Digitalized Energy Systems

Carl von Ossietzky Universität Oldenburg

# Exercise sheet 2

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**Exercise 1**: Create a multi-agent system (MAS) consisting of five agents arranged in a ring topology (0–1–2–3–4–0).

1. Construct an adjacency structure (e.g., a neighbor list) representing the ring. Pass each agent's neighbors via its constructor.
2. When the system starts, each agent must send exactly one greeting message to *each* of its neighbors.
3. Each agent logs all greetings it receives
4. The MAS should terminate once all 10 greeting messages have been received. Implement the termination condition using `asyncio.Event` or `asyncio.Future`

⇒**Code**

**Exercise 2**: Implement the following multi-agent system. ⇒**Code**

1. 10 agents to be able to..
   - ..accept a message from a topology agent telling them their neighborhood.
   - ..send a message to all agents in their neighborhood to inform them about their neighborhood.
2. A topology agent that...
   - ..knows the unique IDs (addresses) of all agents and should develop an overlay topology for them.
   - ..can communicate the resulting neighborhood to all agents.
   - ..establishes a ring structure by sending a message to all other agents informing them of their neighborhood, i.e. the agents with which the respective agent can communicate directly.
3. Have the agents communicate according to the following rule:
   - When an agent has received its neighborhood, it sends an information to all agents of its neighborhood with its ID.
   - An agent that has received a message from another agent stores the received information as `received_ids`.


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**Exercise 3**: In which data structure do the agents store the neighborhood?
⇒**Answer**

**Exercise 4**: Add additional connections to the ring so that you achieve a highly simplified Small World, e.g. with $k = 2$ and no additional connections (random factor would then be 0).
⇒**Code**

**Exercise 5**: Do the `received_ids` data structures and the neighborhood contain the same IDs? In which case is this the case?
⇒**Answer**

**Exercise 6**: Have the topology agent create and distribute another topology. Log the number of messages and compare. How many messages are sent with which topology?
⇒**Answer**

**Exercise 7**: How would we have to change the system shown above so that all agents know the IDs of all other agents in the system?
⇒**Answer**

**Exercise 8**: Re-implement the system from exercise 1 using the topology support provided by `mango` (see: `https://mango-agents.readthedocs.io/en/latest/topology.html`). Note, the easiest way would be to use `mango.custom_topology` with a NetworkX graph (`networkx.cycle_graph`). ⇒**Code**

**Exercise 9**: Imagine you want to solve the n-Queens problem using agents. Every queen is represented by one agent, the so-called QueenAgent. Concisely describe a possible strategy of the QueenAgent to solve the n-Queens problem. How would you characterize the task environment of these agents?
⇒**Answer**