

Multi-Agent Systems

Lecture III
Assignment Project Exam Help

<https://eduassistpro.github.io/>

Dr. Nestor eo,

Add WeChat edu_assist_pro

- Researcher CONSUS (Crop Optimisation through Sensing, Understanding & viSualisation),
- School of Computer Science
- University College Dublin (UCD)



Lecture III Learning Objectives

☐ To understand the elements and principles of Agent Coordination.

Assignment Project Exam Help

☐ To understand the principles of Cooperative Problem Solving.

<https://eduassistpro.github.io/>

☐ To understand the common to coordination.

Add WeChat edu_assist_pro

☐ Review the formalization of coordination.

☐ Identify the elements of the Contract Net Protocol



Coordination

"The process by which an agent reasons about its local actions of other agents (anticipated) to ensure that the community acts in a coordinated manner."

Assignment Project Exam Help

<https://eduassistpro.github.io/>

Add WeChat edu_assist_pro

Nick Jennings, 1996



Why Coordinate?

- Prevent anarchy or chaos.
- Dependencies between agents' actions.
- Need to meet global constraints
- Achieve agents' goals
- No individual has sufficient competence, resources or information to solve the entire problem.
- Efficiency

Assignment Project Exam Help

<https://eduassistpro.github.io/>

Add WeChat edu_assist_pro



Coordination Elements

- The act of coordinating;
- Achieving proper order or a working relationship;
- Harmonious interaction as a function or part thereof;
- Autonomy;

