Verb Categorisation for Hindi Word Problem Solving

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Abstract

Word problem Solving is a challenging NLP task that deals with solving mathematical problems described in natural language. Recently, there has been renewed interest in developing word problem solvers for Indian languages. As part of this paper, we have built a Hindi arithmetic word problem solver which makes use of verbs. Additionally, we have created verb categorization data for Hindi. Verbs are very important for solving word problems with addition/subtraction operations as they help us identify the set of operations required to solve the word problems. We propose a rule-based solver that uses verb categorisation to identify operations in a word problem and generate answers for it. To perform verb categorisation, we explore several approaches and present a comparative study.

1 Introduction

Verb Categorisation is the most intuitive and explainable semantic parsing approach for word problem solving. This approach was introduced in Hosseini et al. (2014). It uses verbs to identify operations required to solve a word problem. The idea is to identify the following parts of a word problem on top of which we use verb categories to perform calculations:

- **Entities**: Objects whose quantity is observed or updated through the course of the word problem.
- **Attributes of Entities**: A characteristic quality or feature of an entity. These are usually marked by adjectives.
- **Containers**: A container refers to a group of entities. It may refer to any animate/inanimate object that possesses or contains entities.
- **Quantities of Entities**: The number of entities in a given container. Quantities in a container can be known or unknown.

This can be explained using the following example:

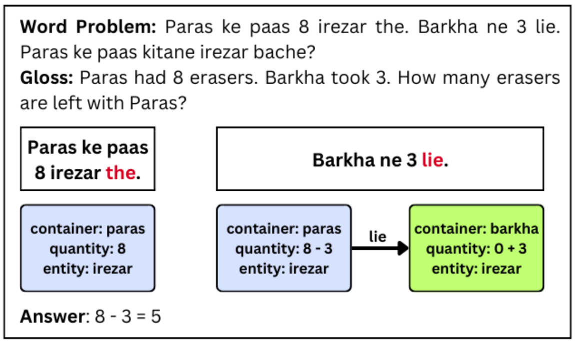

Figure 1: Example of solving word problem using verbs

Leveraging the insights provided by Hosseini et al. (2014), as part of this paper, we make the following contributions:

- Redefine verb categories for word problem solving.
- Create verb categorisation data for Hindi language.
- Introduce three new verb categorisation approaches and provide a comprehensive comparative analysis of these approaches.
- Introduce a rule-based solver[1] that uses verbs to identify specific mathematical operations to solve word problems.

2 Motivation

Let us take an example to understand the vital role of verbs in solving a word problem as shown in the following figures. Figure 2 shows a word problem with containers, entities, and their quantities by masking the verbs. Here, we cannot identify the operation needed to reach the final state and answer

[1] Code and data can be found here: https://github.com/hellomasaya/verb-cat-for-hindi-wps

the question asked in the word problem. However, in Figure 3, we are able to reach the final state. Moreover, when we change the verb from Figure 3 to Figure 4, the operation also changes.

