Autonomous Intelligent Systems,
Institute for Computer Science VI, University of Bonn

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Exercises for Artificial Life (MA-INF 4201), SS11

Exercises sheet 10, due: Mon 4.07.2011

27.6.2011

Group	Name	61	62	63	64	65	66	$\sum$

Written examination: 19.7.2011, 10-12

The written examination will be on Tuesday 19 July 2011, 10:00 - 12:00, lecture hall 2. You will need 50% of the points from the assignments, and an active participation in the exercise groups to be admitted for the exam.

Assignment 61 (4 Points)

Explain how the number of robots influence the result in the so called *Didabot experiment*.

Assignment 62 (3 Points)

The task is to make a group of almost Braitenberg like vehicles organize themselve into a chain of robots, with one robot leading the others as the *head* of the chain performing a type 3b behaviour, and the other robots are following (one after the other).
You are allowed to modify the structure of the robot and the controlling part of the robot to make this task work.
Please describe your modifications.

Assignment 63 (2 Points)

Name and explain three rules that are capable of generating swarming behavior.

Assignment 64 (2 Points)

Describe the different characteristics of *swarm, herd, flock, school, hive, group* with respect to a technical implementation.

Assignment 65 (2 Points)

Create a question from a topic of the Artificial Life lecture SS2011, that is valid 4 points within a written exam, and that can be answered within 4 minutes.
Write down the answer for this question, and indicate for what part of the answer the 4 points shall be granted.

Please complete this assignment on your own, with your own question and answer, even if you are working in a 2 person group.

Assignment 66 (2 Points)

Please answer the following question in some brief sentences, not exeeding one paragraph: What was the content of the Artificial Life lecture in SS2011, Computer Science University of Bonn?

Assignment 61 (4/4)

More robots cause more induced releases of type 2 (two robots that are close to each other). Induced releases have a higher probability to happen close to existing obstacles. So the **number of clusters increases** with a higher number of robots on the field.

Assignment 62 (3/3)

Each robot has two types of sensors. One sensors detects the proximity to arbitrary objects. The other detects the proximity to robots. The normal sensors are connected to the motors in a type 3b way. The robot-proximity sensors are connected in a 3a way. If one of the robot proximity sensors detects a robot, the normal sensors are completely disabled. That way, the robots try to follow another robot as soon as they detect one. The leading robot (head) doesn't see another robot (except if they all form a loop) and therefor has a type 3b (collision avoidance) behavior.

There's a problem with robots that drive in parallel. If both of them see another robot, they would both try to follow that robot and might crash into the other. To avoid such crashes, one could add another sensor on the right side that lowers the speed of both motors if another robot comes too close.

Assignment 63 (2/2)

1) Separation
Individuals of the swarm try to avoid local cluster in the group. For example if one more more mates are too close, the individual moves away from its position.

2) Alignment
Individuals of the swarm try to align themselves with the group. For example if they turn themselves into the average direction of the group.

3) Cohesion
Individuals of the swarm try to stay within the group. For example by aiming to position itself in the center of the group.

Assignment 64 (1/2)

The following are unanimous entities exhibiting emergent collective behavour common to biological groups.
These groups follow 3 basic rules: steer towards average heading of neighbors, remain close to your neighbours, avoid collisions with neighbours.

- swarm - typically refers to swarm behaviour of ants.
- herd - typically refers to swarm behaviour in quadrupeds
- flock - typically refers to swarm behaviour in birds.
- school - typically refers to swarm behaviour in fish

- group - typically refers to swarm behaviour in people.

In addition:

- hive - typically refers to swarm behaviour in bees. Individuals in a bee colony have different physionomy and tasks - an aspect that can be applied to unanimous objects as well (eg. some robots are more intelligent than the others in the swarm with a coordinating role, whilst others are cheap and with very specific roles).

Assignment 65 (2/2)

Benedikt:

Given is a 1-dimensional CA with a van-Neumann neighborhood of radius 2. $k = 2$. How big is the neighborhood? How big is one rule and how many rules are possible?

Answer:

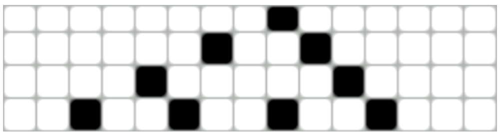
neighborhood size: $n = 2*2+1 = 5$

size of the rule is $2^n = 32$

number of rules = $2^{2^n} = 2^{32}$

Depict the first three steps for rule 256 with one cell set initially.

Answer:



Jaana:

Explain the difference between λ+μ and λ,μ approach in Evolutionary Algorithms and their effect on the performance graph..

Answer:

λ+μ is a rank dependent strategy based on elitism, ie. you do not throw away your best individuals. As a result, the performance graph consists either of incremental increases or horizontal lines.

λ,μ approach is a non-elitist strategy, often used in cases where memory is expensive. The performance graph of this strategy can have show decreases, but should still show a general increase in time.i

Assignment 66 (2/2)

The lecture focused on topics of weak artificial life where properties and principles of life are researched and simulated. The major topics covered **Pattern Formation** (Cellular Automata, Conway's Game of Life, Langton's Loop, Lindenmeyer Systems, Iterated functions, Lotka-

Volterra equations), **Evolutionary Algorithms**, **Robots of Complex Behavior** (Braitenberg Vehicles) and **Swarm Behavior**.

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jaana:
Notes on Didabot experiment:
- robots move around boxes in the arena
- robots avoid obstacles (sensors are at a slight angle, not straight ahead)
- after some time boxes form clusters.
- box is smaller than the distance between sensors of the robot.

Putting more robots increases the number of clusters, ie. increased probability to drop a box when meeting another robot.

Page : 1 Line : 7 Author : 07.07.2011
jaana:
Leading robot is 3b (obstacle avoidance).

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jaana:
One needed to bring out which of these require hierarchical implementation and do individual robots require different implementation or should all be the same.

Examples of typical representatives from the biological world were ok.