Assignment Project Exam Help

<https://eduassistpro.github.io/>

Add WeChat edu_assist_pro



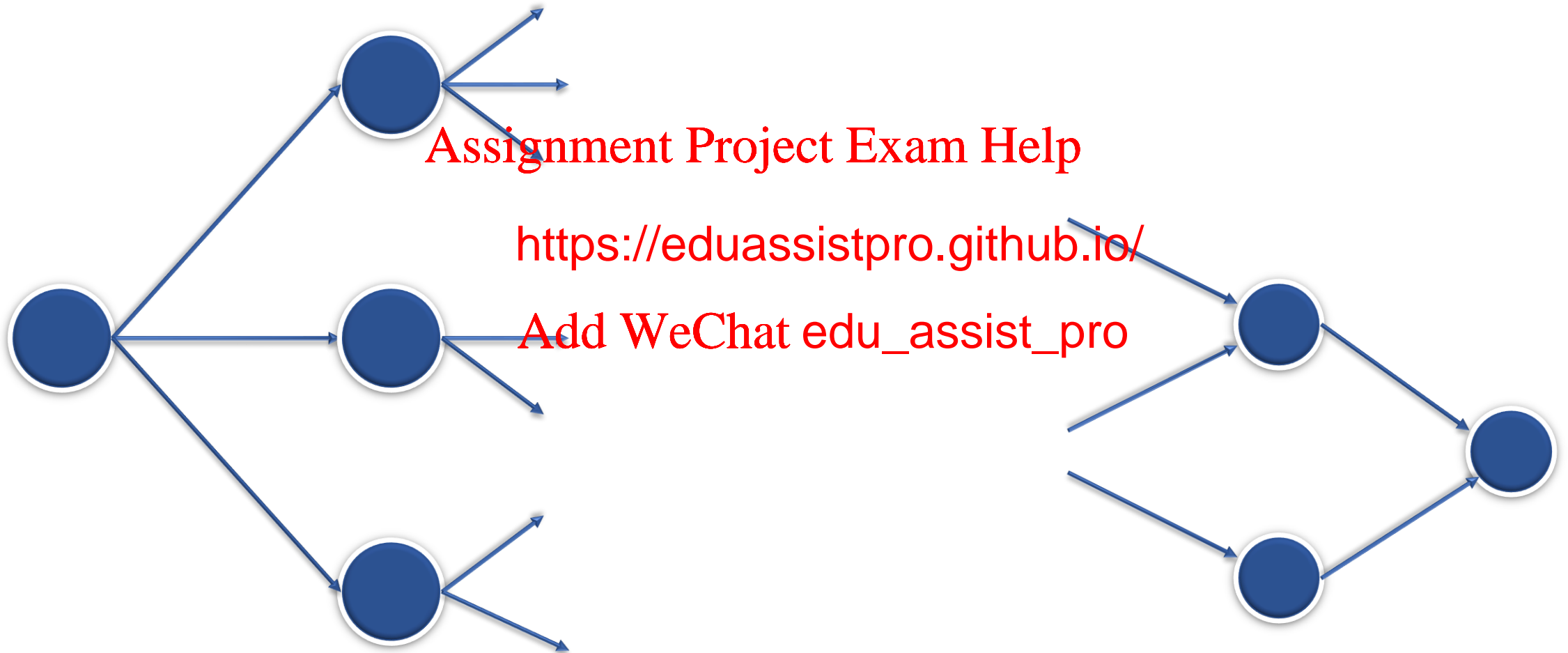
Chess vs Robocup

Assignment Project Exam Help

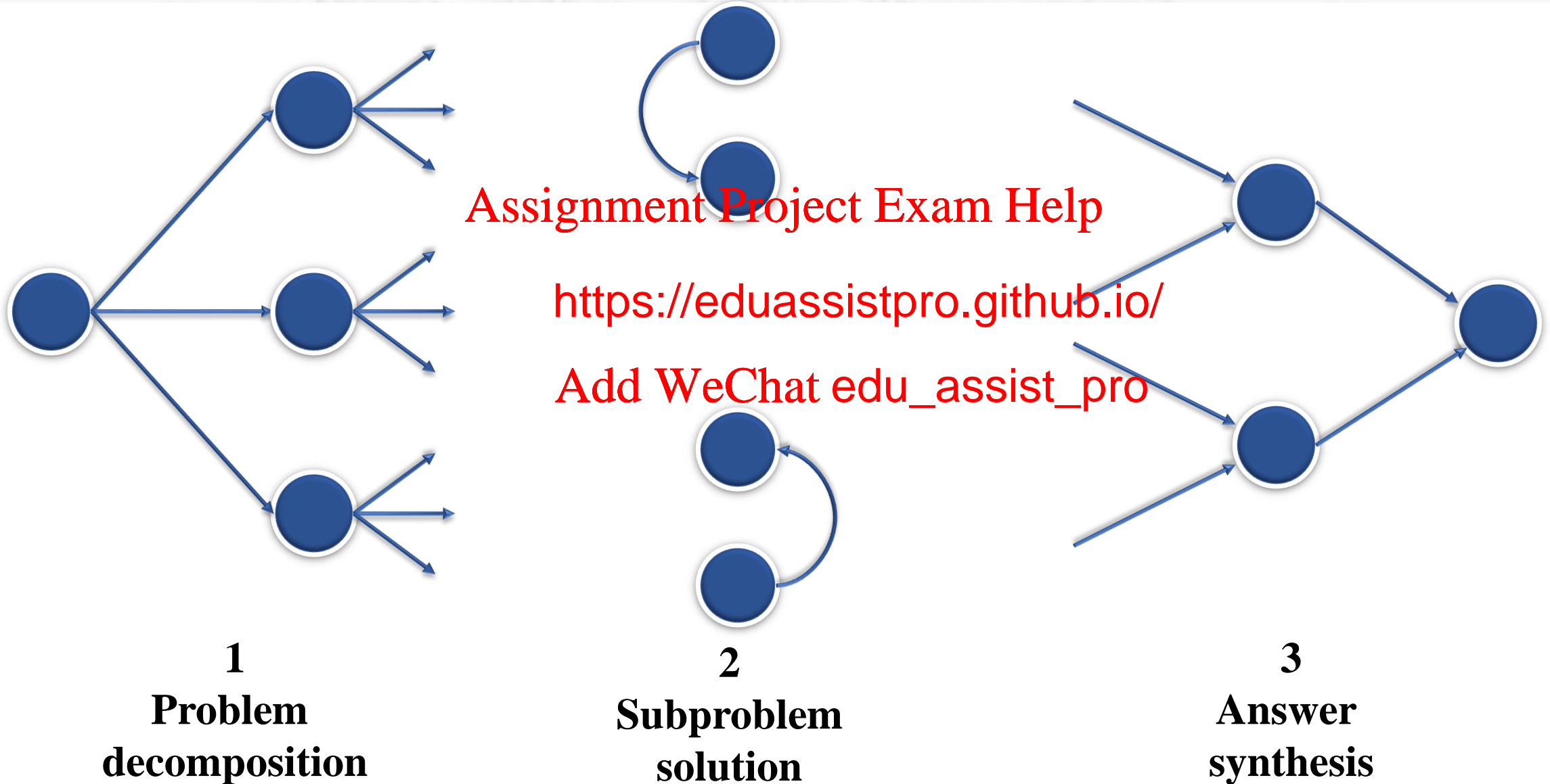
<https://eduassistpro.github.io/>

Add WeChat edu_assist_pro

Cooperative Problem Solving