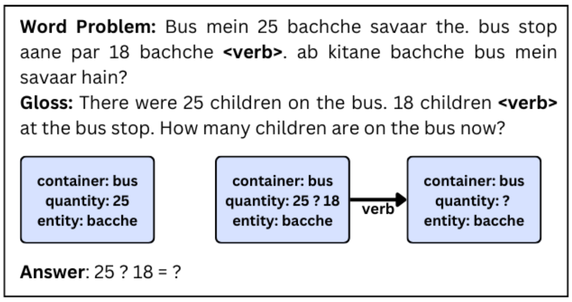

Figure 2: Example of solving word problem without verb

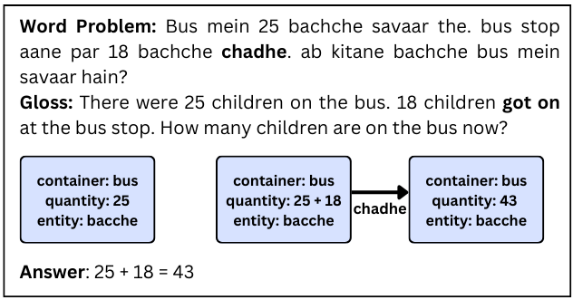

Figure 3: Solving word problem with verb - 1

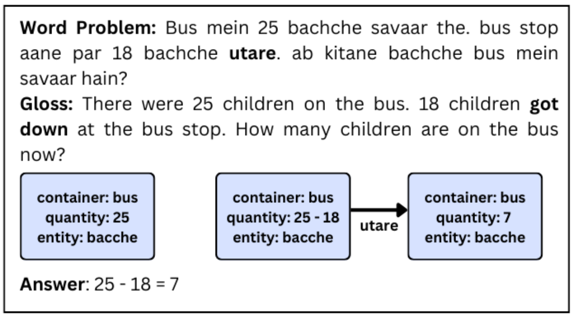

Figure 4: Solving word problem with verb - 2

3 Verb Categorisation

This section focuses on the first step of word problem solving using verb categorisation, i.e. classifying verbs into semantic categories. Since verbs can be used to identify only positive and negative operations, we filtered the HAWP dataset[2] (Sharma et al., 2022) to have only word problems involving addition and subtraction operations. Verbs tell us whether entities are observed, created, destroyed, or transferred. For multiplication and division, we need another layer of categorisation with different Part of Speech categories on top of verb categorisation.

3.1 Verb Categories

Table 1 lists the five categories we have used in this paper. We also included a sixth category - *na*. During POS tagging, non-verbs were tagged as verbs; these tokens were put into the *na* category.

3.2 Annotation of Verbs

In the HAWP dataset (2336 word problems), 1713 word problems are based on addition and subtraction operations. These problems feature in our dataset for word problem solving using verb categorisation. In these 1713 word problems, there are around 200 unique verbs. These verbs were annotated with the categories mentioned above.

Hosseini et al. (2014) have 7 verb categories that are container-centric. They have two additional categories of *Construct* and *Destroy* apart from the ones defined in Table 1. But these two resemble *Positive* and *Negative* categories respectively. Hence, we decide to drop these two categories.

For the verb annotation task, two annotators with post graduate level of education in computational linguistics are involved. We conduct experiments to evaluate the inter-annotator agreement between them on 225 verbs from 100 sentences. The Fleiss'[3] kappa score of agreement is 0.89 which denotes almost perfect agreement. There was maximum disagreement between *Observation* and *Positive* classes.

3.3 Approaches

We tried mainly three kinds of approaches which are detailed in the following subsections. All the approaches are evaluated using 5-fold cross validation technique.

3.3.1 Verb Distance

The first approach is the training less method using verb distance. Each verb in Hindi is represented by its pre-trained FastText word vector (Grave et al., 2018) of 300 dimensions. A test verb is assigned the verb category corresponding to its closest training verb. We implemented this approach using 1-nearest neighbor approach.

[2] https://github.com/hellomasaya/hawp

[3] https://en.wikipedia.org/wiki/Fleiss%27_kappa

Verb Category	Definition
Observation	It states just the presence of entities in a container
Positive	It states the quantity of entities being added to a container or which are created in a container.
Negative	It states the quantity of entities being removed or destroyed from a container.
Positive Transfer	It is associated with statements that involve two containers. It states a transfer of the quantity of entities from second container to the first.
Negative Transfer	It is associated with statements that involve two containers. It states a transfer of the quantity of entities from first container to the second.

Table 1: Five Verb Categories

3.3.2 Statistical Models

3.3.2.1 Data Preparation

The idea is to use a bag of words representation for a verb and its neighbours in their actual order as a sample and the category of the verb as the label. We created samples for the task using word-level information as indicated in Figure 6. After trying context windows of different sizes, we finalised the context window size as 7. Therefore, we will have

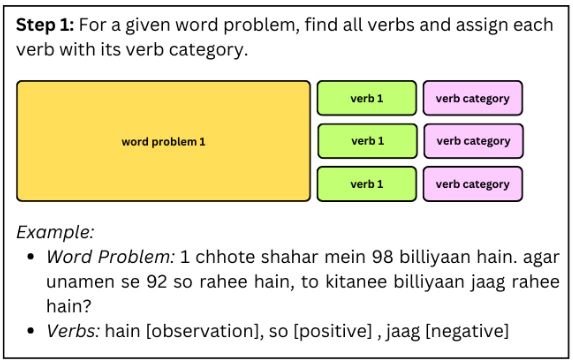

Figure 5: Step 1 of Data Preparation

word-level information for three neighbours to the right of the verb and the same for three neighbours to the left of the verb. We parse each sentence using an in-house shallow parser (Mishra et al., 2023) for identifying the POS tag and root of each word. We used ISC-parser from Natural language tool-kit for Indian Language Processing [4] to get dependency tags of each token in each sentence of each word problem in the dataset.

