llama_trace

April 12, 2024

[ ]:
```
# !pip install -q -U bitsandbytes
# !pip install -q -U git+https://github.com/huggingface/transformers.git
# !pip install -q -U git+https://github.com/huggingface/peft.git
# !pip install -q -U git+https://github.com/huggingface/accelerate.git
# !pip install -q -U datasets scipy ipywidgets matplotlib
```

[ ]:
```
from unsloth import FastLanguageModel
import torch
max_seq_length = 2048 # Choose any! We auto support RoPE Scaling internally!
dtype = None # None for auto detection. Float16 for Tesla T4, V100, Bfloat16␣
 ↪for Ampere+
load_in_4bit = True # Use 4bit quantization to reduce memory usage. Can be␣
 ↪False.

# 4bit pre quantized models we support for 4x faster downloading + no OOMs.
fourbit_models = [
    "unsloth/mistral-7b-bnb-4bit",
    "unsloth/mistral-7b-instruct-v0.2-bnb-4bit",
    "unsloth/llama-2-7b-bnb-4bit",
    "unsloth/llama-2-13b-bnb-4bit",
    "unsloth/codellama-34b-bnb-4bit",
    "unsloth/tinyllama-bnb-4bit",
    "unsloth/gemma-7b-bnb-4bit", # New Google 6 trillion tokens model 2.5x␣
 ↪faster!
    "unsloth/gemma-2b-bnb-4bit",
] # More models at https://huggingface.co/unsloth

# unsloth/codellama-7b-bnb-4bit

model, tokenizer = FastLanguageModel.from_pretrained(
    model_name = "unsloth/llama-2-7b-bnb-4bit", # Choose ANY! eg mistralai/
 ↪Mistral-7B-Instruct-v0.2
    max_seq_length = max_seq_length,
    dtype = dtype,
    load_in_4bit = load_in_4bit,
    # token = "hf_...", # use one if using gated models like meta-llama/
 ↪Llama-2-7b-hf
```

```
)
```

```
config.json:   0%|          | 0.00/1.10k [00:00<?, ?B/s]
```

```
Unused kwargs: ['quant_method']. These kwargs are not used in <class
'transformers.utils.quantization_config.BitsAndBytesConfig'>.
```

```
==((====))==  Unsloth: Fast Llama patching release 2024.3
   \\   /|    GPU: NVIDIA GeForce RTX 3090. Max memory: 23.483 GB. Platform =
Linux.
O^O/ \_/ \    Pytorch: 2.2.1+cu121. CUDA = 8.6. CUDA Toolkit = 12.1.
\        /    Bfloat16 = TRUE. Xformers = 0.0.25. FA = True.
 "-____-"     Free Apache license: http://github.com/unslothai/unsloth
```

```
model.safetensors:   0%|          | 0.00/3.87G [00:00<?, ?B/s]
```

```
generation_config.json:   0%|          | 0.00/188 [00:00<?, ?B/s]
```

```
tokenizer_config.json:   0%|          | 0.00/894 [00:00<?, ?B/s]
```

```
tokenizer.model:   0%|          | 0.00/500k [00:00<?, ?B/s]
```

```
tokenizer.json:   0%|          | 0.00/1.84M [00:00<?, ?B/s]
```

```
special_tokens_map.json:   0%|          | 0.00/438 [00:00<?, ?B/s]
```

[ ]:
```
model = FastLanguageModel.get_peft_model(
    model,
    r = 16, # Choose any number > 0 ! Suggested 8, 16, 32, 64, 128
    target_modules = ["q_proj", "k_proj", "v_proj", "o_proj",
                      "gate_proj", "up_proj", "down_proj",],
    lora_alpha = 16,
    lora_dropout = 0, # Supports any, but = 0 is optimized
    bias = "none",    # Supports any, but = "none" is optimized
    use_gradient_checkpointing = True,
    random_state = 3407,
    use_rslora = False,  # We support rank stabilized LoRA
    loftq_config = None, # And LoftQ
)
```

```
Unsloth 2024.3 patched 32 layers with 32 QKV layers, 32 O layers and 32 MLP
layers.
```

