

# Evolutionary Computation

January 28, 2015; 13:30 - 16:30

This is a 'closed book' exam: you can only use a single sheet of paper with your own notes (A4, double-sided). Write your name, student number and study program on the first page, and your name on any extra pages. All questions are equally weighted. Do not be too brief: clarify your answers !

1. Schema Theorem:
  - Explain the Schema Theorem for Genetic Algorithms.
  - What is its relation with the 'Building Blocks' concept ?
2. Selection Intensity  $I$ :
  - Define the concept.
  - Derive the formula to compute  $I$  in the case of proportionate selection.
3. You want to apply the Linkage Tree Genetic Algorithm on the Graph Bi-Partitioning problem.
  - How would you represent the problem ?
  - What distance (or similarity) measure would you use in the clustering algorithm ?
4. Adaptive Pursuit
  - For what problems can you use the Adaptive Pursuit algorithm?
  - Explain how it works using pseudo code.
5. The paper on the investigation of the fitness landscape in graph bi-partitioning introduced the (approximate) central point concept.
  - Explain this concept.
  - Why would it be useful during evolutionary search ?
6. Grammatical Evolution represents solution sentences in a given context-free grammar. Assume the following grammar:

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 $\langle prog \rangle ::= \langle ifs \rangle (0) \mid \langle ifs \rangle \langle elses \rangle (1)$   
 $\langle ifs \rangle ::= \text{if} ( \langle vars \rangle \langle equals \rangle \langle vars \rangle ) \{ \langle prog \rangle \} (0)$   
 $\quad \mid \text{if} ( \langle vars \rangle \langle equals \rangle \langle vars \rangle ) \{ \langle action \rangle \} (1)$   
 $\langle elses \rangle ::= \text{else} \{ \langle prog \rangle \} (0) \mid \text{else} \{ \langle action \rangle \} (1)$   
 $\langle action \rangle ::= \text{goto}(\text{nearestPill}) (0)$   
 $\quad \mid \text{goto}(\text{nearestPowerPill}) (1)$   
 $\quad \mid \text{goto}(\text{nearestEdibleGhost}) (2)$   
 $\langle equals \rangle ::= < (0) \mid \leq (1) \mid > (2) \mid \geq (3) \mid == (4)$   
 $\langle vars \rangle ::= \text{thresholdDistanceGhost} (0)$   
 $\quad \mid \text{inedibleGhostDistance} (1)$   
 $\quad \mid \text{avgDistanceBetGhosts} (2)$   
 $\quad \mid \text{windowSize} (3)$ 
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- What solution is encoded by the sequence [1 2 3 4] ?
- How is recombination being done in Grammatical Evolution? What do you expect of the fitness crossover correlation coefficients in this domain ?