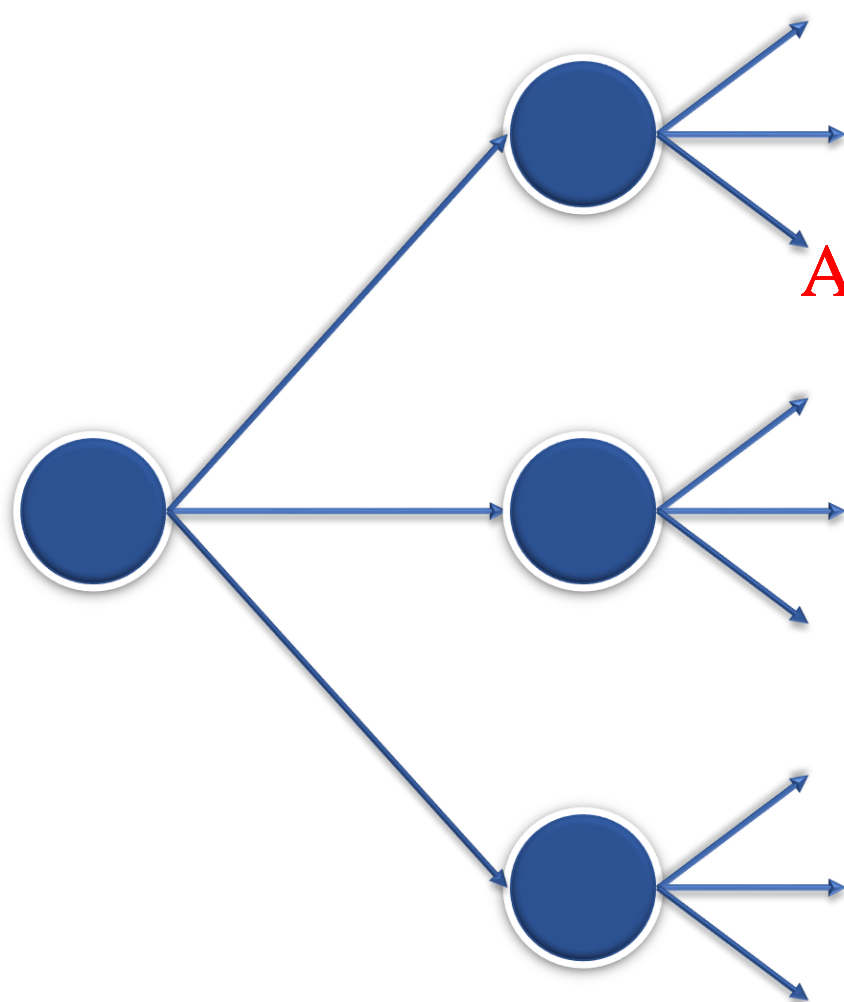
Cooperative Problem Solving





Cooperative Problem Solving

1. Problem decomposition



- How to break a problem down into a set of atomic sub-problems:

• Identify a minimal set of **atomic operations** that can be performed by **individual agents**.

<https://eduassistpro.github.io/> pose the initial problem.