3.3.2.2 Experimental Setup

We performed this classification task using 3 machine learning approaches:

[4] https://github.com/iscnlp/iscnlp/tree/master/iscnlp

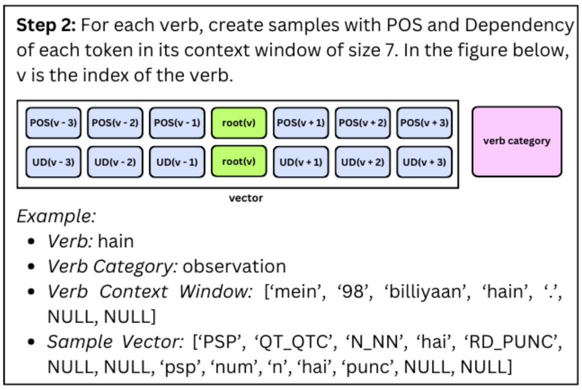

Figure 6: Step 2 of Data Preparation

- Logistic Regression
- Random Forest
- Support Vector Machines (SVM)

All these models have been implemented using Scikit-learn (Pedregosa et al., 2011) machine learning framework.

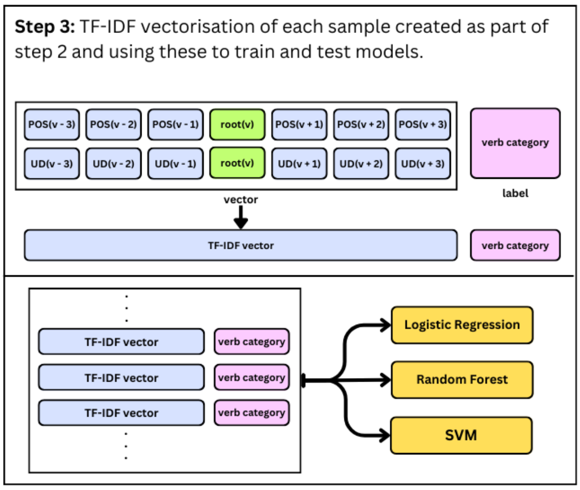

Figure 7: Overview of Training Statistical Models

3.3.3 MuRIL Contextual Embeddings

Contextual embeddings, especially BERT (Devlin et al., 2019) based embeddings, have been shown to be very effective for classification and generalization tasks. BERT is trained in two stages: pre-training and fine-tuning. The model is first trained on a huge monolingual corpus to learn language-specific representations and then fine-tuned on a downstream task. In our case, the downstream task is the verb categorization task. As this is a text or sentence classification task, it is a perfect test for using BERT or BERT-like models. For this, we used MuRIL (Khanuja et al., 2021), a multilingual transformer (Vaswani et al., 2017) model trained on English and 16 Indian languages. MuRIL is pre-trained using masked language modelling as well as translation language modelling. It has a combined vocabulary of 197K words.

3.3.3.1 Data Preparation

We used the 1713 word problems from HAWP. Since MuRIL can handle large contexts, we do not limit ourselves to a fixed context window. For this task, all the words till a verb is encountered constitute a sample. A total of 6506 samples were created for verb categorization. Let us take an example to understand this better.

- Original Question:
  kanishk ko samudr tat par 47 seepiyaan mileen, usane laila ko 25 seepiyaan deen. usake paas ab kitanee seepiyaan hain?

  Gloss: Kanishk found 47 shells on the beach, he gave 25 shells to Laila. How many shells does he have now?

- Samples for Verb Categorization
  - kanishk ko samudr tat par 47 seepiyaan <u>mileen</u>

    Gloss: Kanishk (found) 47 shells on the beach
  - kanishk ko samudr tat par 47 seepiyaan mileen, usane laila ko 25 seepiyaan <u>deen</u>.

    Gloss: Kanishk found 47 shells on the beach, he (gave) 25 shells to Laila.
  - usake paas ab kitanee seepiyaan <u>hain</u>?

    Gloss: How many shells does he (have) now?

3.3.3.2 Experimental Setup

MuRIL has 236 million parameters, and it uses AdamW (Loshchilov and Hutter, 2017) optimizer. We use 5-fold cross validation technique to evaluate the model. MuRIL is fine-tuned for ten epochs with a batch size of 4. MuRIL based text classification model is implemented using HuggingFace (Wolf et al., 2019) library.

3.4 Results and Discussion

The results from all models are shown in Table 2.

