

Evolutionary Computing Midterm Exam

1. (30 points) Answer the following questions.

- a) Define *perturbative search* and *constructive search*. To which group do evolutionary algorithms belong? Explain.
- b) List and explain three ways to hybridize an evolutionary algorithm with other methods.
- c) Explain the difference between an *objective function* and a *fitness function*. Give an example illustrating the difference.
- d) Explain the difference between the *genotype* and the *phenotype* of an individual. Give an example illustrating the difference.
- e) Suppose the probability of mutation at a single bit position is 0.1. Calculate the probability of a 10 bit individual surviving mutation without being changed.

2. (30 points) Answer the following questions:

- a) When doing hypothesis testing, what does the p-value show?
- b) Under which assumptions can we apply a t-test?
- c) How is the Central Limit Theorem related to these assumptions?
- d) Assume that the output of a t-test (with $\alpha=0.05$) to compare two designs A and B is as given below

Welch two sample t-test
 p-value = 0.005612
 95% CI = -3.459167 to -1.004081
 sample estimates:
 mean in group A = 8.066154
 mean in group B = 10.297778

- i) What can you say about the above result?
- ii) What can you say if
 p-value = 0.08
 95% CI = -3.459167 to 1.004081

3. (40 points) An international company is hiring translators for its relations with the EU. Assume that a total of K translators applied for this job. In the application form, each applicant declares the languages he/she knows and the monthly salary he/she requires. The aim of the company is to hire translators such that the total monthly salary it pays to the translators is minimized while ensuring that all the languages spoken in the EU is known at least by one of the translators. You are asked to use an evolutionary algorithm for this purpose. Answer the following questions.

- a) Choose a representation for the individuals. Give an example individual and explain.
- b) What is the objective function?
- c) Design a penalty based fitness function and explain through an example, how an individual is evaluated using this function.
- d) Use a local search mechanism to improve the solutions found by the evolutionary algorithm. How and when will you apply the local search technique? Give an example and explain.