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Exercises to

Swarm Intelligence

Summer 2022

Sheet 8

Note: This is a regular exercise, so you'll meet in the regular exercise rooms.

Problem 19:
John packs his backpack for a one-day hike. When he is finished, he realizes that the backpack is very heavy and weighs 21 kg. He decides to take a maximum of 8 kg of luggage with him. To make the choice easier, he assigns a *usefulness value* between 1 and 10 to each item:

Item	weight	usefulness value
01 Laptop with accessories	3.0 kg	1.0
02 Digital camera	0.5 kg	6.5
03 Solar powered camping espresso machine	4.0 kg	8.5
04 Large water bottle	1.0 kg	10.0
05 Small water bottle	0.5 kg	2.0
06 Disposable grill, and barbecue meat	2.0 kg	9.0
07 Bag of apples	0.5 kg	3.0
08 Picnic blanket	0.5 kg	1.5
09 Book	1.0 kg	1.5
10 Hiking map	0.5 kg	8.0
11 Rain jacket	2.0 kg	4.5
12 Rain pants	0.5 kg	2.0
13 Bathing trunks and towel	1.5 kg	3.0
14 Snorkel gear	3.0 kg	2.0
15 Hiking sticks	0.5 kg	4.0

Now, the total sum of the usefulness values of the actually packed items is to be maximized by means of a *Genetic Algorithm*, without, however, exceeding the fixed maximum weight of 8 kg.

(a) What could be the coding of this problem for a Genetic Algorithm (i.e., the *genotype*)?

(b) Devise appropriate mutation and crossover operators.

(c) Does your approach allow the construction of invalid individuals? If so, how do you deal with them?