

generate a new but incorrect answer.

In contrast, when comparing with collaboration between **MAPoRL**-trained LLMs, **MAPoRL** identifies a useful hint to solve the problem and then arrives at the correct answer, whereas off-the-shelf LLMs fail to do so.

G.10 Interaction Examples - Heterogeneous LLMs training (Section 4.6)

We used the Phi-3 and Qwen2.5 models, along with off-the-shelf models and our **MAPoRL** trained model.

Question.

A 76-star flag has three rows of 8 stars, two rows of 6 stars and the rest are 5-star rows. How many rows of 5 stars are there altogether on the flag?

Phi-3's first turn answer

First, let's calculate the total number of stars represented by the given rows of 8, 6, and 5 stars:

- Two rows of 8 stars give a total of $2 * 8 = 16$ stars.
- **One row** of 6 stars gives a total of $1 * 6 = 6$ stars.

So far, we have accounted for $16 + 6 = 22$ stars on the flag.

Since the flag has a total of 76 stars, the remaining number of stars is $76 - 22 = 54$ stars.

Now, let's calculate the number of rows of 5 stars by dividing the remaining number of stars (54) by the number of stars in each row (5):

$$54 / 5 = 10.8$$

Since we can't have a fraction of a row, we round down to the nearest whole number, which is 10 rows of 5 stars.

Answer: \boxed{10}

Verifier Score: 0.154,

Wrong

They made a very minor mistake: they didn't get the correct number of rows with six stars.

Qwen2.5's first turn answer

To determine the total number of rows of 5 stars on the flag, we first need to calculate the total number of stars on the flag and then subtract the number of stars in the rows with 7 and 6 stars.

We know:

- There are 3 rows of 8 stars each.
- There are 2 rows of 6 stars each.
- The rest of the rows are 5 stars each.

First, let's calculate the total number of stars on the flag:

- Stars in 3 rows of 8 stars: $(3 \times 8 = 24)$
- Stars in 2 rows of 6 stars: $(2 \times 6 = 12)$
- Let's denote the number of 5-star rows as (x) .

The total number of stars on the flag can be expressed as:

$$[24 + 12 + 5x = 36 + 5x]$$

15 We also need to know the total number of stars in the rows with 7 stars and 6 stars:
 16 – Stars in 3 rows of 7 stars: $(3 \times 7 = 21)$
 17 – Stars in 2 rows of 6 stars: $(2 \times 6 = 12)$
 18
 19 So, the total number of 7 and 6 star rows is:
 20 $[21 + 12 = 33]$
 21
 22 The total number of stars on
 23
 24 Answer: $\boxed{1}$ "
 25

1 Verifier Score: 0.028,
 2 Wrong

Qwen2.5 generated a good equation but then re-calculated using a strange equation.

G.10.1 Answers from MAPoRL Trained LLM

Phi-3's second turn answer

1 First, calculate the total number of stars from the given rows:
 2 – Three rows of 8 stars: $3 * 8 = 24$ stars
 3 – Two rows of 6 stars: $2 * 6 = 12$ stars
 4 – Total so far: $24 + 12 = 36$ stars
 5
 6 Subtract this from the total number of stars on the flag:
 7 – Remaining stars: $76 - 36 = 40$ stars
 8
 9 Finally, divide the remaining number of stars by the number of stars per row:
 10 – Number of rows: $40 / 5 = 8$ rows
 11
 12 Answer: $\boxed{8}$,

1 Verifier Score: 0.224,
 2 Right

This agent closely followed Qwen 2.5's answer, except for its incorrect part. Additionally, they recognized that Qwen 2.5 was likely providing the wrong answer.

Qwen 2.5's second turn answer

1 "There are three rows of 8 stars and two rows of 6 stars. This totals up to $3 * 8 = 24$ stars from the rows
 2 of 8 and $2 * 6 = 12$ stars from the rows of 6. Combined, there are $24 + 12 = 36$ stars accounted
 3 from complete rows. The total stars is 76. So the remaining number of stars = $76 - 36 = 40$, in
 4 rows of 5 stars each. Therefore number of whole 5-star rows = $40 / 5 = 8$.
 5
 6 Reward reasoning validates as concise completion computation completion
 7
 8 Answering Calculated `8'
 9
 10 Answer: $\boxed{8}$

1 Verifier Score: 0.903,
2 **Right**

Qwen 2.5 adopted the style of Phi-3's reply by avoiding equations with the variable x , but they solved this math problem by backtracking, similar to Phi-3's previous troal

G.10.2 Answers from Off-the-Shelf LLMs

1 Step 1: Calculate the total number of stars in the 3 rows of 8 stars.
2 The total number of stars in the 3 rows of 8 stars is $3 * 8 = 24$.
3
4 Step 2: Calculate the total number of stars in the 2 rows of 6 stars.
5 The total number of stars in the 2 rows of 6 stars is $2 * 6 = 12$.
6
7 Step 3: Calculate the total number of stars on the flag.
8 The total number of stars on the flag is the sum of the stars in the 3 rows of 8 stars, the 2 rows of 6 stars,
and the 1 row of 7 stars: $24 + 12 + 21 = 57$.
9
10 Step 4: Calculate the number of stars in the 1 row of 5 stars.
11 The total number of stars on the flag is 57, and the number of stars in the rows with 7 and 6 stars is 33.
The number of stars in the 1 row of 5 stars is the difference between the total number of stars and
the number of stars in the rows with 7 and 6 stars: $57 - 33 = 24$.
12
13 Step 5: Determine the number of rows of 5 stars.
14 The number of rows of 5 stars is the number of stars in the 1 row of 5 stars, which is 24.
15
16 The final answer is: \$\boxed{24}\$

1 Verifier Score: 0.312,
2 **Wrong**

For Phi-3, they repeated a similar error—Qwen 2.5's first-turn reply and this turn's Phi-3 reply both included a row of seven stars, which was not correct.

Qwen 2.5's second turn answer

1 Step 1: Calculate the total number of stars in the rows with 8, 6, and 7 stars.
2 First, let's calculate the total number of stars in the rows with 8, 6, and 7 stars. We have 3 rows of 8
stars each, 2 rows of 6 stars each, and 3 rows of 7 stars each.
3
4 Step 2: Calculate the total number of stars for each row of 8, 6, and 7 stars.
5 3 rows of 8 stars: $3 * 8 = 24$ stars
6 2 rows of 6 stars: $2 * 6 = 12$ stars
7 **3 rows of 7 stars: $3 * 7 = 21$ stars**
8 Step 3: Calculate the total number of stars for all rows of 8, 6, and 7 stars.
9 Total stars for rows with 8, 6, and 7 stars = $24 + 12 + 21 = 57$ stars
10
11 Step 4: Calculate the total number of stars for all rows.
12 Total number of stars in all rows = Total stars in rows with 8, 6, and 7 stars + Stars in rows with 7 and 6
stars.
13 Total stars in all rows = $57 + 33 = 90$ stars
14
15 Step 5: Calculate the number of rows of 5 stars by dividing the total number of stars by the number of
stars in each row of 5 stars.