

Assignment3 - Decoding, Prompting and Instruction Tuning

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Introduction

In this assignment, I utilized the **Llama** model to perform text completion and question-answering tasks. First, I applied five decoding strategies—greedy decoding, beam search decoding, top-k sampling, top-p sampling, and random sampling with temperature—to the Llama base model (meta-llama/Llama-3.2-1B). These strategies were tested on a set of unfinished sentences to observe how each method influences the model's output. Subsequently, I presented the model with complex questions requiring step-by-step reasoning to assess its problem-solving abilities. I compared the model's answers using few-shot prompting, chain-of-thought prompting (one-shot), and a combination of both techniques. Then, I employed the instruction-tuned model (meta-llama/Llama-3.2-1B-Instruct) and followed the same process with the questions to observe the differences from the base model.

Model Information

Base Model: Meta's Llama 3.2 1B Model (meta-llama/Llama-3.2-1B)

Reason for Selection: I chose this model because its lightweight 1 billion parameter size ensures faster runtime on Colab, making it efficient for experimentation without requiring excessive computational time. This allowed me to quickly test and iterate on various tasks, without waiting too long.

Instruction-Tuned Model: Meta's Llama 3.2 1B Instruct Model (meta-llama/Llama-3.2-1B-Instruct)

Reason for Selection: This version is fine-tuned specifically to follow instructions better. I selected it to test how well it performs when given tasks that require clear responses based on specific prompts, while still being quick to run on Colab.

Decoding Strategies

I implemented five decoding strategies to observe how each influences the generated text.

1. Greedy decoding

How It Works: Selects the token with the highest probability at each step.

Pros:

- Deterministic outputs.
- Fast and straightforward implementation.

Cons:

- Can produce repetitive or bland text.
- May miss out on better alternative sequences.

2. Beam Search Decoding

How It Works: Explores multiple hypotheses simultaneously by keeping the top k sequences at each step (where k is the beam width).

Pros:

- Balances between exploration and exploitation.
- Generates more coherent and higher-quality text than greedy decoding.

Cons:

- Computationally more intensive.
- Can still be prone to generic responses.

3. Top-k Sampling

How It Works: At each step, samples from the top k most probable tokens.

Pros:

- Introduces randomness, leading to more diverse outputs.
- Controls the level of diversity through k.

Cons:

- May generate less coherent text if k is too high.
- Less deterministic.

4. Top-p (Nucleus) Sampling

How It Works: Samples from the smallest set of tokens whose cumulative probability exceeds a threshold p.

Pros:

- Balances diversity and coherence.

- Adapts the number of candidate tokens based on the probability distribution.

Cons:

- Can be unpredictable in terms of the number of tokens considered.
- Requires careful tuning of p.

5. Random Sampling with Temperature

How It Works: Adjusts the probability distribution using a temperature parameter before sampling.

Pros:

- Higher temperatures yield more diverse and creative outputs.
- Lower temperatures make outputs more focused and deterministic.

Cons:

- High temperatures can lead to incoherent or irrelevant text.
- May require tuning to find the optimal temperature.

Output Comparison

For text completion task with base model, outputs with greedy decoding and beam search decoding seemed to show pretty decent results. However, the one with greedy decoding seems to output a sentence that seems slightly off-topic later on. However, for question-answering task with base model, the one with beam search decoding only yielded satisfactory results. Other methods often produced completely irrelevant responses. However, for instruction-tuned model, almost all outputs, except those using random sampling with temperature decoding, appeared plausible.