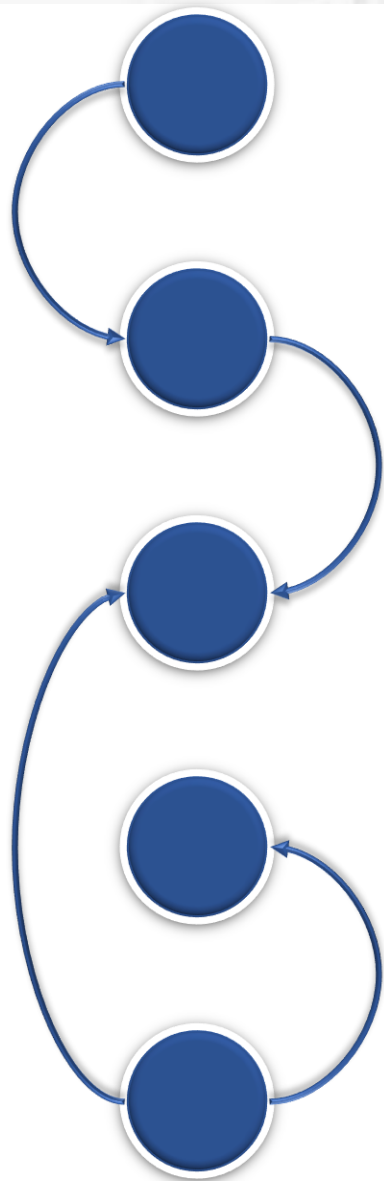
Add WeChat edu_assist_pro

- Issues:

- What is an appropriate level of granularity?
- How to decompose the problem? Recursively?
- Who should decompose the problem? (user, agents)
- Who should solve the sub problems?

Cooperative Problem Solving

2. Subproblem solution



- Solving individual sub-problems.
- Sub-problems are allocated in the previous phase.
- Sub-problems may have dependencies.
- Sub-problems may need to be solved in a specific order.
- Issues:
 - How to get help?
 - Who to share information with others?
 - What information to share?
 - Static / Dynamic decomposition.

Assignment Project Exam Help

<https://eduassistpro.github.io/>
Add WeChat edu_assist_pro

3. Answer Synthesis

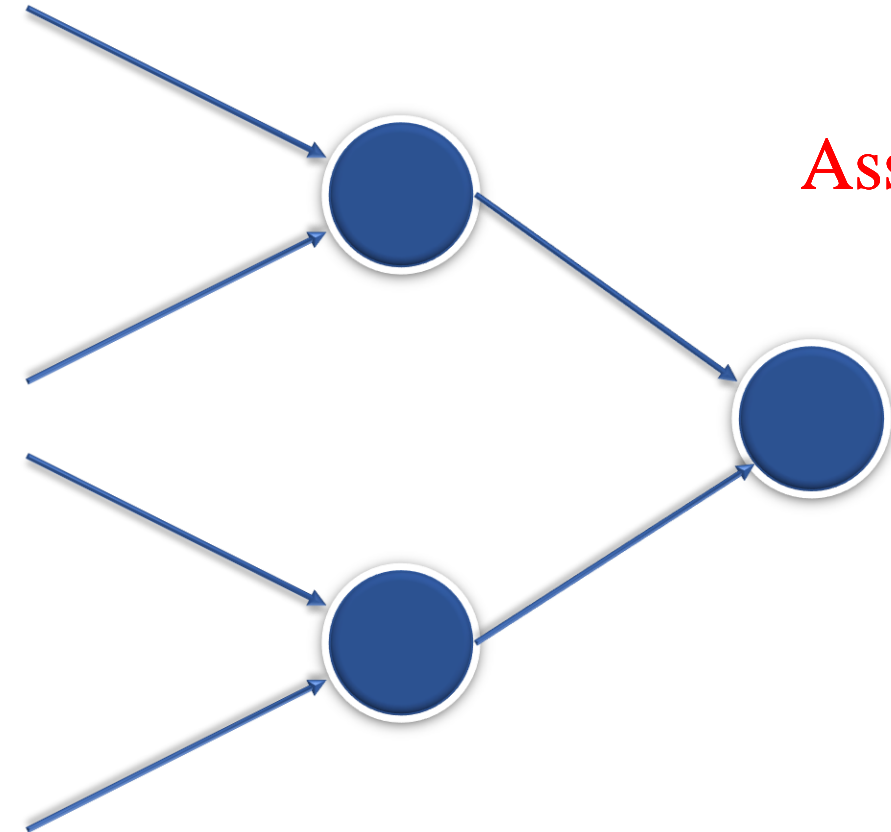
- Combining the results.
- Solutions to atomic sub-problems are combined to provide solutions to higher-level problems.

