## Irrelevant Load

O1. What is one plus one?

O2.What<html> is <br/>one plus one?<\n>....



**Irrelevant Expression** Added

#### Repetitive Load

O1. 1+2+3=?Please tell me the answer

> Repetition Count Added

O2.

1+2+3=?1+2+3=? 1+2+3=?1+2+3=?

Please tell me the answer





# **Cognitive Load**



#### Ambiguous Load

O1. Tom and Bob are friends, please ask Bob to work hard!

**Ambiguous Expression** Added

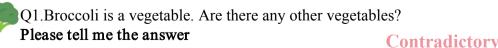
O2. Tom and Bob are friends, please ask him to work hard!

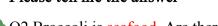


Added

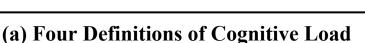


#### Contradictory Load





Q2.Broccoli is seafood. Are there any other vegetables? Expression Please tell me the answer



# Step1: Task Decomposition and Specialization

The orchestrator O decomposes the user query  $Q \rightarrow produces$  specialized prompts  $\{\phi_i\}$  for each agent A<sub>i</sub>, which then generate their first-round thoughts  $\{y_i, 0\}$  in parallel.

$$\{\phi_1,...,\phi_M\} = O_{\text{decompose}}(Q)$$

$$y_i,0=A_i(Q,\phi_i)\forall A_i\in A$$

# Step2: Iterative Refinement with Collective Memory

Initialize the collective memory  $S_1$  with the first-round thoughts; iterate for T rounds:

In each round, every agent A<sub>i</sub> refines its thought y<sub>i</sub>,t based on the current memory S<sub>t</sub> and the peer outputs selected by O, after which O writes all new outputs into the updated memory  $S_{t+1}$ .

$$y_{i,t} = A_i Q, \phi_i, S_t, O_{\text{select}} \{y_{j,t-1}\}_{j=1}^M$$

$$S_{t+1} = O_{\text{updatemem}}(S_{t} \{y_{1,t}, \dots, y_{M,t}\})$$



## Step3: Final Synthesis

After T rounds, O synthesizes the final outputs  $\{y_i, T\}$  together with the final memory  $S_{T+1}$  into the ultimate answer  $Y^*$ .

$$Y = O_{\text{synthesize}}(\{y_{1,T},...,y_{M,T}\},S_{T+1})$$

#### (b) Cognitive Orchestration Framework (COF)