and representation.	Eiben & Smith (chapter 1-4, not 1.4, 3.6 and 4.4.2)
07.09.2016	Evolutionary algorithms II: Population management and popular algorithms	Eiben & Smith (chapter 5-6, not 5.2.6, 5.5.7, 6.5-6.6 and 6.8) (+ Marsland 10.1-10.4)
14.09.2016	Evolutionary algorithms III: Multi-objective optimization. Hybrid algorithms. Working with evolutionary algorithms.	Eiben & Smith (chapter 9, 10, 12, not 10.4 and 12.3.4)
21.09.2016	Intro to machine learning and classification. Single-layer neural networks.	Marsland (chapter 1 and 3, not 3.4.1)
28.09.2016	Multi-layer neural networks. Backpropagation and practical issues.	Marsland (chapter 2.2 and 4)
05.10.2016	Break	
12.10.2016	Reinforcement learning and Deep Learning	Marsland (chapter 11) + online paper
19.10.2016	Support vector machines. Ensemble learning. Dimensionality reduction.	Marsland (chapter 8, 13, 6.2.)
26.10.2016	Unsupervised learning. K-means. Self-organizing maps.	Marsland (chapter 14)
02.11.2016	Swarm Intelligence. Evolvable hardware.	TBA (On-line papers on the course web page)
09.11.2016	Bio-inspired computing for robots and music. Future perspectives on Artificial Intelligence including ethical issues	On-line papers on the course web page
16.11.2016	Summary and Questions	

What is the Course about?

- Artificial Intelligence/Machine learning/Self-learning:
 - Technology that can adapt by learning
- Systems that can sense, reason (think) and/or respond
- Why bio-inspired?
- Increase intelligence in both single node and multiple node systems

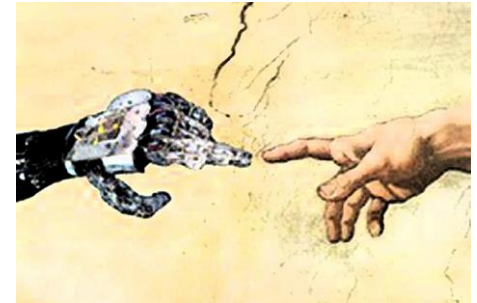


Self learning/Machine learning (ex: evolutionary computation)



Man/Woman vs Machine – Who are smartest?

- Machines are good at:
 - number crunching
 - storing data and searching in data
 - specific tasks (e.g. control systems in manufacturing)
- Humans are good at:
 - sensing (see, hear, smell etc and be able to recognize what we senses)
 - general thinking/reasoning
 - motion control (speaking, walking etc).



Major Mechanisms in Nature

- **Evolution:** Biological systems develop and change during generations.
- **Development/growth:** By cell division a multi-cellular organism is developed.
- **Learning:** Individuals undergo learning through their lifetime.
- **Collective behavior:** Immune systems, flocks of birds, fishes etc
- **Sensing and motion**

