UNIVERSITETET I OSLO

Det matematisk-naturvitenskapelige fakultet

Exam in: **INF5450 — Evolusjonære algoritmer og maskinvare**
Day of exam: **December 1st, 2009**
Exam hours: **14:30 – 17:30**
This examination paper consists of 2 pages.
Appendices: **None**
Permitted materials: **None**

Make sure that your copy of this examination paper is complete before answering.

Question 1 Evolutionary Computing

1a (weight 10%)
Write a short pseudocode for a typical evolutionary algorithm. List possible termination criteria.

1b (weight 20%)
Give two examples of problems that need to be evolved with permutation representation. What is specific for this representation, and what is required of the evolutionary operators?

Explain two methods for undertaking mutation and the method order crossover, respectively for such a representation.

1c (weight 10%)
List alternative methods for undertaking parent selection (tip: fitness-proportional selection is the most common method) in genetic algorithms and shortly explain each of them.

1d (weight 10%)
Describe and give the names for the approaches for undertaking recombination in ES by how gene values for the offspring can be determined and how many parents that can be involved.

1e (weight 10%)
List possible time measurement units for evolution and what challenges that relate to each of them. Which of them (one or more) is to be preferred and why?

Question 2 Evolvable Hardware

2a (weight 10%)
What represents genotypes and phenotypes when circuits are evolved? List a couple of properties which become possible by circuit evolution which traditional design does not offer.

2b (weight 10%)
Illustrate and explain how a classifier can be built from N-inputs AND gates. Why is incremental evolution beneficial in general, and why is this architecture well suited for it?

2c (weight 10%)
Higuchi's group has implemented an autonomous mobile robot. Describe how it is constructed by which sensors and actuators being used. Further, what is the basis for the fitness computation?

2d (weight 10%)
Describe how the two legged robot described in the paper of Mats and Lena was shaped. How was the chromosome defined to evolve walking patterns?