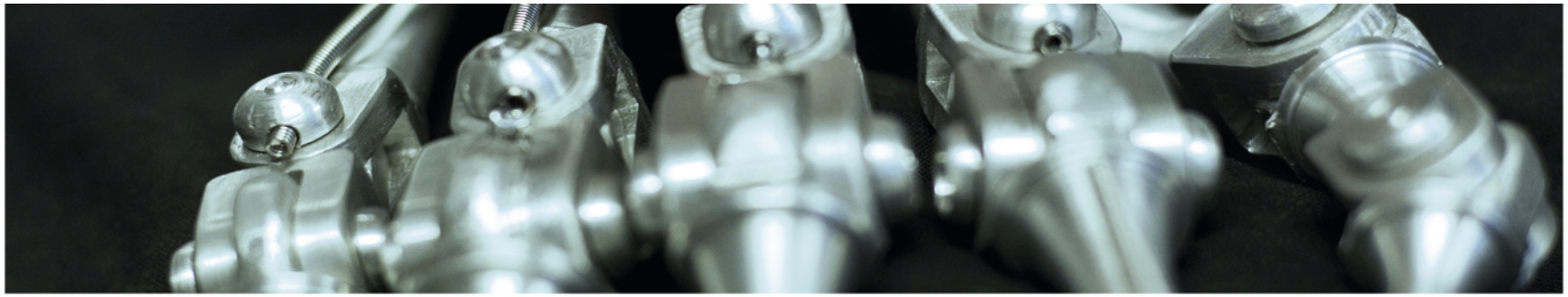

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INF3490 - Biologically inspired computing

Lecture 16 November 2015

Summary & Questions

Jim Tørresen

INF3490/4490 Exam

- Format: Written
- When: December 9, at 09:00 (4 hours)
- "Closed book exam": **No materials are permitted on the exam**
- **Location: See** http://www.uio.no/studier/emner/matnat/ifi/INF3490/h15/eksamen/index.html
- http://www.uio.no/studier/emner/matnat/ifi/INF4490/h15/eksamen/index.html
- Same exam in INF4490 as in INF3490

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Multiple-choice Questions on Parts of the Exam

The exam text consists of problems 1-30 (multiple choice questions) to be answered on the form that is enclosed in the appendix and problems 31-3? which are answered on the usual sheets. Problems 1-30 have a total weight of 60%, while problems 31-3? have a weight of 40%.

About problem 1-30:
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, resulting in a score ranging from 0 to 60.

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	

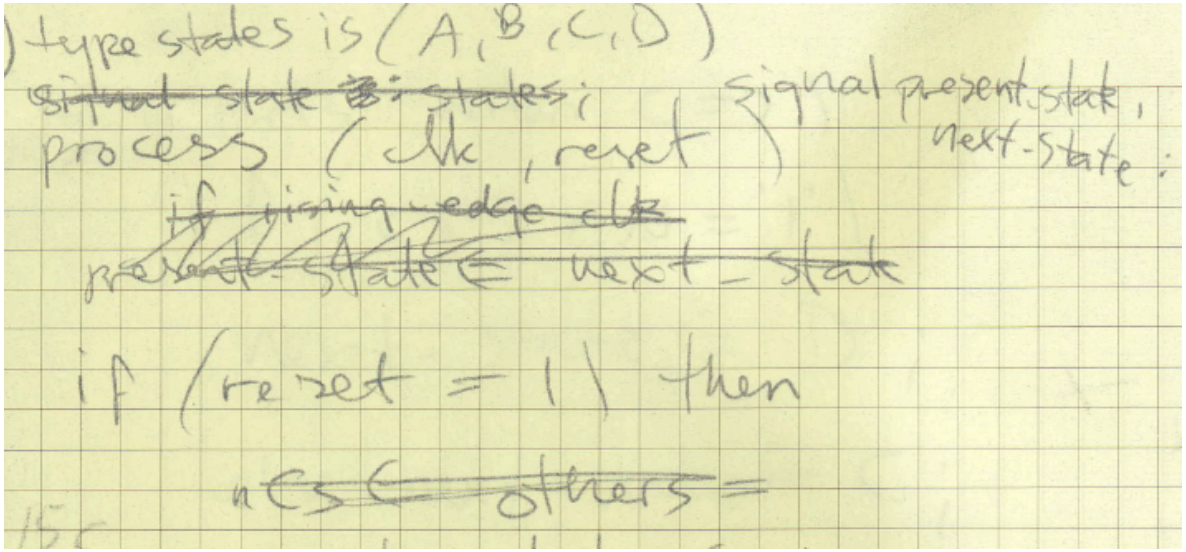
Reply on Multiple-choice Questions on Attached Form