[ ]:
```
from datasets import load_dataset
tokenizer.pad_token = tokenizer.eos_token

json_file_path = "./python_states_singleline.json"
alpaca_prompt = """Below is an instruction that describes a task, paired with␣
 ↪an input that provides further context. Write a response that appropriately␣
 ↪completes the request.
```

```
### Instruction:
Write down all of the state changes that take place after the code snippet is executed.

### Input:
{}

### Response:
{}"""
# trace_prompt = """<s>[INST] {} [/INST] {}</s>"""

def formatting_prompts_func(examples):
    inputs = examples["input"]
    outputs = examples["output"]
    texts = []
    for input, output in zip(inputs, outputs):
        text = alpaca_prompt.format(input, output)
        texts.append(text)
    return {"text": texts}


dataset = load_dataset("json", data_files=json_file_path, split="train").select(range(2001))
dataset = dataset.map(formatting_prompts_func, batched=True) # had to unset batched
```

[ ]:
```
from trl import SFTTrainer
from transformers import TrainingArguments

trainer = SFTTrainer(
    model = model,
    tokenizer = tokenizer,
    train_dataset = dataset,
    dataset_text_field = "text",
    max_seq_length = max_seq_length,
    dataset_num_proc = 2,
    packing = False, # Can make training 5x faster for short sequences.
    args = TrainingArguments(
        per_device_train_batch_size = 2,
        gradient_accumulation_steps = 4,
        warmup_steps = 5,
        # max_steps = 200,
        num_train_epochs=1,
        learning_rate = 2e-4,
        fp16 = not torch.cuda.is_bf16_supported(),
        bf16 = torch.cuda.is_bf16_supported(),
        logging_steps = 1,
```

```
        optim = "adamw_8bit",
        weight_decay = 0.01,
        lr_scheduler_type = "linear",
        seed = 3407,
        output_dir = "outputs",
    ),
)
```

```
Map (num_proc=2):   0%|          | 0/2001 [00:00<?, ? examples/s]
```

```
max_steps is given, it will override any value given in num_train_epochs
```

[ ]:
```
trainer_stats = trainer.train()
```

```
==((====))==  Unsloth - 2x faster free finetuning | Num GPUs = 1
   \\   /|    Num examples = 2,001 | Num Epochs = 1
O^O/ \_/ \    Batch size per device = 2 | Gradient Accumulation steps = 4
\        /    Total batch size = 8 | Total steps = 200
 "-____-"     Number of trainable parameters = 39,976,960
```

```
<IPython.core.display.HTML object>
```

[ ]:
```
obj = {
        "input": "state: h = [None, {}, {}, None, None, None]; j = 2; o = 'k';␣
 ↪code: h[j][o] = 1",
        "output": "h = [None, {}, {'k': 1}, None, None, None]; j = 2; o = 'k';",
        "example": 8585426
    }

FastLanguageModel.for_inference(model) # Enable native 2x faster inference
inputs = tokenizer([
    alpaca_prompt.format(
            "state: h = [None, {}, {}, None, None, None]; j = 2; o = 'k'; code:␣
 ↪h[j][o] = 1"
            , "")
], return_tensors = "pt").to('cuda')
```

[ ]:
```
outputs = model.generate(**inputs, max_new_tokens = 64, use_cache = True)
print(tokenizer.batch_decode(outputs))
```

```
["<s> Below is an instruction that describes a task, paired with an input that
provides further context. Write a response that appropriately completes the
request.\n\n### Instruction:\nWrite down all of the state changes that take
place after the code snippet is executed.\n\n### Input:\nstate: h = [None, {},
{}, None, None, None]; j = 2; o = 'k'; code: h[j][o] = 1\n\n### Response:\nh =
[None, {}, {}, None, None, 1]; j = 2; o = 'k';\n\n### Explanation:\nh[j][o] =
1;\n\n### Explanation:\nh = [None, {}, {}, None, None, "]
```