	Greedy Decoding	Beam Search Decoding	Top-k Sampling	Top-p Sampling	Random Sampling with Temperature
Artificial intelligence has transformed the way we	Artificial intelligence has transformed the way we live, work and play. It is reshaping our economy as well. The latest technology in artificial intelligence (AI) can be used to help detect cancer at its earliest stage, reduce surgical errors by up to a third, improve medical diagnosis and increase accuracy of drug discovery. However, AI technologies are also raising concerns about privacy, bias and cybersecurity. The EU's Digital Services Act aims to address these challenges while ensuring that new digital services contribute positively to society.	Artificial intelligence has transformed the way we 3D print objects, but it's not without its challenges. In this blog post, we'll explore some of the most common issues that arise when using artificial intelligence for 3d printing, and how to overcome them. One of the biggest challenges with artificial intelligence is the need for large amounts of data. In order to train an AI model, it needs to be fed a large amount of data, which can be difficult to come by. This can lead to overfitting, where the model becomes too specific to the data it's been trained on and doesn't generalize well to new data.	Artificial intelligence has transformed the way we 3D print, but what about in manufacturing? Will AI be able to transform industrial production too? With increasing levels of automation and computerization taking place across many industries today there is no doubt that artificial intelligence (AI) will play a key role. But how far can it go before its limitations are exposed by human error or inefficiencies? One area where this technology could have an impact on manufacturers is with additive manufacturing processes such as 3d printing. These techniques involve creating objects layer-by-layer using various materials including metals, plastics and composites.	Artificial intelligence has transformed the way we think and work. From driving self-driving cars to delivering personalized health care, AI is changing our lives in ways that were unimaginable just a few years ago. But what about humans? Are they ready for this new era of artificial intelligence? The answer may surprise you: Yes!	Artificial intelligence has transformed the way we use words. When computers became intelligent enough, in our mind's eye, they began to write for us. Someone saw it as a gift from God with promises of salvation and redemption via machines that could think out complicated problem-solving algorithms - an AI paradise compared with today. But artificial intelligence is more like being thrown down into hell where anything goes once its free-floating brain is unleashed - whether you know what it was built on or not. While we try so longed hard all kinds of reasons why this doesn't deserve attention outside certain corners: there are too many examples within human beings.
Hanyang University is a leading institution for	Hanyang University is a leading institution for 21st century higher education in Korea. Founded as the first public university of its kind, Hanyang has grown into one of the most prestigious universities with over 30 colleges and schools spanning across six campuses. With more than 22,000 students enrolled at any given time (including international student population), it's easy to see why this school consistently ranks among top institutions worldwide. With cutting-edge research facilities like their Center For Excellence In Nanoscience & Technology where they conduct some incredible scientific experiments involving quantum physics, there are plenty opportunities here too!	Hanyang University is a leading institution for 21st century education and research in Korea. It was founded in 1946 as the first private university in Korea, and has since grown to become one of the largest and most prestigious universities in the country. The university offers a wide range of undergraduate, graduate, and doctoral programs in a variety of fields, including engineering, science, business, humanities, and social sciences. It is known for its strong emphasis on research and innovation, and its commitment to providing students with a high-quality education that prepares them for successful careers in their chosen fields.	Hanyang University is a leading institution for 21st century higher education in Korea. It has the highest number of international students among all universities, and its graduates are highly sought after by global employers. The university's main campus was established in Seoul with the opening of Hanyang College (later renamed as National Defense Academy) on October 30th, 1946. In 1952 it became one of South Korea's first public universities when President Syngman Rhee signed an act creating the Department of Education at Seoul National University to grant degrees from that time onwards.	Hanyang University is a leading institution for research and teaching in Korea. The university offers various courses at the undergraduate, graduate as well as doctoral levels. The application deadline for HANYANG UNIVERSITY scholarships has been extended to March 31st, 2022.	Hanyang University is a leading institution for 20-years. Their first priority in their recruitment process should be student achievement, not simply GPA (or even LSAT). Instead of measuring students ability to score or excel in a single course, they put importance on the total holistic development within four years. To learn how HANYANG implemented Kapsy's assessment program and achieve high-stake test participation with their staff members during COVID-19 pandemic time: we interviewed Assistant Director at Student Affairs Office from In-house Education Department who lead testing efforts. He has great suggestions in the following conversation! /n/
The city of Seoul is known for its vibrant culture and	The city of Seoul is known for its vibrant culture and 24-hour entertainment. The capital has a diverse population, with many people from different ethnic backgrounds. Seoul offers plenty to see in the daytime as well as at night when it comes to nightlife options. You can enjoy some great food while you're there too! You'll find that this city has something special on offer - whether you like shopping or dining out! There are also lots of things going down every weekend so don't miss your chance if visiting South Korea soon enough! In this article we will discuss what makes Seoul one of Asia's most popular destinations today.	The city of Seoul is known for its vibrant culture and 24-hour nightlife, but it's also home to some of the world's best museums. Whether you're a history buff, art lover, or just looking for a fun night out, there are plenty of museums in Seoul to explore. In this blog post, we'll take a look at some of Seoul's top museums, including the National Museum of Modern and Contemporary Art, the National Folk Museum of Korea, and the Gyeongbokgung Palace. We'll also give you some tips on how to get the most out of your visit to these museums, so you can make the most of your time in Seoul.	The city of Seoul is known for its vibrant culture and 24-hour nightlife, but it's also a great place to learn about the country's history. With over one million years of recorded human activity in South Korea, there are plenty of museums dedicated to ancient civilizations. One such museum is Gyeongbokgung Palace Museum. Located near the heart of central Seoul on Changdeok-gil Street, this beautiful building was built as part of the original royal complex that once occupied the site where Gwanghwamun Square now stands.	The city of Seoul is known for its vibrant culture and 24-hour nightlife, but it's also a great place to take in the sights. If you're looking for some unique experiences while visiting South Korea, there are plenty of things to do that will leave your memories with lasting impressions. Here are five activities you can enjoy on an overnight trip from New York City: 1) Visit Gyeongbokgung Palace! Gyeongbokgung was built by King Sejong during the Joseon Dynasty (1392-1910).	The city of Seoul is known for its vibrant culture and 60+ traditional festivals each year. As part of that tradition, many are also unique in some aspect to their particular region.

