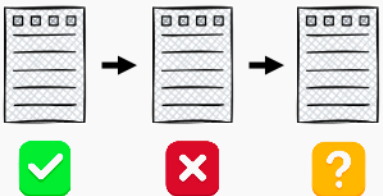


## MCQA Records



## Misconception Prototype Construction



Iterate over each past QA record

Concept  
Extraction

MCTS-based Reasoning  
Trajectory Recovery

Error Pattern  
Summary

## Answer Prediction

Misconception  
Prototype Mapping

Prediction

### Past QA Records $P$

#### Record $P_i$

**Stem  $s_i$ :** If  $|A| = 2$  and  $|B| = 3$ , how many different relations are there from  $A$  to  $B$ ?  
A.64 B.6 C.9 D.512

**Distractor  $d_i$ :** C. 9

### Test QA Records

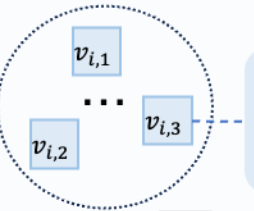
#### Record $P_j$

**Stem  $s_i$ :** If  $|A| = n$  and  $|B| = m$ , how many different relations are there from  $A$  to  $B$ ?  
A. $2^{nm}$  B. $mn$  C. $m^n$  D. $2^{m^n}$

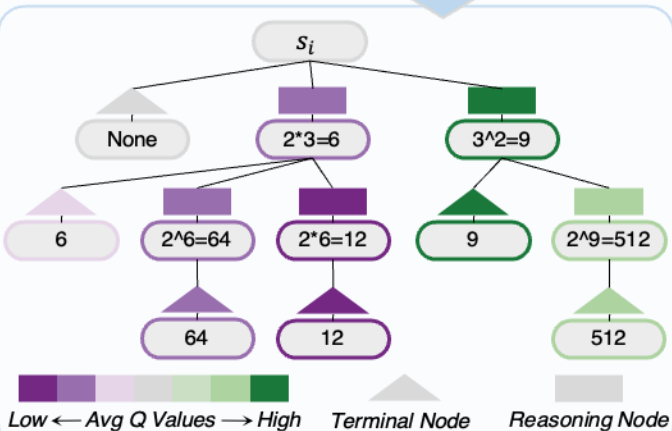
**Distractor  $d_j$ :**



$\phi_{concept}$



**Name:**  
*Relation Definition*



### Error Pattern Library

**Name:** *Relation Definition Reasoning Trajectories:*

1. Confused relations with functions; used  $3^2=9$ .
2. Good mastery. Correct solve the problem.

...



$\phi_{sum}$

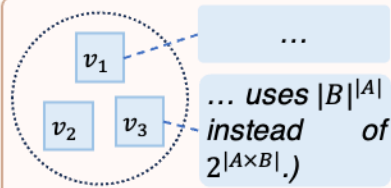
### Misconception Prototype

**Name:** *Relation Definition Misconceptions:*

*Weak mastery. Often confuses relations with functions; uses  $|B|^{|A|}$  instead of  $2^{|A \times B|}$ .*

**Stem  $s_i$ :** If  $|A| = n$  and  $|B| = m$ , how many different relations are there from  $A$  to  $B$ ?  
A. $2^{nm}$  B. $mn$  C. $m^n$  D. $2^{m^n}$

Compute Similarity  
& Retrieve



$\phi_{pred}$

*The student may confuse relations with functions, leading to  $m^n$ .*

**Distractor  $\hat{d}_j$ :** C.  $m^n$