[ ]:
```python
from collections import Counter

# EVAL LOGIC
def calculate_token_level_f1(prediction_tokens, reference_tokens):
    """
    Calculate precision, recall, and F1 score based on token overlap.
    """
    common_token_count = Counter(prediction_tokens) & Counter(reference_tokens)
    num_same = sum(common_token_count.values())

    if num_same == 0:
        return 0, 0, 0

    precision = 1.0 * num_same / len(prediction_tokens)
    recall = 1.0 * num_same / len(reference_tokens)
    f1 = (2 * precision * recall) / (precision + recall)

    return precision, recall, f1


def correct_solution(prediction_str, reference_str):
    """
    Compare the final numerical output of the model with the reference tokens.

    Args:
    - prediction_tokens: List of token IDs representing the model's prediction.
    - reference_tokens: List of token IDs representing the reference output.

    Returns:
    - 1 if the final numerical output of the model matches the reference tokens␣
 ↪exactly, else 0.
    """
    # prediction_str = tokenizer.decode(prediction_tokens,␣
 ↪skip_special_tokens=True)
    # reference_str = tokenizer.decode(reference_tokens,␣
 ↪skip_special_tokens=True)

    prediction_lines = prediction_str.strip().split("\n")
    reference_lines = reference_str.strip().split("\n")

    # print(prediction_lines)
    # print(reference_lines)

    last_prediction_line = prediction_lines[-1].strip()
    last_reference_line = reference_lines[-1].strip()

    # print("predicted ",last_prediction_line)
```

```
    # print("reference ",last_reference_line)
    # print(last_prediction_line== last_reference_line)

    if last_prediction_line== last_reference_line:
        return 1
    else:
        return 0


def custom_metrics_gsm8k(preds):
    # TODO Changed this function group to work with gsm8k
    logits = torch.tensor(preds.predictions)
    labels = torch.tensor(preds.label_ids)

    batch_size, seq_length, vocab_size = logits.shape

    # steal from inside llama
    # shift logits by 1 index cuz of causal lm
    shift_logits = logits[..., :-1, :].contiguous()
    shift_labels = labels[..., 1:].contiguous()
    # Flatten the tokens
    # loss_fct = CrossEntropyLoss()
    shift_logits = shift_logits.view(batch_size, -1, vocab_size)
    shift_labels = shift_labels.view(batch_size, -1)

    probs = torch.nn.functional.softmax(shift_logits.view(-1, vocab_size),␣
 ↪dim=-1)
    p_true_tokens = probs.view(-1, vocab_size)[
        torch.arange(batch_size * (seq_length - 1)), shift_labels.view(-1)
    ].view(batch_size, (seq_length - 1))

    nll = -torch.log(p_true_tokens)
    mean_nll = nll.mean()
    ppl = torch.exp(mean_nll)  # perplexity

    # compute percentage of correct tokens
    correct_tokens = (
        (shift_logits.view(-1, vocab_size).argmax(-1) == shift_labels.view(-1))
        .float()
        .mean()
    )

    pred_max_labels = shift_logits.argmax(-1).view(batch_size, -1)

    f1_scores = []
    precision_scores = []
    recall_scores = []
```

```
    solution_scores = []

    for i in range(batch_size):
        unmasked_label_tokens = shift_labels[i][shift_labels[i] != -100][
            :-1
        ]  # drop eos_token
        # find the index where the instruction token ends and the answer begins
        inst_token_seq = tokenizer.encode("[/INST]", return_tensors="pt")[0][1:]
        first_output_idx = None
        for j in range(unmasked_label_tokens.shape[0] - len(inst_token_seq)):
            if torch.equal(
                unmasked_label_tokens[j : j + len(inst_token_seq)],␣
↪inst_token_seq
            ):
                first_output_idx = j + len(inst_token_seq)
                break
        assert (
            first_output_idx is not None
        ), "Could not find the end of the instruction token"

        # get ground truth output tokens
        gt_output_tokens = unmasked_label_tokens[first_output_idx:]
        # get predicted output tokens (including padding)
        pred_output_tokens_masked = pred_max_labels[i][first_output_idx:]
        # drop the pad tokens
        pred_output_tokens_unmasked = pred_output_tokens_masked[
            pred_output_tokens_masked != -100
        ]

        eos_token_indices = torch.where(
            pred_output_tokens_unmasked == tokenizer.eos_token_id
        )[0]

        if eos_token_indices.size(0) > 0:
            first_pred_output_stop_idx = eos_token_indices[0].item()
        else:
            first_pred_output_stop_idx = len(pred_output_tokens_unmasked) - 1

        pred_output_tokens = pred_output_tokens_unmasked[:
↪first_pred_output_stop_idx]

        gt_output_str = tokenizer.decode(gt_output_tokens)
        pred_output_str = tokenizer.decode(pred_output_tokens)

        precision, recall, f1 = calculate_token_level_f1(pred_output_str,␣
↪gt_output_str)
```

```
        correct = correct_solution(pred_output_str, gt_output_str)
        solution_scores.append(correct)

        f1_scores.append(f1)
        precision_scores.append(precision)
        recall_scores.append(recall)

    mean_f1 = np.mean(f1_scores) if f1_scores else 0
    mean_precision = np.mean(precision_scores) if precision_scores else 0
    mean_recall = np.mean(recall_scores) if recall_scores else 0
    solve_rate = np.mean(solution_scores) if solution_scores else 0

    # wandb.log(
    #     {
    #         "perplexity": ppl.item(),
    #         "correct_tokens": correct_tokens.item(),
    #         "f1": mean_f1,
    #         "solve_rate": solve_rate,
    #     }
    # )
    return {
        "perplexity": ppl,
        "correct_tokens": correct_tokens.item(),
        "f1": mean_f1,
        "mean_precision": mean_precision,
        "mean_recall": mean_recall,
        "solve_rate":solve_rate,
    }
```