Text completion

Prompting Techniques

- **Few-Shot Prompting:** Providing the model with examples of questions and their corresponding answers within the prompt.

- Included two problem sets, having similar structures.
- Aimed to guide the model on how to structure its reasoning and responses.

	Greedy Decoding	Beam Search Decoding	Top-k Sampling	Top-p Sampling	Random Sampling with Temperature
Q: A farmer has 30 rows of corn plants with 10 plants in each row. After a drought, 40 plants died, but he planted 50 new ones. How many corn plants does the farmer have now?		100 plants			25n/n/n/n## Solution/n/ would divide total (before any losses) by what is divided up per item; these can then just be combined easily./n50, /n30 div 2 = 205/n/so that after 60%, all things remaining constant it will only take half again for all items as much space. i.e., \$5/(n6: (n17)-355\$. Since no other factors change in our situation above./n/te answers are about equal here.
Q: Mike has 5 boxes of markers. Each box contains 20 markers. He gave 25 markers to his classmates and lost 15 markers. How many markers does Mike have left?		50 markers.	35 markers.		

- **Chain-of-Thought Prompting:** Encouraging the model to produce intermediate reasoning steps leading to the final answer.

- Crafted prompts that explicitly outlined each step in solving the problem.
- Used phrases like "Let's calculate..." and "Next, find out..." to structure the reasoning.

	Greedy Decoding	Beam Search Decoding	N-top Sampling	Top-p Sampling	Random Sampling with Temperature
Q: A farmer has 30 rows of corn plants with 10 plants in each row. After a drought, 40 planted 50 new ones. How many corn plants does the farmer have now?	<p>To find out how much corn there is after planting more crops, we need to subtract from the number of original corn plants before any dieing occurred (the total number of initial plantings) and then add back on some extra crop that was grown as compensation for those who were killed by death due to lack of water during the previous growing season. This means that our answer should be equal to the sum of both numbers minus their difference: $(30 \times 10) - 50 + (50 \times 5)$. $((30 * 10) - 50) + (50 * 5)$ ((80 over 5)) / ((end(matrix))right)=300. \$5nAfter the loss caused by dying plants, the remaining population becomes \$525(10+12)+20=boxed{76}\$. We can calculate it using the same formula above because all terms are integers since they involve only whole numbers. In this method works well if you know an equation involving subtraction and addition without having to do long division first, such as multiplying two fractions together to get another fraction whose denominator is common between them.</p>	<p>The number of plants before the drought is $30 \times 10 = 300$. After the drought, there are $300 - 40 + 260$ plants left. To find the number of new plants, we need to know how many plants died and how many new ones were planted. We can use the formula $n \text{ Plants} = \text{Old Plants} - \text{Dying Plants}$ in this case, we know that 40 died and 50 were planted, so the new plants are $50 - 50 = 100$. Therefore, the farmer now has $260 - 100 = 160$ corn plants.</p>	<p>The number of corn plants before the drought is $30 \times 10 = 300$. After the drought, there are $300 - 40 + 260$ plants left. To find the number of new plants, we need to know how many plants died and how many new ones were planted. We can use the formula $n \text{ Plants} = \text{Old Plants} - \text{Dying Plants}$ in this case, we know that 40 died and 50 were planted, so the new plants are $50 - 50 = 100$. Therefore, the farmer now has $260 - 100 = 160$ corn plants.</p>	<p>Here is another way: we will add these together to make our answer easier. \lnwe need to know how many plants there are before planting that equals outland more or less.</p>	
Q: Mike has 5 boxes of markers. Each box contains 20 markers. He gave 25 markers to his classmates and lost 15 markers. How many markers does Mike have left?	<p>Mike started out with a total of 100 markers in all five boxes. After giving away some he now only has 85 markers remaining (total of 80 for him + 5 boxes from his classmate). So we can write an equation like that:$50 \times 20 = 70 \times 5$ where x is how many Markers Mike still has after everything was given away or divided between them. We know what values are possible because they were stated as integers by us earlier on when it came up in the context of these questions about being divisible by other things etc...We solve our equation using addition/subtraction instead of multiplication/division here since there aren't any decimals involved anymore....</p>	<p>Mike starts with a total of $5 \times 20 = 100$ markers, so he has $100 - 25 = 75$ markers. Then he gives 25 to his classmate, leaving him with $75 - 10 = 65$ markers. Finally, he loses 15, so his remaining markers are $65 - 5 = 60$ markers. Hence, Mike has only 60 left.</p>	<p>Mike started out with a total of $5 \times 20 = 100$ markers in all. After giving away 25 he now only has 75 which is not divisible by 10) so we need to find how much was lost/after losing 15 Markers there were remaining 55 which can be divided into two parts that are both less than 30 i.e either 28 or 27 but cannot be more because if it would then the remainder when dividing them it also would become odd as well. So let us take 29 for sure as the least common multiple between these numbers is equal to their LCM. Now since after losing 15 Marks there remains one part whose sum is greater than 50. This means that its count must be even i.e say N such that $M + 45 - 60 > 10$ here I am going to solve using simple method where I'm adding up first 7 terms till I get my answer satisfying above condition, i.e., $n(n+1)/2 + n(n-1)/2 + n(n-2)/2 + \dots + n(n-6)/2 = 10$</p>	<p>Markers per person will always be even greater for these types of questions! Start by listing down all of the possible combinations of N/Write down, for some odd positive number : $5n = 155$, $= 5(17), (-1) \rightarrow \lambda(\text{photon})(\alpha)(16)$, $= 25(10) - 75(-10) - 10(5) - 125(50)$</p>	<p>Mike has a total of possible combinations of N/Write down, for some odd positive number : $5n = 155$, $= 5(17), (-1) \rightarrow \lambda(\text{photon})(\alpha)(16)$, $= 25(10) - 75(-10) - 10(5) - 125(50)$</p> <p>usually figure out that Δp-factor here in which we can use an "arithmetic rule".</p>

