

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** 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:

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

We also need to know the total number of stars in the rows with 7 stars and 6 stars:

– Stars in 3 rows of 7 stars: $3 \times 7 = 21$

– Stars in 2 rows of 6 stars: $2 \times 6 = 12$

So, the total number of 7 and 6 star rows is:

$21 + 12 = 33$

The total number of stars on

Answer: $\boxed{1}$

Verifier Score: 0.028,

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

First, calculate the total number of stars from the given rows:

– Three rows of 8 stars: $3 \times 8 = 24$ stars

– Two rows of 6 stars: $2 \times 6 = 12$ stars

– Total so far: $24 + 12 = 36$ stars

Subtract this from the total number of stars on the flag:

– Remaining stars: $76 - 36 = 40$ stars

Finally, divide the remaining number of stars by the number of stars per row:

– Number of rows: $40 / 5 = 8$ rows

Answer: $\boxed{8}$,

Verifier Score: 0.224,

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

"There are three rows of 8 stars and two rows of 6 stars. This totals up to $3 \times 8 = 24$ stars from the rows of 8 and $2 \times 6 = 12$ stars from the rows of 6. Combined, there are $24 + 12 = 36$ stars accounted from complete rows. The total stars is 76. So the remaining number of stars is $76 - 36 = 40$, in rows of 5 stars each. Therefore number of whole 5-star rows = $40 / 5 = 8$.

Reward reasoning validates as concise completion computation completion

Answering Calculated `8`

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 trial

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,
9 **and the 1 row of 7 stars:** $24 + 12 + 21 = 57$.
10
11 Step 4: Calculate the number of stars in the 1 row of 5 stars.
12 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.
13 The number of stars in the 1 row of 5 stars is the difference between the total number of stars and
14 the number of stars in the rows with 7 and 6 stars: $57 - 33 = 24$.
15
16 Step 5: Determine the number of rows of 5 stars.
17 The number of rows of 5 stars is the number of stars in the 1 row of 5 stars, which is 24.
18
19 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
3 stars each, 2 rows of 6 stars each, and 3 rows of 7 stars each.
4
5 Step 2: Calculate the total number of stars for each row of 8, 6, and 7 stars.
6 3 rows of 8 stars: $3 * 8 = 24$ stars
7 2 rows of 6 stars: $2 * 6 = 12$ stars
8 **3 rows of 7 stars: $3 * 7 = 21$ stars**
9 Step 3: Calculate the total number of stars for all rows of 8, 6, and 7 stars.
10 Total stars for rows with 8, 6, and 7 stars = $24 + 12 + 21 = 57$ stars
11
12 Step 4: Calculate the total number of stars for all rows.
13 Total number of stars in all rows = Total stars in rows with 8, 6, and 7 stars + Stars in rows with 7 and 6
14 stars.
15 Total stars in all rows = $57 + 33 = 90$ stars
16
17 Step 5: Calculate the number of rows of 5 stars by dividing the total number of stars by the number of
18 stars in each row of 5 stars.