[ ]:
```
# @title GSM8K Prompts

PREAMBLE = """As an expert problem solver solve step by step the following␣
 ↪mathematical questions."""

# The default gsm8k prompt from the CoT paper
# https://arxiv.org/pdf/2201.11903.pdf page 35.

PROMPT = """Q: There are 15 trees in the grove. Grove workers will plant trees␣
 ↪in the grove today. After they are done, there will be 21 trees. How many␣
 ↪trees did the grove workers plant today?
A: We start with 15 trees. Later we have 21 trees. The difference must be the␣
 ↪number of trees they planted. So, they must have planted 21 - 15 = 6 trees.␣
 ↪The answer is 6.

Q: If there are 3 cars in the parking lot and 2 more cars arrive, how many cars␣
 ↪are in the parking lot?
```

```
A: There are 3 cars in the parking lot already. 2 more arrive. Now there are 3␣
 ↪+ 2 = 5 cars. The answer is 5.

Q: Leah had 32 chocolates and her sister had 42. If they ate 35, how many␣
 ↪pieces do they have left in total?
A: Leah had 32 chocolates and Leah's sister had 42. That means there were␣
 ↪originally 32 + 42 = 74 chocolates. 35 have been eaten. So in total they␣
 ↪still have 74 - 35 = 39 chocolates. The answer is 39.

Q: Jason had 20 lollipops. He gave Denny some lollipops. Now Jason has 12␣
 ↪lollipops. How many lollipops did Jason give to Denny?
A: Jason had 20 lollipops. Since he only has 12 now, he must have given the␣
 ↪rest to Denny. The number of lollipops he has given to Denny must have been␣
 ↪20 - 12 = 8 lollipops. The answer is 8.

Q: Shawn has five toys. For Christmas, he got two toys each from his mom and␣
 ↪dad. How many toys does he have now?
A: He has 5 toys. He got 2 from mom, so after that he has 5 + 2 = 7 toys. Then␣
 ↪he got 2 more from dad, so in total he has 7 + 2 = 9 toys. The answer is 9.

Q: There were nine computers in the server room. Five more computers were␣
 ↪installed each day, from monday to thursday. How many computers are now in␣
 ↪the server room?
A: There are 4 days from monday to thursday. 5 computers were added each day.␣
 ↪That means in total 4 * 5 = 20 computers were added. There were 9 computers␣
 ↪in the beginning, so now there are 9 + 20 = 29 computers. The answer is 29.

Q: Michael had 58 golf balls. On tuesday, he lost 23 golf balls. On wednesday,␣
 ↪he lost 2 more. How many golf balls did he have at the end of wednesday?
A: Michael initially had 58 balls. He lost 23 on Tuesday, so after that he has␣
 ↪58 - 23 = 35 balls. On Wednesday he lost 2 more so now he has 35 - 2 = 33␣
 ↪balls. The answer is 33.

Q: Olivia has $23. She bought five bagels for $3 each. How much money does she␣
 ↪have left?
A: She bought 5 bagels for $3 each. This means she spent 5 * $3 = $15 on the␣
 ↪bagels. She had $23 in beginning, so now she has $23 - $15 = $8. The answer␣
 ↪is 8."""


# Extension of the default 8-shot prompt, page 35 in
# https://arxiv.org/pdf/2201.11903.pdf
# The extension is intended to improve performance on
# more complicated gsm8k examples.
```

```
EXTRA_3_SHOTS = """As an expert problem solver solve step by step the following␣
 ↪mathematical questions.

Q: Tina makes $18.00 an hour.  If she works more than 8 hours per shift, she is␣
 ↪eligible for overtime, which is paid by your hourly wage + 1/2 your hourly␣
 ↪wage.  If she works 10 hours every day for 5 days, how much money does she␣
 ↪make?
A: Here's how to calculate Tina's earnings:

**Regular Time:**
- Hours per shift: 8 hours
- Wage per hour: $18.00
- Regular pay per shift: 8 hours * $18.00/hour = $144.00

**Overtime:**
- Overtime hours per shift: 10 hours - 8 hours = 2 hours
- Overtime pay per hour: $18.00 + ($18.00 / 2) = $27.00
- Overtime pay per shift: 2 hours * $27.00/hour = $54.00

**Total per day:**
- Regular pay + overtime pay: $144.00/shift + $54.00/shift = $198.00/day

**Total for 5 days:**
- 5 days * $198.00/day = $990.00

**Therefore, Tina will make $990.00 in 5 days.** The answer is 990.

Q: Abigail is trying a new recipe for a cold drink. It uses 1/4 of a cup of␣
 ↪iced tea and 1 and 1/4 of a cup of lemonade to make one drink. If she fills␣
 ↪a pitcher with 18 total cups of this drink, how many cups of lemonade are in␣
 ↪the pitcher?
A: ## Ambiguity in the Problem Statement:

There is one main ambiguity in the problem statement:

**Total volume vs. Number of servings:** The statement "18 total cups of this␣
 ↪drink" could be interpreted in two ways:
  * **18 cups of the combined volume:** This would mean Abigail used a total of␣
 ↪18 cups of liquid, including both iced tea and lemonade.
  * **18 individual servings:** This would mean Abigail made 18 individual␣
 ↪drinks, each containing 1/4 cup of iced tea and 1 1/4 cup of lemonade.

Let us assume the interpretation "18 cups of the combined volume".

## Solution assuming 18 cups of combined volume:
```

```
**Step 1: Find the proportion of lemonade in one drink:**

* Lemonade: 1 1/4 cups
* Iced tea: 1/4 cup
* Total: 1 1/4 + 1/4 = 1 1/2 cups
* Lemonade proportion: (1 1/4) / (1 1/2) = 5/6

**Step 2: Calculate the amount of lemonade in the pitcher:**

* Total volume: 18 cups
* Lemonade proportion: 5/6
* Volume of lemonade: 18 * (5/6) = 15 cups

Therefore, there are 15 cups of lemonade in the pitcher. The answer is 15.

Q: A deep-sea monster rises from the waters once every hundred years to feast␣
 ↪on a ship and sate its hunger. Over three hundred years, it has consumed 847␣
 ↪people. Ships have been built larger over time, so each new ship has twice␣
 ↪as many people as the last ship. How many people were on the ship the␣
 ↪monster ate in the first hundred years?
A: Let us solve it using algebra. Let x be the number of people on the ship the␣
 ↪monster ate in the first hundred years.

The number of people on the ship eaten in the second hundred years is 2x, and␣
 ↪in the third hundred years is 4x.

Therefore, the total number of people eaten over three hundred years is x + 2x␣
 ↪+ 4x = 847.

Combining like terms, we get 7x = 847.

Dividing both sides by 7, we find x = 121.

Therefore, there were 121 people on the ship the monster ate in the first␣
 ↪hundred years. The answer is 121."""
```