Approach	F1-score
Verb Distance	0.895
Linear Regression	0.865
Random Forest	0.883
Support Vector Machines	0.904
MuRIL Fine-tuning	**0.962**

Table 2: Verb Categorization Results with with different approaches

We can observe that MuRIL Fine-tuning outperforms other approaches by a significant margin. The class *na* contains highest classification error. The major cause of ambiguity is between the *Observation* and *Positive* in all the models.

4 Solver

We build a simple rule-based system that takes in a word problem and generates answers to the word problem. For each problem, we iterate through all tokens in each of its sentences and follow the rules mentioned below.

4.1 Find container, quantity and entity

- A container is a *proper noun* or *adverb of place*.

- A quantity is a *number*. Whenever a quantity is found, the last identified container is associated with this quantity.

- An entity is a *noun*. If there is an adjective associated with this entity, it is clubbed with the entity. When a word problem has the *Rupee* symbol, the entity is taken to be this symbol itself. Examples of these rules can be found in Figures 11 and 10.

4.2 Store States

Here, a state refers to the status of an entity that stores information about an entity, its container, its associated quantity, and any attributes of the entity.

1. Once an entity is found, the associated quantity and container are used to form a state.

2. Before storing the quantity in a state, if the verb that follows the identified entity of this state has its verb category as Negative, the quantity is negated and stored. A detailed example of applying these rules can be found in Figure 10.

4.3 Handle Transfer Category

1. Once a verb is found in the word problem, we check for Transfer categories. We check if the verb belongs to Positive Transfer or Negative Transfer category from our verb categorisation exercise.

2. If Transfer verb category is found, we find transfer components, i.e. transfer containers (two containers b/w which transfer is taking place) and the quantity of entities being transferred.

3. Then, we iterate through the states and find which already present states have transfer-container 1 and transfer-container 2. Then, we check if transfer-entity is present in these states.

4. Finally, we update the previous states based on which containers and entities are already available in the previous states. These cases for positive and negative categories can be seen in Fig 8 and Fig 9. A detailed example of applying these rules can be found in Fig 11.

4.4 Finding Answer

1. Find Question Entity (and Question Container, only in the case when a transfer verb is encountered) from the question using the same rules mentioned in Section 4.1.

2. Find Main Operation.

    - If a transfer verb category is encountered in the word problem, the main operation is Transfer.
    - If any positive indicator is present in question, the main operation is Positive.
    - If any negative indicator is present in question, the main operation is negative.
    - The main operation is positive if none of the above conditions are met.

Indicators	Examples
Positive Indicators	‘kul’, ‘milakar’, ’milkar’ etc.
Negative Indicators	‘mukable’, ‘tulna’, ‘pehle’, ‘chahiye’ etc.

Table 3: Indicators in questions

3. If the main operation is Transfer, our calculation is already complete as part of 4.3. We find the state that has the answer to the question by looking at all the states we created, and whichever state matches the question’s container and entity pair, we return its quantity as the answer. A detailed example of the transfer verb category is explained in Fig 11. More examples can be found in the Appendix.

4. If main operation is Negative, we find all states that have the same entity as the question entity. Then, keeping the quantity in the first state as it is, we subtract the quantities of the states that follow from it to finally reach the answer.

5. If main operation is Positive, we find all states that have the same entity as the question entity and add all the quantities of these states to finally reach the answer. A detailed example of this case is explained in Fig 10.

4.5 More Rules

1. If the final answer calculated by the solver is negative, we return its absolute value.

2. While identifying relevant entities from states, if the entities from the question and a state match but attribute is missing in either state or question, we still regard the entity as relevant.

3. If the entity in the word problem is found to be one of ‘paisa’, ‘keemat’, ‘laagat’, and ‘rupay’, we change it to the *Rupee* symbol.

4. If a quantity is found without an entity or container, we retain the same entity and container from the last state and create a new state with the quantity found. This is called circumscription assumption (McCarthy, 1980).

