Swarm Intelligence — Implementation Exercise **2**
Ant Colony Optimization

Christian L. Camacho Villalón

For this exercise, you have to work in pair with one of your classmates.

1. Using instances lin318.tsp and att532.tsp compare the performance of your implementations of AS with 1000 evaluations and 50 repetitions. Are they statistically similar?
   ** Note: For each algorithm use the best parameter configuration found in the previous exercise. Remember to use different random seeds.*

2. Each of you must implement Max-Min ant system (MMAS) or Ant colony system (ACS). You can based on your implementation of AS.

3. Real ants are able to find short paths by means of stigmergy, that is, indirect communication mediated by modifications of the environment. Using MMAS on instance ch130.tsp show that cooperation improves the probability of finding better solutions.

4. What is the effect on the performance of ACS when removing the local pheromone update?

5. Study the q_0 parameter of ACS using instance att532.tsp. How is the performance of the algorithm influenced by this parameter?

6. Compare MMAS and ACS on instance att532.tsp using the same number of function evaluations. Is there one better than the other?

7. Use the best parameter configuration found for each algorithm and plot their convergence on instance att532.tsp. What is a reasonable budget to run each of the algorithms?

8. Implement 2–opt local search for the TSP and apply it after generating every tour (ant). Using MMAS or ACS, what is the effect of adding local search?