[ ]:
```python
import re

def extract_number_from_text(text, prefix="The answer is"):
    """
    Extracts the last number from a text string that follows a given prefix.
    Args:
        text (str): The text from which to extract the number.
        prefix (str): The prefix to search for before extracting the number.
    Returns:
        float or None: The extracted number, or None if no valid number is␣
 ↪found.
```

```
    """
    # Find the part of the text that starts with the prefix
    match = re.search(re.escape(prefix) + r".*", text)
    if match:
        # Extract all numbers from the matched text
        numbers = re.findall(r"[-+]?[0-9]*\.?[0-9]+", match.group(0))
        if numbers:
            # Return the last number found as a float
            last_number = numbers[-1]
            try:
                return float(last_number)
            except ValueError:
                print(f"Could not convert '{last_number}' to float.")
                return None
    return None

def extract_response_after_question(full_output, question):
    """
    Extracts the line immediately following the question in the model's output.

    Args:
    - full_output (str): The complete output from the model.
    - question (str): The question text used to locate the response line.

    Returns:
    - str: The line following the question line or None if not found.
    """
    # Normalize line breaks
    full_output = full_output.replace('\r\n', '\n').replace('\r', '\n')
    lines = full_output.split('\n')

    # Attempt to find the line containing the question
    for i, line in enumerate(lines):
        if question in line:
            # Return the next line if it exists
            if i + 1 < len(lines):
                return lines[i + 1].strip()
            break

    return None

# # Example Usage:
# full_output = """
# Q: How many eggs do Janet's ducks lay?
# A: Janet's ducks lay 16 eggs per day. She eats 3 for breakfast.
# She bakes muffins with 4. She sells the rest for $2 per fresh duck egg.
# So, she gets 16 * 3 - 4 * 2 = $48. The answer is $48.
```

```
# """
# question = "How many eggs do Janet's ducks lay?"

# next_line = extract_response_after_question(full_output, question)
# print(f"Response after the question: '{next_line}'")
```