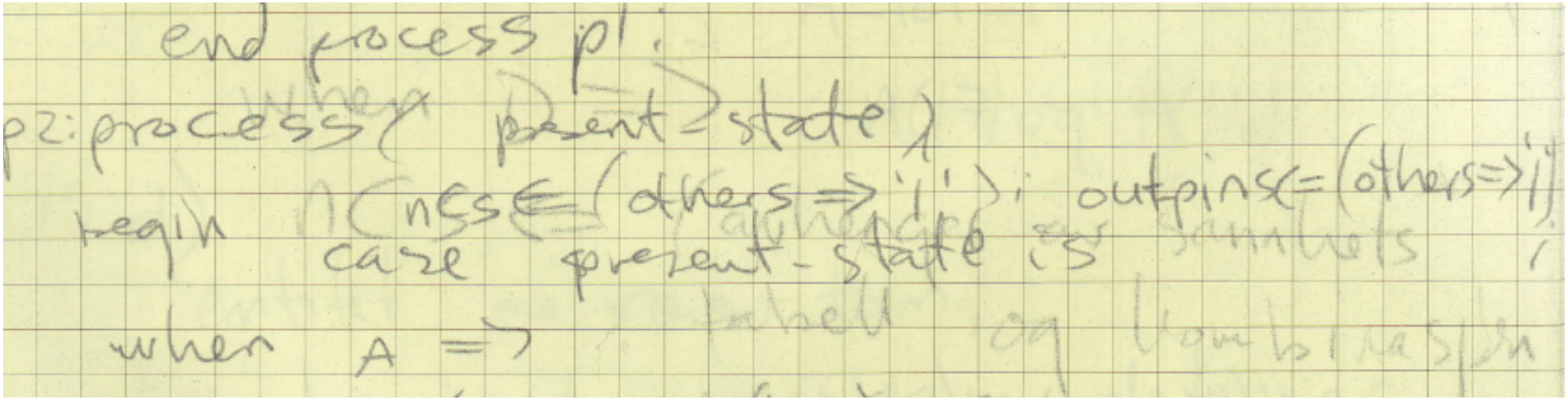
Appendix 1

INF3490/INF4490 Answers problems 1 – 30 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…



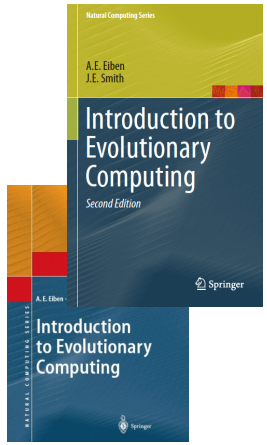


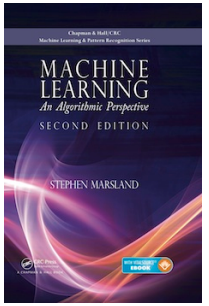
username: authorization
password: complete

INF3490/INF4490

Syllabus: See more details on the web page

- 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) **OR** 2nd printing, 2007 (ISBN: 978-3-540-40184-1). Springer.
  - S. Marsland: Machine learning: An Algorithmic Perspective. ISBN: 978-1466583283
  - On-line papers (on the course web page).
- The lecture notes.





Obligatory Exercises:

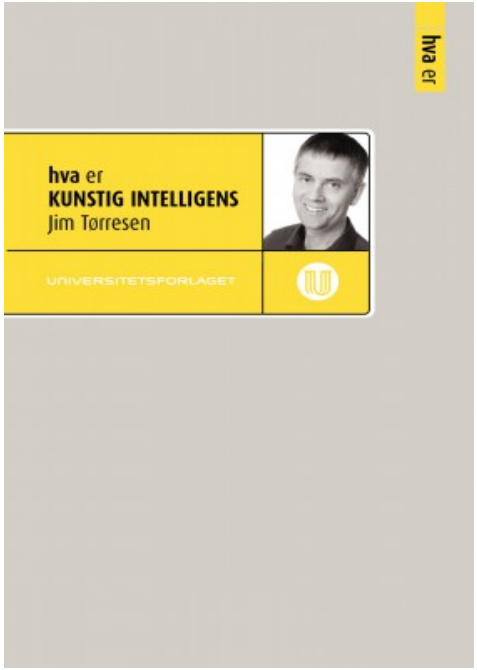
- Two exercises on evolutionary algorithms and machine learning.
- ***Students registered for INF4490 will be given additional tasks in the excercises.***

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?