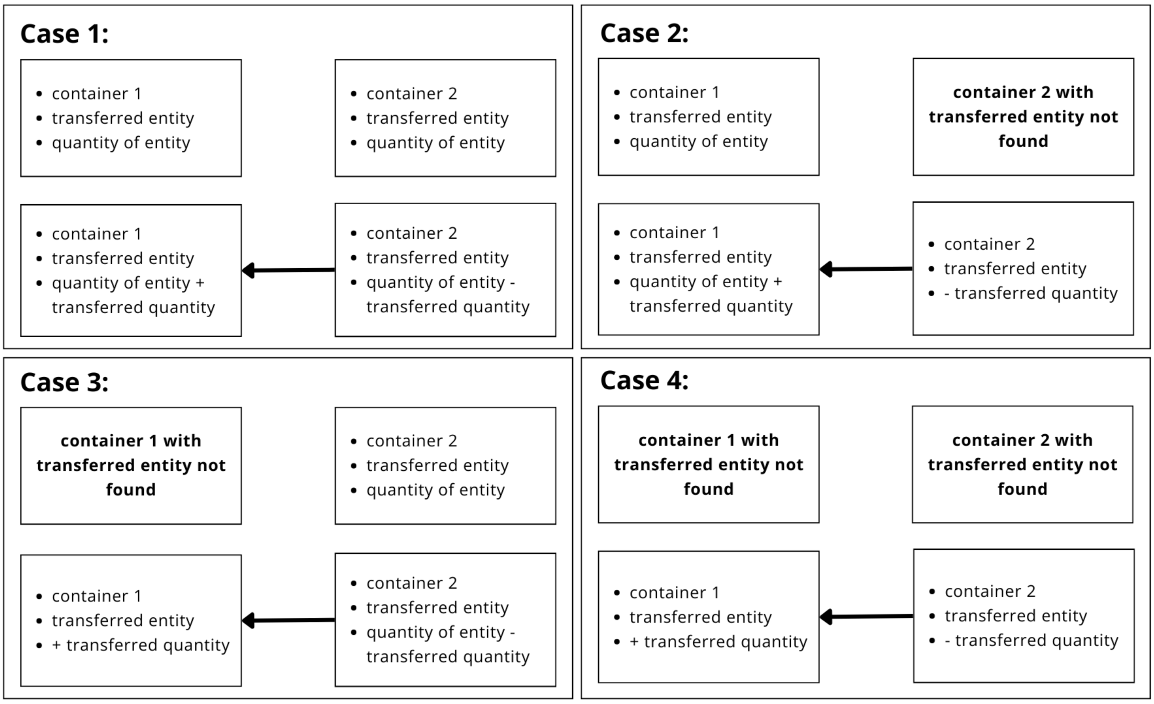

Figure 8: Transfer for verb category: Positive Transfer

5. If the entity in question is not found in states, we assume the entity of the first state to be the entity in the question and perform the steps for finding the answer.

Detailed examples of all rules can be found in the Appendix.

4.6 Results and Discussion

The solver was tested on test sets using predicted verb categories, and an average accuracy of 41.2% was reported, which is comparable to 40.04% reported by Sharma et al. (2022) for one operation problems in the HAWP dataset. Some of the cases in which the solver fails are listed below:

- Irrelevant Information: The solver fails to identify some cases of irrelevant information.
- Error in entity/container/action identification.
- Set Completion: The solver fails to handle word problems which require the knowledge of set completion.
- Parsing Errors: Errors caused by incorrectly tagged part of speech. This also includes cases when parsers miss foreign words.
- Rules: There are cases when a rule that works for some examples may not work for others.

Examples of these cases can be found in the Appendix in Table 4.

5 Limitations

Apart from the limitations of the solver, the method of using verb categorisation to solve word problems also has some limitations. As stated, solving word problems using verb categorisation is only limited to addition and subtraction word problems because verbs can only help us identify these operations. Moreover, there were errors in the dependency labels. Since verb categorisation very heavily relies on these parsers from finding verb categories to identifying entities, containers and actions/verbs for solving the word problems. This adds to the limitation of this method.

6 Conclusion and Future Work

In this paper, we create a rule-based and easily explainable solver that uses verb categorisation technique to identify operations to solve word problems. This can be used as a teaching aid for both students and teachers. As part of the verb categorisation task, we run experiments with three approaches: Verb Distance (no training involved), statistical, and neural approaches using MuRIL. As part of future work, we will explore more approaches to improve the accuracy of our solver and its range,