[ ]:
```
import torch
from datasets import load_dataset

TEMPLATE = """
Q: {}
A:"""

# Load GSM8K dataset
gsm8k_test = load_dataset("gsm8k","main", split="test")

# Assuming model and tokenizer are already initialized
model.eval()  # Set the model to evaluation mode

# Helper function to encode inputs
def prepare_input(p):
    # print(question)
    prompt = (PREAMBLE +'\n\n' + PROMPT + '\n' +
                  TEMPLATE.format(p))
    return tokenizer(prompt, return_tensors='pt').input_ids

# Function to decode model output
def decode_output(output_ids):
    return tokenizer.decode(output_ids, skip_special_tokens=True)


# Manual testing loop
all_correct = 0
all_responses = {}
idx = 0
total = len(gsm8k_test)
total = 100

for task_id, problem in enumerate(gsm8k_test):
    if idx == total:
        break

    print(f"task_id {task_id}")

    # Prepare the input for the model
    input_ids = prepare_input(problem['question'])
    with torch.no_grad():
```

```
        output_ids = model.generate(input_ids, max_new_tokens = 120)  # Adjust␣
↪max_length as needed

    response = decode_output(output_ids[0])
    all_responses[task_id] = response

    answer_line = extract_response_after_question(response, problem['question'])

    # Compare model output to the ground truth
    model_number = extract_number_from_text(answer_line, "The answer is")
    ground_truth_number = extract_number_from_text(problem['answer'], "####")

    # print(model_number)
    # print(ground_truth_number)

    if model_number == ground_truth_number:
        all_correct += 1


    print(f"Model answer: {model_number}")
    print(f"Ground truth answer: {ground_truth_number}")
    print(f"Correct: {all_correct} out of {total}")
    print("="*40)
    idx += 1


# Final accuracy
accuracy = all_correct / len(gsm8k_test)
print(f"Final Accuracy: {accuracy:.2f}")
```

```
task_id 0
Model answer: None
Ground truth answer: 18.0
Correct: 0 out of 100
========================================
task_id 1
Model answer: 0.0
Ground truth answer: 3.0
Correct: 0 out of 100
========================================
task_id 2
Model answer: 0.0
Ground truth answer: 70000.0
Correct: 0 out of 100
========================================
task_id 3
Model answer: 540.0
```

```
Ground truth answer: 540.0
Correct: 1 out of 100
========================================
task_id 4
Model answer: 240.0
Ground truth answer: 20.0
Correct: 1 out of 100
========================================
task_id 5
Model answer: 80.0
Ground truth answer: 64.0
Correct: 1 out of 100
========================================
task_id 6
Model answer: None
Ground truth answer: 260.0
Correct: 1 out of 100
========================================
task_id 7
Model answer: 0.0
Ground truth answer: 160.0
Correct: 1 out of 100
========================================
task_id 8
Model answer: None
Ground truth answer: 45.0
Correct: 1 out of 100
========================================
task_id 9
Model answer: None
Ground truth answer: 460.0
Correct: 1 out of 100
========================================
task_id 10
Model answer: None
Ground truth answer: 366.0
Correct: 1 out of 100
========================================
task_id 11
Model answer: None
Ground truth answer: 694.0
Correct: 1 out of 100
========================================
task_id 12
Model answer: None
Ground truth answer: 13.0
Correct: 1 out of 100
========================================
```

```
task_id 13
Model answer: 5.0
Ground truth answer: 18.0
Correct: 1 out of 100
========================================
task_id 14
Model answer: None
Ground truth answer: 60.0
Correct: 1 out of 100
========================================
task_id 15
Model answer: None
Ground truth answer: 125.0
Correct: 1 out of 100
========================================
task_id 16
Model answer: 7.0
Ground truth answer: 230.0
Correct: 1 out of 100
========================================
task_id 17
Model answer: None
Ground truth answer: 57500.0
Correct: 1 out of 100
========================================
task_id 18
Model answer: 24.0
Ground truth answer: 7.0
Correct: 1 out of 100
========================================
task_id 19
Model answer: 3.0
Ground truth answer: 6.0
Correct: 1 out of 100
========================================
task_id 20
Model answer: None
Ground truth answer: 15.0
Correct: 1 out of 100
========================================
task_id 21
Model answer: 29.0
Ground truth answer: 14.0
Correct: 1 out of 100
========================================
task_id 22
Model answer: 7.0
Ground truth answer: 7.0
```

```
Correct: 2 out of 100
========================================
task_id 23
Model answer: None
Ground truth answer: 8.0
Correct: 2 out of 100
========================================
