Name: .....

Artificial Intelligence
April 16, 2019

Problem:

n boxes must be distributed in two containers. Each box has a different weight (box number i has m_i kg). Help the workers to divide the boxes as best as possible in such a way that the weight is as much as equal distributed between the two containers, without opening or dividing a box.

Example: Consider: $n = 7$ and $\mathbf{m} = \{3, 5, 2, 7, 2, 6, 10\}$

A possible solution is: for $cont_1 = \{3, 5, 2, 7\}$ and for $cont_2 = \{2, 6, 10\}$

In order to solve this problem 3 methods will be considered: BFS, EA and PSO.

1. For a BFS search depict the search tree (not all, but enough to be clear how is built). (50p)

.....
.....
.....
.....
.....
.....
.....
.....
.....

2. Describe the operator that is used in order to expand a node: (25p)

.....
.....

3. Write 5 nodes in the proper order if that tree is visited in BFS (10p)

.....
.....

4. What is a proper representation for an EA for this problem? (15p)

.....
.....

5. Describe (pseudocode and/or example) a mutation for this representation (25p)

.....
.....
.....
.....

6. Describe (pseudocode and/or example) a crossover for this representation (25p)

.....
.....
.....
.....

7. Write a proper fitness for your representation for this problem (25p)

.....
.....
.....
.....

8. Describe a stop condition for the evolutionary algorithm (25p)

.....
.....

For the PSO algorithm that solve this problem:

9. How you initialise a particle's position? (example and/or pseudocode) (25)

Consider the following pseudocode:

1: **for** each particle **do**
2: determine best neighbour of the particle (bn)
3: **for** $i = \overline{1..len(particle)}$ **do**
4: $v_i^{(t+1)} = w * v_i^t + rand() * c_1 * (x_i^{bn} - x_i^t) + rand() * c_2 * (x_i^b - x_i^t)$
5: $x_i^{t+1} = x_i^t + v_i^{(t+1)}$
6: **end for**
7: perform corrections to x_i^{t+1} and $v_i^{(t+1)}$
8: ...
9: **end for**

10. Identify the code line(s) from a typical PSO that will not work for this problem: explain the problem. (50)

11. Describe a neighbourhood for a particle for this problem. (25)

12. Explain the line 7. from the pseudocode (in what representation is use, in which conditions, how it works?) (50)