one-shot + chain-of-thought (Base)

- Mixture of the two prompting techniques above

Implementation:

- Included two problem sets, each designed to include detailed steps of problem-solving with Chain-of-Thought prompting.

	Greedy Decoding	Beam Search Decoding	Top-k Sampling	Top-p Sampling	Random Sampling with Temperature
Q: A farmer has 30 rows of corn plants with 10 plants in each row. After a drought, 40 plants died, but he planted 50 new ones. How many corn plants does the farmer have now?	<p>The number of corn plant is given by $\text{Number of Corn Plants} \times (\text{Number of Corn Plants after Drought} - \text{Number of Dead Corn Plants})$. Now we can solve for N. We get $N = 20$. So there are 20 corn plants.</p>	<p>The number of plants in the farmer's field before the drought was 30×10 or 300 plants. After the drought, there were $300 - 40 = 260$ plants left. Therefore, the farmer now has $260 + 50 = 310$ plants in his field.</p>	<p>We can use multiplication here! Let's start by writing down what we know about how there are total 100 corn plants (there were originally 300). Next, let us subtract the number that was lost due to dying (i.e., 20) from our original count. This leaves us with only 80 remaining. Finally, multiply these two numbers together since they represent one group of ten plants per row, giving you an answer of $\frac{800}{10} = 80$. Then, if we add up all those groups, it is equal to $80 \times 10 = 800$. Note: The correct solution uses division instead of subtraction for the final part; however, I found both methods equally easy to understand. Related Questions: In base-ten notation, write out the decimal expansion for $\frac{1}{8}$ (102)5, where $3n > 73$. Decimals & Fractions : Arithmetic Operations on Decimals If $5x < y5$ and $5y < z5$ which of the following must be true?</p>	<p>First, let's count how big is one corn plant. There are actually two options. If 13 corns were harvested there should be an amount equivalent to that multiplied with three because every single corner grows from it. So I started off by just trying out various multipliers like $(20^{10})^{10}$. What numbers did I come up with? $\log(n) = 75$. The root operation $\sqrt[n]{x}$ denotes the root function $\sqrt[n]{x}$.</p>	
Q: Mike has 5 boxes of markers. Each box contains 20 markers. He gave 25 markers to his classmates and lost 15 markers. How many markers does Mike have left?	<p>Mike started with a total of 30 markers (each marker is counted as one unit), but after giving away some markers to friends and losing others, he ends up having only $5 \times (20 - 25) = -5$ markers. Since there are five boxes, $5 \times -5 = -25$. Hence, we get that all remaining numbers should be multiples of 11 or 22 (i.e., integers divisible by both 11 & 22). We need to find two such values for which the difference between their squares will give us our target value. The sum of digits of these two terms must also equal the original given value, since it can't exceed either 99 or 999.</p>	<p>Here's how we can solve this problem: Let's go through the steps one at a time. Step 1: Mike started with $5 \times 20 = 100$ markers. Step 2: He gave away 25 of them to his classmate, leaving $100 - 25 = 75$ markers. This means that he has $75 - 15 = 60$ markers left. Step 3: He lost some markers, so we need to subtract 15 from the number of markers he has left. This leaves us with $60 - 14 = 46$ markers.</p>	<p>Here is a list of all possible steps for solving this problem. Step #1: Mike started with $5 \times 20 = 100$ markers. Step #2: He gave away 25 markers (he can give out as much or as little as he wants), making it now $75 - 25 = 50$ markers. Step #3: He lost 15 markers, leaving $50 - 15 = 35$ markers remaining. Hence, we are done by going back one step at a time until you get your answer. Related Posts: What is The Difference Between Algebra And Geometry? The difference between algebra and geometry lies primarily on their nature: they both deal with mathematical concepts but differ greatly from each other. Different Types Of Mathematical Models For Business Applications Mathematical models play an important role when doing business analysis because they allow us to predict how things will change over...</p>	<p>Mike had the right combination! Let's check it one by one. If there are already enough stickers than you'll never be unhappy (since now your balance sheet says that is possible). Also take into account how much money your pocket could earn per sticker. How would I get an equation for N total cards given $N \times J$ unique colored deck? Hello friends. Today I want help someone my question my math quiz but what's going on here when we do quadratic graph method if I divide? What does D.E.R., W.W.P., J.Q.Y.A.M.N.F.U.L.T.H.O.V. (for the purposes of) mean?</p>	