task_id 24
Model answer: 24.38
Ground truth answer: 26.0
Correct: 2 out of 100
========================================
task_id 25
Model answer: None
Ground truth answer: 2.0
Correct: 2 out of 100
========================================
task_id 26
Model answer: None
Ground truth answer: 243.0
Correct: 2 out of 100
========================================
task_id 27
Model answer: None
Ground truth answer: 16.0
Correct: 2 out of 100
========================================
task_id 28
Model answer: 25.0
Ground truth answer: 25.0
Correct: 3 out of 100
========================================
task_id 29
Model answer: 96.0
Ground truth answer: 104.0
Correct: 3 out of 100
========================================
task_id 30
Model answer: 174.0
Ground truth answer: 109.0
Correct: 3 out of 100
========================================
task_id 31
Model answer: None
Ground truth answer: 80.0
Correct: 3 out of 100
========================================
task_id 32
```

```
Model answer: 35.0
Ground truth answer: 35.0
Correct: 4 out of 100
========================================
task_id 33
Model answer: 140.0
Ground truth answer: 70.0
Correct: 4 out of 100
========================================
task_id 34
Model answer: None
Ground truth answer: 23.0
Correct: 4 out of 100
========================================
task_id 35
Model answer: 5.0
Ground truth answer: 9.0
Correct: 4 out of 100
========================================
task_id 36
Model answer: 120.0
Ground truth answer: 75.0
Correct: 4 out of 100
========================================
task_id 37
Model answer: None
Ground truth answer: 2.0
Correct: 4 out of 100
========================================
task_id 38
Model answer: None
Ground truth answer: 10.0
Correct: 4 out of 100
========================================
task_id 39
Model answer: None
Ground truth answer: 18.0
Correct: 4 out of 100
========================================
task_id 40
Model answer: None
Ground truth answer: 8.0
Correct: 4 out of 100
========================================
task_id 41
Model answer: None
Ground truth answer: 200.0
Correct: 4 out of 100
```

```
========================================
task_id 42
Model answer: 9.0
Ground truth answer: 26.0
Correct: 4 out of 100
========================================
task_id 43
Model answer: None
Ground truth answer: 48.0
Correct: 4 out of 100
========================================
task_id 44
Model answer: None
Ground truth answer: 20.0
Correct: 4 out of 100
========================================
task_id 45
Model answer: None
Ground truth answer: 104.0
Correct: 4 out of 100
========================================
task_id 46
Model answer: None
Ground truth answer: 163.0
Correct: 4 out of 100
========================================
task_id 47
Model answer: 5.0
Ground truth answer: 800.0
Correct: 4 out of 100
========================================
task_id 48
Model answer: 24.0
Ground truth answer: 8.0
Correct: 4 out of 100
========================================
task_id 49
Model answer: 120.0
Ground truth answer: 30.0
Correct: 4 out of 100
========================================
task_id 50
Model answer: None
Ground truth answer: 294.0
Correct: 4 out of 100
========================================
task_id 51
Model answer: 46.0
```

```
Ground truth answer: 5.0
Correct: 4 out of 100
========================================
task_id 52
Model answer: 7.0
Ground truth answer: 15.0
Correct: 4 out of 100
========================================
task_id 53
Model answer: 120.0
Ground truth answer: 40.0
Correct: 4 out of 100
========================================
task_id 54
Model answer: 33.0
Ground truth answer: 40.0
Correct: 4 out of 100
========================================
task_id 55
Model answer: 56.0
Ground truth answer: 14.0
Correct: 4 out of 100
========================================
task_id 56
Model answer: 2.0
Ground truth answer: 3.0
Correct: 4 out of 100
========================================
task_id 57
Model answer: None
Ground truth answer: 83.0
Correct: 4 out of 100
========================================
task_id 58
Model answer: 54.0
Ground truth answer: 57.0
Correct: 4 out of 100
========================================
task_id 59
Model answer: 124.0
Ground truth answer: 187.0
Correct: 4 out of 100
========================================
task_id 60
Model answer: 20.0
Ground truth answer: 17.0
Correct: 4 out of 100
========================================
```

```
task_id 61
Model answer: 930.0
Ground truth answer: 1430.0
Correct: 4 out of 100
========================================
task_id 62
Model answer: None
Ground truth answer: 25000.0
Correct: 4 out of 100
========================================
task_id 63
Model answer: 266.0
Ground truth answer: 1596.0
