**Worksheet 1 Report Analysis**  
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**Task 1: 4 Agents with Resource Collection**

* There would be a simulation of 4 agents in a 4x4 grid for 20 steps. Resources would be scattered randomly, and in case the agents are in the same location and collide, they would pick up the resources.

**Code Breakdown:**

* **Movement and Wrapping:**  
  Each agent moves in some predetermined direction, and positions wrap around the grid using the modulo (%) operator. This prevents agents from going out of bounds but instead makes them show up on the other side of the grid. It does this by doing:
* **Collision Detection:**  
  Here, the code uses a set to count all the unique agent positions; thus, if len(new\_positions) is not equal to len(set(new\_positions)), then it was a collision. This is also a good way to cover the case when several agents land on the same space.
* **Resource Collection:**  
  The resources will first be dropped randomly on the grid. When the position of an agent's new location matches with the position of a resource, that resource will be collected and removed from the grid by deleting its position from the grid. Finally, it counts how many resources have been collected.

**Conclusion for Task 1:**  
This simple movement and collision handling design keeps the agents in motion within the grid without leaving it continuously. Consequently, no collisions occurred due to the fixed pattern of movement. Resources collected were mostly due to the random placement of the resources, and agents collected more because they might have been initially closer to the resources. This simulation could be further developed by either adding more agents, making resource collection competitive, or by increasing the size of the grid. It could also be done by changing the movement pattern, which would tend to increase the occurrence of collisions, making it harder for the agents to move around the grid.

**Task 2: Sheep Simulation with Energy and Food**

**Objective:**  
Simulate 4 sheep in a 6x6 grid, considering energy consumption, food, and collisions. Explore the following questions:

* What happens if more agents are added?
* How does this simulation change with a different food spawn rate?
* What other dynamics come into play when parameters are altered?

**Code Description:**

* **Movement and Energy:**  
  Like in Task 1, the sheep's movements are pre-programmed. Positions of sheep wrap around the grid. Each sheep is initialized with 2 energy points. A sheep loses 1 energy point at each step. If it reaches 0 energy, the sheep dies and stops moving.
* **Place Food:**  
  The scatter\_food function randomly places food on the grid, ensuring unique positions. A sheep falling into a position with food will eat it, restoring its energy to 2 points.
* **Collision Detection:**  
  Similar to Task 1, collisions occur when two sheep land on the same position. This depletes their energy, but they do not move for that step, increasing their risk of starvation.

**Experiment 1: Additional Agents**

* **Variables:** Increased agents from 4 to 8, keeping 5 food items.
* **Outcome:** Total collisions increased from 0 to 1, and sheep died after fewer steps due to faster energy depletion from collisions. The simulation ended in 1 step.
* **Conclusion:** Adding more agents increases collisions and reduces survival chances due to quicker energy loss.

**Experiment 2: Increased Food Spawn Rate**

* **Variables:** Kept 4 agents, increased food items from 5 to 10.
* **Outcome:** Sheep survived for longer (6 steps) without collisions, as more frequent food spawning helped them regain energy.
* **Conclusion:** A higher food spawn rate extends the simulation, allowing sheep to survive longer and avoid collisions.

**Experiment 3: Less Energy Loss**

* **Variables:** Reduced energy loss per step from 1 to 0.5.
* **Outcome:** Sheep survived longer, up to 8 moves, with no recorded collisions.
* **Conclusion:** Reducing energy loss prolongs survival, and collisions become less relevant as energy depletion slows down.

**Conclusion of Task 2:**  
This simulation demonstrates how behavior changes with the number of agents, the food spawn rate, and energy management. More agents lead to more collisions, while increasing food or reducing energy loss lengthens survival time. Future work could include random sheep movements, dynamic food regeneration, or variable-sized grids.

**Summary and Improvements:**

Both tasks can be expanded by increasing the number of agents, adding randomness, or modifying grid layouts to test more challenging environmental conditions. This provides insights into how collisions, energy, and resource management interact in complex simulations.