Assignment Project Exam Help

- <https://eduassistpro.github.io/> be assembled during this process

Add WeChat edu_assist_pro

- Issues:
 - Who does the solution synthesis?
 - How are the sub-problems combined?
 - Where are the sub-problems combined?





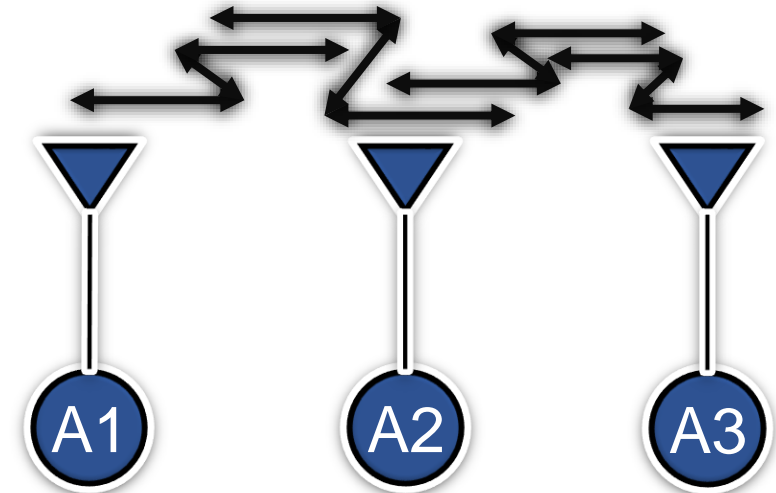
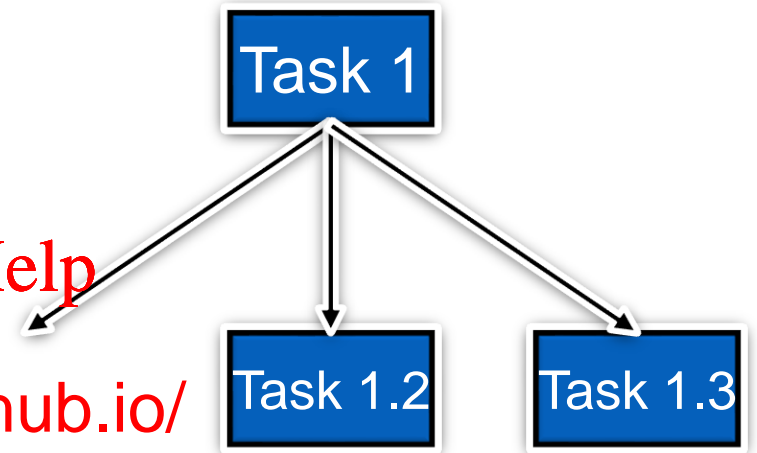
How to Coordinate?

- There are two common forms of coordination:
- **Task sharing:**
 - When a problem is decomposed into subproblems and assigned to different agents.
- **Result sharing:**
 - When agents share information relevant to their subproblems.