Correct: 4 out of 100
========================================
task_id 64
Model answer: None
Ground truth answer: 300.0
Correct: 4 out of 100
========================================
task_id 65
Model answer: 48.0
Ground truth answer: 36.0
Correct: 4 out of 100
========================================
task_id 66
Model answer: None
Ground truth answer: 48.0
Correct: 4 out of 100
========================================
task_id 67
Model answer: 605.0
Ground truth answer: 595.0
Correct: 4 out of 100
========================================
task_id 68
Model answer: 900.0
Ground truth answer: 36.0
Correct: 4 out of 100
========================================
task_id 69
Model answer: 60.0
Ground truth answer: 60.0
Correct: 5 out of 100
========================================
task_id 70
Model answer: None
Ground truth answer: 7425.0
```

```
Correct: 5 out of 100
========================================
task_id 71
Model answer: 40.0
Ground truth answer: 60.0
Correct: 5 out of 100
========================================
task_id 72
Model answer: 234.0
Ground truth answer: 221.0
Correct: 5 out of 100
========================================
task_id 73
Model answer: 45.0
Ground truth answer: 255.0
Correct: 5 out of 100
========================================
task_id 74
Model answer: None
Ground truth answer: 88.0
Correct: 5 out of 100
========================================
task_id 75
Model answer: 8.0
Ground truth answer: 60.0
Correct: 5 out of 100
========================================
task_id 76
Model answer: None
Ground truth answer: 5.0
Correct: 5 out of 100
========================================
task_id 77
Model answer: None
Ground truth answer: 100.0
Correct: 5 out of 100
========================================
task_id 78
Model answer: 27.0
Ground truth answer: 6.0
Correct: 5 out of 100
========================================
task_id 79
Model answer: 70.0
Ground truth answer: 70.0
Correct: 6 out of 100
========================================
task_id 80
```

```
Model answer: 14.0
Ground truth answer: 10.0
Correct: 6 out of 100
========================================
task_id 81
Model answer: 33.0
Ground truth answer: 17.0
Correct: 6 out of 100
========================================
task_id 82
Model answer: 624.0
Ground truth answer: 623.0
Correct: 6 out of 100
========================================
task_id 83
Model answer: 1080.0
Ground truth answer: 600.0
Correct: 6 out of 100
========================================
task_id 84
Model answer: 30.0
Ground truth answer: 15.0
Correct: 6 out of 100
========================================
task_id 85
Model answer: None
Ground truth answer: 44.0
Correct: 6 out of 100
========================================
task_id 86
Model answer: None
Ground truth answer: 22.0
Correct: 6 out of 100
========================================
task_id 87
Model answer: None
Ground truth answer: 9360.0
Correct: 6 out of 100
========================================
task_id 88
Model answer: 0.0
Ground truth answer: 8000.0
Correct: 6 out of 100
========================================
task_id 89
Model answer: None
Ground truth answer: 24.0
Correct: 6 out of 100
```

```
========================================
task_id 90
Model answer: None
Ground truth answer: 225.0
Correct: 6 out of 100
========================================
task_id 91
Model answer: None
Ground truth answer: 28.0
Correct: 6 out of 100
========================================
task_id 92
Model answer: None
Ground truth answer: 4.0
Correct: 6 out of 100
========================================
task_id 93
Model answer: None
Ground truth answer: 36.0
Correct: 6 out of 100
========================================
task_id 94
Model answer: None
Ground truth answer: 348.0
Correct: 6 out of 100
========================================
task_id 95
Model answer: None
Ground truth answer: 40.0
Correct: 6 out of 100
========================================
task_id 96
Model answer: 3.0
Ground truth answer: 3.0
Correct: 7 out of 100
========================================
task_id 97
Model answer: 6.0
Ground truth answer: 12.0
Correct: 7 out of 100
========================================
task_id 98
Model answer: 20.0
Ground truth answer: 5.0
Correct: 7 out of 100
========================================
task_id 99
Model answer: 40.0
```

```
Ground truth answer: 58.0
Correct: 7 out of 100
========================================
Final Accuracy: 0.01
```

[ ]:
```python
accuracy = all_correct / total* 100
print(f"Final Accuracy Llama2 pretrained on trace: {accuracy:.2f}%")
```

```
Final Accuracy Llama2 pretrained on trace: 7.00%
```

[ ]:
```python
model_save_path = "model_save_path/llama-2-trace"
model.save_pretrained(model_save_path)
```

[ ]:
```python

```