Examen (1h:30 minutes)

Exercise 1 (10 points)

Circle the correct answer of the following questions:

1) Optimization is :
    a) A theory and subject related to finding optimal points (referring to maxima or minima).
2) In optimization, objective function aims to :
    a) Measure the obtained solutions during optimization.
3) The difference between exact and approximate optimization methods is:

b) Exact methods find the best solution in higher time, contrary to approximate methods that find good solution in lower time.

4) The difference between heuristic and meta-heuristic optimization methods :
    a) Heuristic methods designed for specific problem, where meta-heuristic methods designed for general classes of problems.
5) Tabu Search heuristic discards the solution that have been previously visited by using memory which is called tabu list, in order to :
    c) Avoid cycles.

Exercise 2 (4 points)

According to Particle Swarm Optimization (PSO), the Velocity of each agent can be modified by the following equation:

$$v_i^{k+1} = wv_i^k + c_1 rand_1 \times (pbest_i - s_i^k) + c_2 rand_2 \times (gbest - s_i^k)$$

In addition, according to PSO, The current position (searching point in the solution space) can be modified by the following equation:

$$s_i^{k+1} = s_i^k + v_i^{k+1}$$

Explain these two equations of PSO meta-heuristic.

$$v_i^{k+1} = wv_i^k + c_1 rand_1 \times (pbest_i - s_i^k) + c_2 rand_2 \times (gbest - s_i^k) \quad (1)$$

where, v_i^k : velocity of agent i at iteration k,
w : weighting function,
c_j : weighting factor,
rand : random number between 0 and 1,
s_i^k : current position of agent i at iteration k,
$pbest_i$: pbest of agent i,
gbest : gbest of the group.

Exercise 3 (6 points)

Using linear programming simplex graphical methods, find the maximal and minimal value of z = 4x1 +3x2 when the constraint conditions are,

$$\begin{aligned} 2x_1 \quad +3x_2 &\leq 6 \\ -3x_1 \quad +2x_2 &\leq 3 \\ 2x_2 &\leq 5 \\ 2x_1 \quad +x_2 &\leq 4 \\ x_1,\ x_2 &\geq 0\ . \end{aligned}$$

If your goal is to maximize:

- $x_1 = 5/7$, $x_2 = 18/7$, Max Z ≈ 10.57

If your goal is to minimize:

- $x_1 = 0$, $x_2 = 0$, Min Z = 0