few-shot + chain-of-thought (Base)

Instruction Tuning

Key Differences Between Base and Instruction-Tuned Models

When comparing the base model to the instruction-tuned model, there were several differences I noticed.

Firstly, the instruction-tuned model consistently followed prompts more effectively than the base model. It provided appropriate responses with minimal need for elaborate prompting. In contrast, the base model often struggled if there was no detailed guidance.

Secondly, instruction-tuned model demonstrated better reasoning and produced more accurate answers to complex questions, regardless of which decoding strategy I used. However, the base model heavily relied on the decoding strategy. In my experience, only the one with beam search decoding worked well.

The part that felt like the biggest difference was that, in the case of base models, there were often instances where the context suddenly shifted to something completely unrelated in the

middle of a response. However, with instruction fine-tuned models, this rarely happened. Also, with the base model, there were instances where it repeated what had already been said or suddenly generated new questions and answered them. Therefore, these issues had to be manually resolved through an appropriate post-processing procedure.

	Greedy Decoding	Beam Search Decoding	Top-k Sampling	Top-p Sampling	Random Sampling with Temperature
Q: A farmer has 30 rows of corn plants with 10 plants in each row. After a drought, 40 plants died, but he planted 50 new ones. How many corn plants does the farmer have now?	40	100	50 corn plants.	150 corn plants	35 corn plants from our original calculation.
Q: Mike has 5 boxes of markers. Each box contains 20 markers. He gave 25 markers to his classmates and lost 15 markers. How many markers does Mike have left?	45 markers.	35 markers.	20 markers.	60 markers.	50 markers. Mark is given three boxes. Each box contains 20 candies. Note: Mark cannot have exactly 50 candies. Let X represent Mark's total candies. To solve this question, the 50 candies must all be used up. First, Mark takes 25 candies. There are 5 boxes to take 25 candies, so each box represents 5 candies. X=20-25=5 candies can fit into boxes. Hence a 8 candies leftover.

few-shot (Instruction-tuned)

