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

Dr. N. Goerke
Friedrich-Ebert-Allee 144, 53113 Bonn, Tel: (0228) 73-4167
E-Mail: goerke@ais.uni-bonn.de
www.ais.uni-bonn.de

Exercises for Artificial Life (MA-INF 4201), SS15

Exercises sheet 6, till: Mon 1.6.2015

18.5.2015

Group	Name	37	38	39	40	41	42	43	Σ

Assignment 37 (2 Points)

Show by calculation, that the relation

$$N(s) = a\frac{1}{s^\alpha}$$

yields a linear dependency in a *log - log* plot.

Assignment 38 (3 Points)

A function $f(z)$ is called *scale invariant* if scaling the argumenmt z with a constant factor k
yields a proportional scaling of the function value
$f(kz) \sim f(z)$.

Show, that the function $N(s) = a\frac{1}{s^\alpha}$ is *scale invariant*.
Give another function, or family of functions, that is *scale invariant*.

Assignment 39 (3 Points)

Zipf's Law describes the relation between the frequency of a word within a text, and the
rank of that very word.

Propose a way to check if *Zipf's Law* is valid for source-code of computer programs.
What are the problems you will have to focus for this task?
What data you propose for such an investigation?

Assignment 40 (2 Points)
Gradient descent is a widely used method of optimization, still it has some drawbacks.
Name, and describe (**in your own words**) at least three properties of a gradient descent
task, that could be called negative.

Assignment 41 (2 Points)
Compare the methods *Random Search* and *Random Optimization*.
What is different what is common?

Assignment 42 (1 Point)
Derive a formula to implement an exponential decay (pheromones for an ant algorithm) that
calculates the pheromone concentration to decay to 10% after 42 steps of iteration.

Assignment 43 (2 Points)
Remark: Try to answer the Assignment 43 in 5 minutes.
Explain why the *evaporation of pheromones* in Ant Algorithms is helpful, if the environment
is dynamic.