Assignment Project Exam Help

<https://eduassistpro.github.io/>

Add WeChat edu_assist_pro





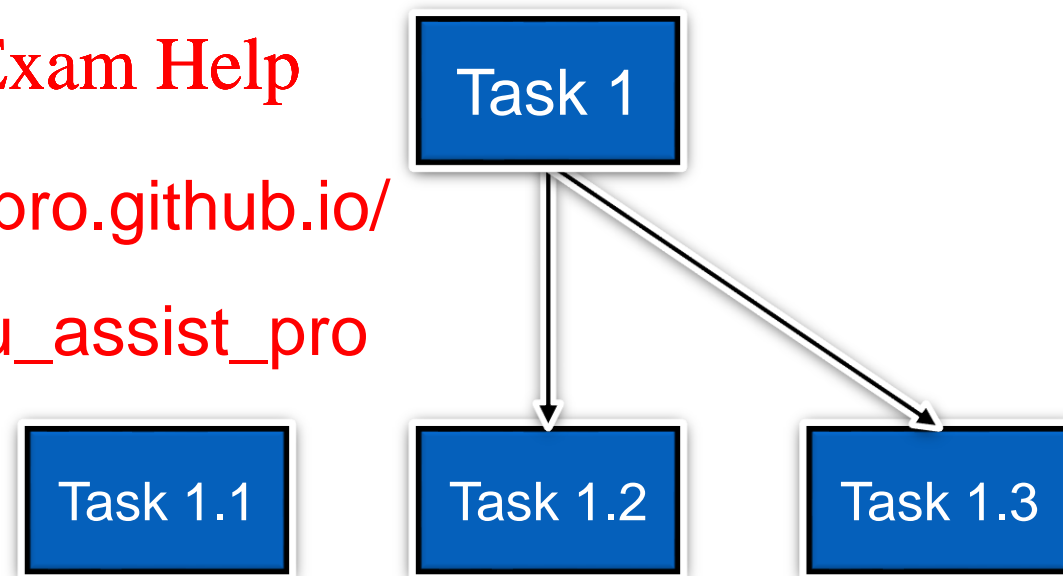
Task Sharing

The agent decomposes the task into a set of sub-tasks that are assigned to agents:

- The tasks are assigned dynamically at run-time based on agents capabilities.

The task allocation process <https://eduassistpro.github.io/>

- through a **central coordinator** (manager is authorised to assign tasks to worker agents).
- through some form of **coordination mechanism** that allows peers to reach agreement as to who will do what (e.g. negotiation, distributed planning, ...).





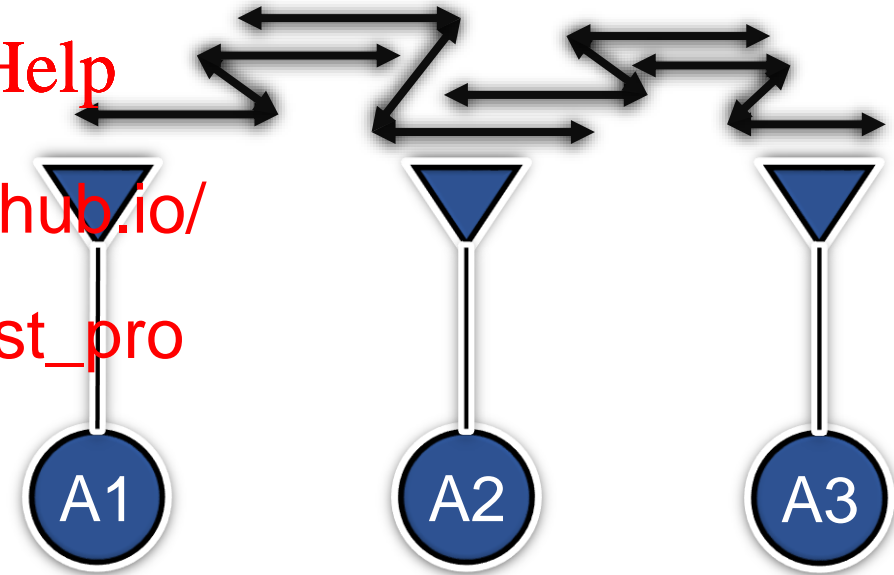
Result Sharing

- Problem solving proceeds by agents cooperatively exchanging information as the solution is developed.
 - The set of tasks are pre-assigned at design time
- Results may be share
 - **proactively** - one agent sends an agent some information because it believes that the other will be interested in it.
 - **reactively** – an agent sends information to another in response to a request.

Assignment Project Exam Help

<https://eduassistpro.github.io/>

Add WeChat edu_assist_pro





Result Sharing

- A Result Sharing system's performance can take advantage of:
 - **Confidence:** Higher confidence in a result if multiple agents independently derive it.
Assignment Project Exam Help
<https://eduassistpro.github.io/>
Add WeChat edu_assist_pro
 - **Completeness:** Sharing *local* can help to achieve a better *global view*.
 - **Precision:** Individual agents can refine their result based upon the results of the other agents.
 - **Timeliness:** If the agents work together to formulate the solution in parallel, the result can be attained quicker.