	Greedy Decoding	Beam Search Decoding	Top-k Sampling	Top-p Sampling	Random Sampling with Temperature
Q: A farmer has 30 rows of corn plants with 10 plants in each row. After a drought, 40 plants died, but he planted 50 new ones. How many corn plants does the farmer have now?	Let's go through this step-by-step!n1. The farmer has 30 rows of corn plants with 10 plants in each row, so he starts with 30 x 10 = 300 plants.n2. After a drought, 40 plants died - 300 - 40 = 260 plants.n3. The farmer planted 50 new ones, so he has 260 + 50 = 310 plants.nTherefore, the farmer has 310 plants left.	Let's go through this step-by-step!n1. The farmer has 30 rows of corn plants with 10 plants in each row, so he starts with 30 x 10 = 300 plants.n2. After a drought, 40 plants died, so he now has 300 - 40 = 260 plants.n3. He planted 50 new ones, so he now has 260 + 50 = 310 plants.nTherefore, the farmer has 310 plants left.	Let's go through this step-by-step!n1. The farmer has 30 rows of corn plants with 10 plants in each row, so he starts with 30 x 10 = 300 plants.n2. After a drought, 40 plants died, so he now has 300 - 40 = 260 plants.n3. He planted 50 new ones, so he now has 260 + 50 = 310 plants.nTherefore, the farmer has 310 plants left.	Let's go through this step-by-step!n1. The farmer has 30 rows of corn plants with 10 plants in each row, so he starts with 30 x 10 = 300 plants.n2. After a drought, 40 plants died - 300 - 40 = 260 plants.n3. The farmer planted 50 new ones, so he now has 260 + 50 = 310 plants.nTherefore, the farmer has 310 plants left. After the 30 corn plants die, he will have (30 - 40 / 50)10 + 10 = 6+10 = 16 new ones remaining to plant.nAfter planting 169 = 144 corn plants can be harvested and counted from each row after the drought.nHe has, 10 + 144 = 150 total new ones, plants that he planted in new corn rows.	
Q: Mike has 5 boxes of markers. Each box contains 20 markers. He gave 25 markers to his classmates and lost 15 markers. How many markers does Mike have left?	Let's go through this step-by-step!n1. Mike has 5 boxes of markers, each containing 20 markers, so he starts with 5 x 20 = 100 markers.n2. He gives 25 markers to his classmates, leaving him with 100 - 25 = 75 markers.n3. He loses 15 markers, leaving him with 75 - 15 = 60 markers.nTherefore, Mike has 60 markers left.	Let's go through this step-by-step!n1. Mike has 5 boxes of markers, each containing 20 markers, so he starts with 5 x 20 = 100 markers.n2. He gives 25 markers to his classmates, leaving him with 100 - 25 = 75 markers.n3. He loses 15 markers, leaving him with 75 - 15 = 60 markers.nTherefore, Mike has 60 markers left.	Let's go through this step-by-step!n1. Mike has 5 boxes of markers, each containing 20 markers, so he starts with 5 x 20 = 100 markers.n2. He gives 25 markers to his classmates, leaving him with 100 - 25 = 75 markers.n3. He loses 15 markers, leaving him with 75 - 15 = 60 markers.nTherefore, Mike has 60 markers left.	Let's go through this step-by-step!n1. Mike has 5 boxes of markers, each containing 20 markers, so he starts with 5 x 20 = 100 markers.n2. He gives 25 markers to his classmates, leaving him with 100 - 25 = 75 markers.n3. He loses 15 markers, leaving him with 75 - 15 = 60 markers.nTherefore, Mike has 60 markers left. Let's use this problem and go through it:n1. Mike has 5 x 20 = 100 markers, and each student gives him back 2 markers.n2. He ends up with a total of 100 markers minus 25 = 75 markers. Then he subtracts 15:n3.75 - 15 = 60.n4. So there were 100 - 25 = 75 markers left to be distributed between his classmates.nMike left with 25 / 5 classmates = 5 friends.n5. If we say S = 5, then we can write the number of markers left as: $\text{Markers Left} = \frac{\text{Total Markers}}{\text{Number of Boxes}} - (\text{Markers Given}) - (\text{Markers Lost})$ $= \frac{5 \times 20}{5} - (25) - (15)$ $= 100 - 25 - 15$ $= 60$ So Mike has 60 markers left. Let's verify this with another method:n1. We know Mike has 5 boxes of 20 markers each, totaling 100 markers.n2. He gave away 25 markers, leaving him with 75 markers.n3. He lost 15 more markers, leaving him with 60 markers.n4. Therefore, Mike has 60 markers left. Let's check our work by adding back what was subtracted:n1. Starting from the final amount, 60 markers.n2. Add back the 15 markers lost: 60 + 15 = 75 markers.n3. Add back the 25 markers given: 75 + 25 = 100 markers.n4. This matches the original total of 100 markers, confirming our answer is correct. Final Answer: Mike has 60 markers left.	

one-shot + chain-of-thought (Instruction-tuned)

