Assignment 3

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Task 1 - N Queen Problem

- The aim of this task is to understand how agents communicate and cooperate to achieve their goal using the N Queens problem.
- Rules of the game:
  - Create a NxN size chessboard, placing N queens on it
  - No two queens can share the same row
  - No two queens can share the same column
  - No two queens can share the same diagonal line
- Provide multiple arrangements for your queens.
- Your solution must work for N = [4,5,.. 19,20]

Task 1 - N Queen Problem

- Setup:
  - Each queen is an agent.
  - **Queens communicate with messages (using _ask_ is not acceptable)**
  - **Queens can only talk to their predecessor and their successor**
  - If a queen has no available position, she must let her predecessor know and ask her to reposition her
  - If the predecessor has no available positions left, she must message her predecessor and so on and on…
  - Stop when all queens are correctly positioned.

Task 2 - Positioning Speakers at Main Stage

- There are multiple stages in the festival example.
- Each stage is hosting an act that last for a fixed time.
  - Some stages have better light shows.
  - Some others have better visuals.
  - Some of them have a better sound system.
- The guest knows at any given time where all stages are.
- Considering the details for each stage, the guest picks one based on their preferences.
  - If they like the music style, lightshow, sound quality, etc.
- Each time an agent selects a stage to go. They make this decision based on some sort of an **utility function.** For example:
  - Let us say the user preference is as follows: **LightShow = 0.1**, **Speaker = 0.3**, **Music Style = 0.2**
  - The details of stage 1 is: **LightShow = 0.4**, **Speaker = 0.8**, **Music Style = 0.9**
  - The details of stage 2 is: **LightShow = 0.2**, **Speaker = 0.1**, **Music Style = 0.4**
  - The utility value for this user and stage 1 is: $0.1 * 0.4 + 0.3 * 0.8 + 0.2 * 0.9$ = **0.46**
  - The utility value for this user and stage 1 is: $0.1 * 0.2 + 0.3 * 0.1 + 0.2 * 0.4$ = **0.13**
  - Since the user always select the highest utility value, then they pick stage 1.

Task 2 - Positioning Speakers at Main Stage

- Setup:
  - Create some new agents for stages that the guests can travel to.
  - Give each stage some attributes with different values to model the details.
  - Guests communicate with stages via **FIPA** to know the attribute value.
  - Guests calculate their utility for each stage.
  - The stage with the highest utility is picked!

Goals

- Hands on experience with agents working together to find a solution to a problem.
- Agent utility function to control behaviour.
- More parameters used in FIPA service.

Extra Effort and Challenges!

- This assignment has 1 challenges!

Challenge 1: Global Utility Function

- The task is introducing a new attribute, **crowd mass**, into the decision-making process of guests.
- This attribute determines the guests' preferences regarding the size of the crowd they want to be a part of.
- Define the "Crowd Mass" Attribute:
    - Some guests prefer being part of a large crowd.
    - Others prefer quiet environments with sufficient space around them.
    - Make this attribute a key factor in the decision-making process of the guests.
- Decision-Making Process:
    - Each guest initially selects a stage based on their preferences, including the crowd mass.
    - After all guests have chosen their acts, they communicate with each other to share their decisions.
    - To simplify coordination:
        - Assign one agent as a **leader** that tells everyone where to go for an optimal solution.
- Dynamic Adjustment Based on Crowd Mass:
    - If a guest prefers less crowd but notices that most guests are choosing the same stage, they may decide to switch to another stage.
    - Conversely, if a guest prefers a large crowd but ends up at a stage with only a few guests, they should switch acts to maximize both their utility and that of others.
    - The goal is to adjust choices dynamically to maximize the overall utility of all guests.

Challenge 1: Global Utility Function

- Global Utility Optimization:
    - Guests must collaborate to maximize the global utility by:
        - Sacrificing some of their own utility where necessary.
        - Ensuring that the combined satisfaction (utility) of all guests is maximized.
    - Use the FIPA protocol for communication between guests.
- Deliverables:
    - Show the initial choice of guests and their corresponding global utility at that time.
    - Demonstrate how guests adjust their choices to increase global utility over time.
    - Indicate when the maximum global utility has been reached.
        - When max global utility has been reached, the agents can enjoy their show!

2 point is awarded for clear and complete demonstration of this