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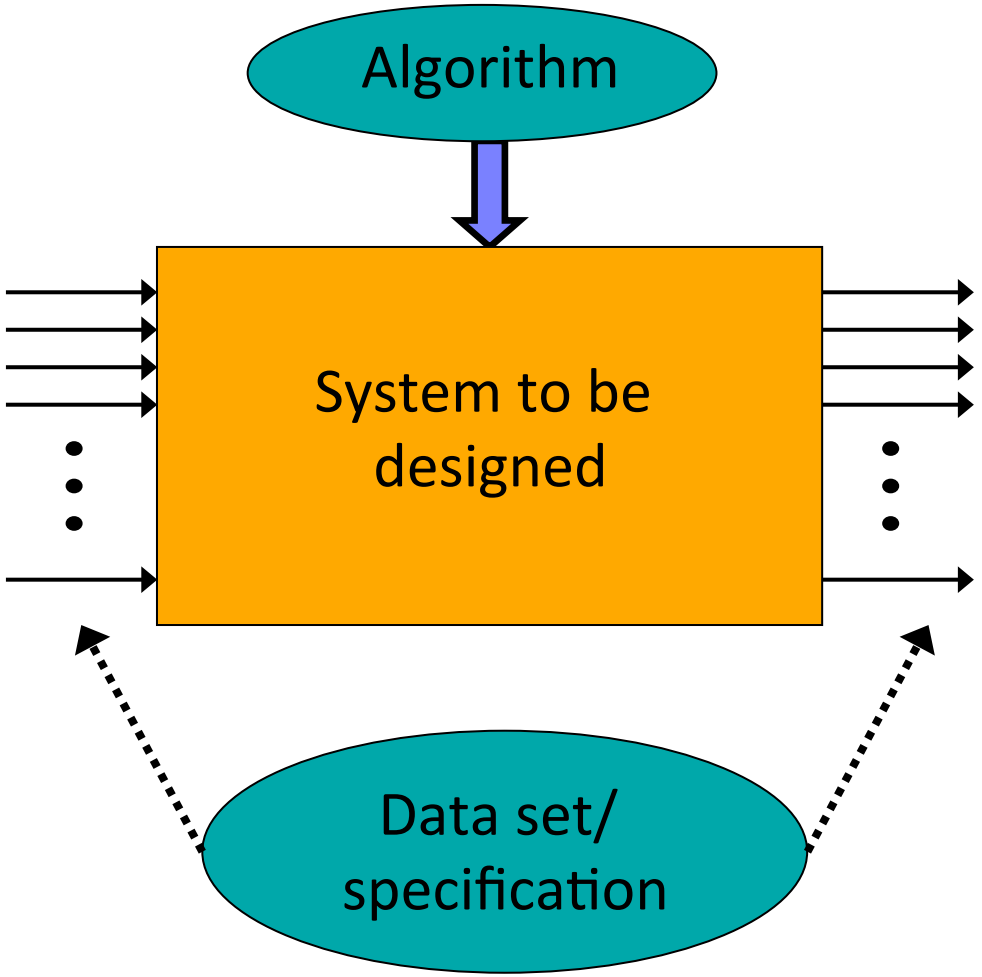
Lecture Plan Autumn 2015

Date	Topic	Syllabus
24.08.2015	Intro to the course. Optimization and search.	Marsland (chapter 9.1, 9.4-9.6)
31.08.2015	Evolutionary algorithms I: Introduction and representation.	Eiben & Smith (chapter 1-4, old book: 1-3)
07.09.2015	Evolutionary algorithms II: Population management and popular algorithms	Eiben & Smith (chapter 5-6, old book: 3-6) (+ Marsland 10.1-10.4)
14.09.2015	Evolutionary algorithms III: Multi-objective optimization. Hybrid algorithms. Working with evolutionary algorithms.	Eiben & Smith (chapter 9, 10, 12 (old book: 9, 10, 14)
21.09.2015	Intro to machine learning and classification. Single-layer neural networks.	Marsland (chapter 1 and 3)
28.09.2015	Break (no lecture)	
05.10.2015	Multi-layer neural networks. Backpropagation and practical issues	Marsland (chapter 4)
12.10.2015	Swarm Intelligence. Evolvable hardware.	TBA (On-line papers on the course web page)
19.10.2015	Support vector machines. Ensemble learning. Dimensionality reduction.	Marsland (chapter 8, 13, 6.2.)
26.10.2015	Unsupervised learning. K-means. Self-organizing maps.	Marsland (chapter 14)
02.11.2015	Reinforcement learning	Marsland (chapter 11)
09.11.2015	Bioinspired computing for robots and music. Future perspectives on Artificial Intelligence.	On-line papers on the course web page
16.11.2015	Summary. Questions	

What is the course about?

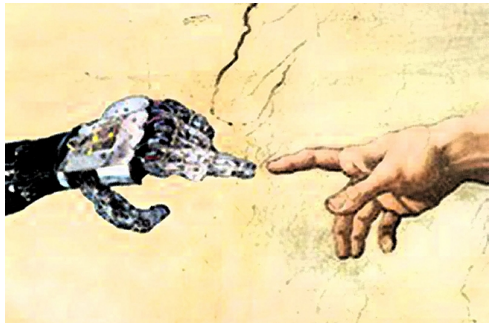
- Artificial Intelligence/machine learning
- Self-learning and adaptive systems
- Systems that can sense, reason (think) and/or respond
- Why bio-inspired?
- Increase intelligence in both single node and multiple node systems

Self learning/Machine learning (ex: evolutionary computation)



Learning by examples

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**