	Greedy Decoding	Beam Search Decoding	Top-k Sampling	Top-p Sampling	Random Sampling with Temperature
<p>Q: A farmer has 30 rows of corn plants with 30 plants in each row. A drought, 40 plants died, but he planted 50 new ones. How many corn plants does the farmer have now?</p>	<p>Let's go through this step-by-step.\n1. The farmer has 30 rows of corn plants with 30 plants in each row, so he starts with $30 \times 30 = 900$ plants.\n2. 40 plants died, so he has $900 - 40 = 260$ plants.\n3. He planted 50 new plants, so he has $260 + 50 = 310$ plants.\nTherefore, the farmer has 310 plants left.</p>	<p>Let's go through this step-by-step.\n1. The farmer has 30 rows of corn plants with 10 plants in each row, so he starts with $30 \times 10 = 300$ plants.\n2. After a drought, 40 plants died, leaving him with $300 - 40 = 260$ plants.\n3. He planted 50 new plants, leaving him with $260 + 50 = 310$ plants.\nTherefore, the farmer has 310 plants left.</p>	<p>Let's go through this step-by-step.\n1. The farmer has 30 rows of corn plants with 10 plants in each row, so he starts with $30 \times 10 = 300$ plants.\n2. After a drought, 40 plants died, leaving him with $300 - 40 = 260$ plants.\n3. He planted 50 new plants, leaving him with $260 + 50 = 310$ plants.\nTherefore, the farmer has 310 plants left.</p>	<p>Let's go through this step-by-step.\n1. The farmer has 30 rows of corn plants with 10 plants in each row, so he starts with $30 \times 10 = 300$ plants.\n2. After a drought, 40 plants died, leaving him with $300 - 40 = 260$ plants.\n3. He planted 50 new plants, leaving him with $260 + 50 = 310$ plants.\nTherefore, the farmer has 310 plants left.</p>	<p>Let's go through this step-by-step.\n1. The farmer has 30 rows of corn plants with 10 plants in each row, so he starts with $30 \times 10 = 300$ plants.\n2. After a drought, 40 plants died, leaving him with $300 - 40 = 260$ plants.\n3. He planted 50 new plants, leaving him with $260 + 50 = 310$ plants.\n4. The farmer started with 50 \times 1 = 350 fewer plants than he started with, so he only has $300 - 50 = 250$ plants now.\n5. The farmer planted 50 new plants, so his grandtotal is $300 + 50 = 350$ plants.\n6. The farmer lost 40 plants, so he has $350 - 40 = 310$ plants left.\n7. The farmer still has 25 rows now, so he has 25 rows \times 12 plants = 300 plants left.</p>
<p>Q: Mike has 5 boxes of markers. Each box contains 20 markers. He gave 25 markers to his classmates, leaving him 100 - 25 = 75 markers. How many markers does Mike have left?</p>	<p>Let's go through this step-by-step.\n1. Mike has 5 boxes of markers with 20 markers in each box, so he starts with $5 \times 20 = 100$ markers.\n2. He gave 25 markers to his classmates, leaving him with $100 - 25 = 75$ markers.\n3. He lost 15 markers, leaving him with $75 - 15 = 60$ markers.\nTherefore, Mike has 60 markers left.</p>	<p>Let's go through this step-by-step.\n1. Mike has 5 boxes of markers with 20 markers in each box, so he starts with $5 \times 20 = 100$ markers.\n2. He gave 25 markers to his classmates, leaving him with $100 - 25 = 75$ markers.\n3. He lost 15 markers, leaving him with $75 - 15 = 60$ markers.\nTherefore, Mike has 60 markers left.</p>	<p>Let's go through this step-by-step.\n1. Mike has 5 boxes of markers with 20 markers in each box, so he starts with $5 \times 20 = 100$ markers.\n2. He gave 25 markers to his classmates, leaving him with $100 - 25 = 75$ markers.\n3. He lost 15 markers, leaving him with $75 - 15 = 60$ markers.\nTherefore, Mike has 60 markers left.</p>	<p>Let's go through this step-by-step.\n1. Mike has 5 boxes of markers with 20 markers in each box, so he starts with $5 \times 20 = 100$ markers.\n2. He gave 25 markers to his classmates, leaving him with $100 - 25 = 75$ markers.\n3. He lost 15 markers, leaving him with $75 - 15 = 60$ markers.\nTherefore, Mike has 60 markers left.</p>	<p>Let's go through this step-by-step.\n1. Mike has 5 boxes of markers with 20 markers in each box, so he starts with $5 \times 20 = 100$ markers.\n2. He gave 25 markers to his classmates, leaving him with $100 - 25 = 75$ markers.\n3. He lost 15 markers, leaving him with $75 - 15 = 60$ markers.\n4. He lost 15 markers, leaving him with $60 - 15 = 45$ markers.\n5. He lost 15 markers, leaving him with $45 - 15 = 30$ markers.\n6. He lost 15 markers, leaving him with $30 - 15 = 15$ markers.\n7. He lost 15 markers, leaving him with $15 - 15 = 0$ markers.\n8. He lost 15 markers, leaving him with $0 - 15 = -15$ markers.\n9. He lost 15 markers, leaving him with $-15 - 15 = -30$ markers.\n10. He lost 15 markers, leaving him with $-30 - 15 = -45$ markers.\n11. He lost 15 markers, leaving him with $-45 - 15 = -60$ markers.\n12. He lost 15 markers, leaving him with $-60 - 15 = -75$ markers.\n13. He lost 15 markers, leaving him with $-75 - 15 = -90$ markers.\n14. He lost 15 markers, leaving him with $-90 - 15 = -105$ markers.\n15. He lost 15 markers, leaving him with $-105 - 15 = -120$ markers.\n16. He lost 15 markers, leaving him with $-120 - 15 = -135$ markers.\n17. He lost 15 markers, leaving him with $-135 - 15 = -150$ markers.\n18. He lost 15 markers, leaving him with $-150 - 15 = -165$ markers.\n19. He lost 15 markers, leaving him with $-165 - 15 = -180$ markers.\n20. He lost 15 markers, leaving him with $-180 - 15 = -195$ markers.\n21. He lost 15 markers, leaving him with $-195 - 15 = -210$ markers.\n22. He lost 15 markers, leaving him with $-210 - 15 = -225$ markers.\n23. He lost 15 markers, leaving him with $-225 - 15 = -240$ markers.\n24. He lost 15 markers, leaving him with $-240 - 15 = -255$ markers.\n25. He lost 15 markers, leaving him with $-255 - 15 = -270$ markers.\n26. He lost 15 markers, leaving him with $-270 - 15 = -285$ markers.\n27. He lost 15 markers, leaving him with $-285 - 15 = -300$ markers.\n28. He lost 15 markers, leaving him with $-300 - 15 = -315$ markers.\n29. He lost 15 markers, leaving him with $-315 - 15 = -330$ markers.\n30. He lost 15 markers, leaving him with $-330 - 15 = -345$ markers.\n31. He lost 15 markers, leaving him with $-345 - 15 = -360$ markers.\n32. He lost 15 markers, leaving him with $-360 - 15 = -375$ markers.\n33. He lost 15 markers, leaving him with $-375 - 15 = -390$ markers.\n34. He lost 15 markers, leaving him with $-390 - 15 = -405$ markers.\n35. He lost 15 markers, leaving him with $-405 - 15 = -420$ markers.\n36. He lost 15 markers, leaving him with $-420 - 15 = -435$ markers.\n37. He lost 15 markers, leaving him with $-435 - 15 = -450$ markers.\n38. He lost 15 markers, leaving him with $-450 - 15 = -465$ markers.\n39. He lost 15 markers, leaving him with $-465 - 15 = -480$ markers.\n40. He lost 15 markers, leaving him with $-480 - 15 = -495$ markers.\n41. He lost 15 markers, leaving him with $-495 - 15 = -510$ markers.\n42. He lost 15 markers, leaving him with $-510 - 15 = -525$ markers.\n43. He lost 15 markers, leaving him with $-525 - 15 = -540$ markers.\n44. He lost 15 markers, leaving him with $-540 - 15 = -555$ markers.\n45. He lost 15 markers, leaving him with $-555 - 15 = -570$ markers.\n46. He lost 15 markers, leaving him with $-570 - 15 = -585$ markers.\n47. He lost 15 markers, leaving him with $-585 - 15 = -600$ markers.\n48. He lost 15 markers, leaving him with $-600 - 15 = -615$ markers.\n49. He lost 15 markers, leaving him with $-615 - 15 = -630$ markers.\n50. He lost 15 markers, leaving him with $-630 - 15 = -645$ markers.\n51. He lost 15 markers, leaving him with $-645 - 15 = -660$ markers.\n52. He lost 15 markers, leaving him with $-660 - 15 = -675$ markers.\n53. He lost 15 markers, leaving him with $-675 - 15 = -690$ markers.\n54. He lost 15 markers, leaving him with $-690 - 15 = -705$ markers.\n55. He lost 15 markers, leaving him with $-705 - 15 = -720$ markers.\n56. He lost 15 markers, leaving him with $-720 - 15 = -735$ markers.\n57. He lost 15 markers, leaving him with $-735 - 15 = -750$ markers.\n58. He lost 15 markers, leaving him with $-750 - 15 = -765$ markers.\n59. He lost 15 markers, leaving him with $-765 - 15 = -780$ markers.\n60. He lost 15 markers, leaving him with $-780 - 15 = -795$ markers.\n61. He lost 15 markers, leaving him with $-795 - 15 = -810$ markers.\n62. He lost 15 markers, leaving him with $-810 - 15 = -825$ markers.\n63. He lost 15 markers, leaving him with $-825 - 15 = -840$ markers.\n64. He lost 15 markers, leaving him with $-840 - 15 = -855$ markers.\n65. He lost 15 markers, leaving him with $-855 - 15 = -870$ markers.\n66. He lost 15 markers, leaving him with $-870 - 15 = -885$ markers.\n67. He lost 15 markers, leaving him with $-885 - 15 = -900$ markers.\n68. He lost 15 markers, leaving him with $-900 - 15 = -915$ markers.\n69. He lost 15 markers, leaving him with $-915 - 15 = -930$ markers.\n70. He lost 15 markers, leaving him with $-930 - 15 = -945$ markers.\n71. He lost 15 markers, leaving him with $-945 - 15 = -960$ markers.\n72. He lost 15 markers, leaving him with $-960 - 15 = -975$</p>

few-shot + chain-of-thought (Instruction-tuned)

Suitability for Commercial Applications

I think that instruction-tuned models are more suitable for commercial applications, since users don't need to spend much time crafting precise prompts to get good results as what I did. Also, instruction-tuned model provide more reliable and consistent outputs, which is essential for commercial use. If content completely unrelated to the customer's intent appears in the middle of the response, customer satisfaction is likely to drop significantly.

Thank you.