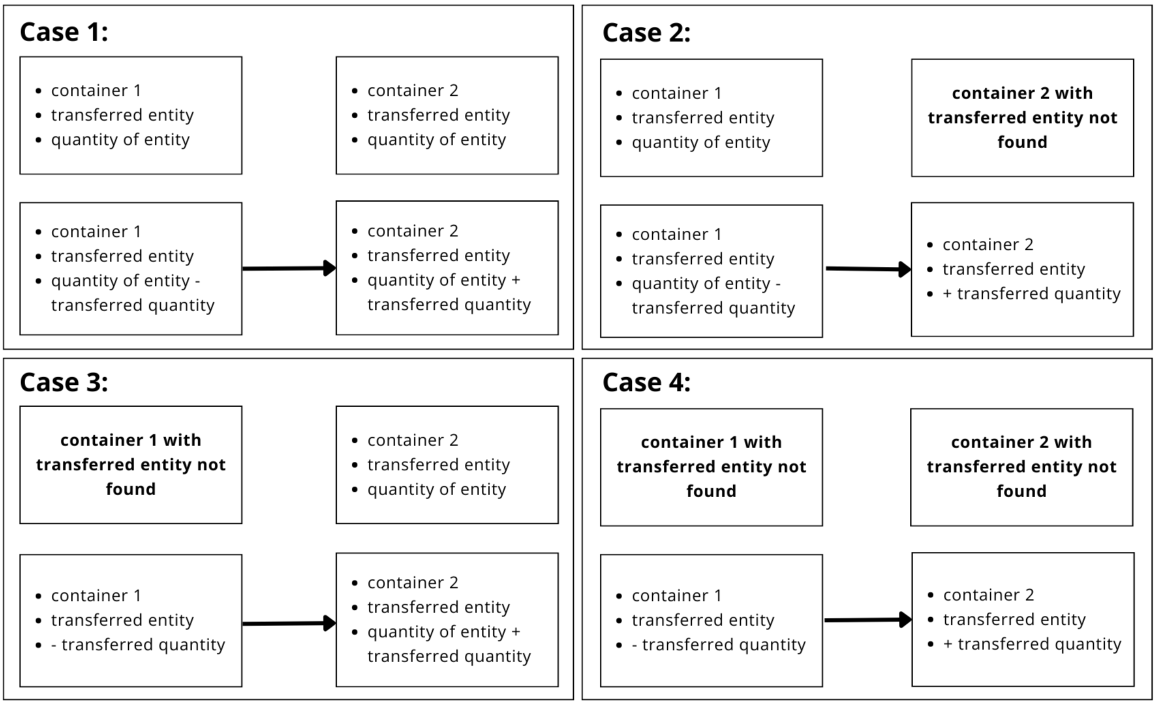

Figure 9: Transfer for verb category: Negative Transfer

i.e., solving word problems with multiplication and division operations.

References

Jacob Devlin, Ming-Wei Chang, Kenton Lee, and Kristina Toutanova. 2019. BERT: Pre-training of deep bidirectional transformers for language understanding. In *Proceedings of the 2019 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies, Volume 1 (Long and Short Papers)*, pages 4171–4186, Minneapolis, Minnesota. Association for Computational Linguistics.

Edouard Grave, Piotr Bojanowski, Prakhar Gupta, Armand Joulin, and Tomas Mikolov. 2018. Learning word vectors for 157 languages. In *Proceedings of the Eleventh International Conference on Language Resources and Evaluation (LREC 2018)*, Miyazaki, Japan. European Language Resources Association (ELRA).

Mohammad Javad Hosseini, Hannaneh Hajishirzi, Oren Etzioni, and Nate Kushman. 2014. Learning to solve arithmetic word problems with verb categorization. In *Proceedings of the 2014 Conference on Empirical Methods in Natural Language Processing (EMNLP)*, pages 523–533, Doha, Qatar. Association for Computational Linguistics.

Simran Khanuja, Diksha Bansal, Sarvesh Mehtani, Savya Khosla, Atreyee Dey, Balaji Gopalan, Dilip Kumar Margam, Pooja Aggarwal, Rajiv Teja Nagipogu, Shachi Dave, et al. 2021. Muril: Multilingual representations for indian languages. *arXiv preprint arXiv:2103.10730*.

Ilya Loshchilov and Frank Hutter. 2017. Decoupled weight decay regularization. *arXiv preprint arXiv:1711.05101*.

John McCarthy. 1980. Circumscription—a form of non-monotonic reasoning. *Artificial intelligence*, 13(1-2):27–39.

Pruthwik Mishra, Vandan Mujadia, and Dipti Misra Sharma. 2023. Multi Task Learning Based Shallow Parsing for Indian Languages.

F. Pedregosa, G. Varoquaux, A. Gramfort, V. Michel, B. Thirion, O. Grisel, M. Blondel, P. Prettenhofer, R. Weiss, V. Dubourg, J. Vanderplas, A. Passos, D. Cournapeau, M. Brucher, M. Perrot, and E. Duchesnay. 2011. Scikit-learn: Machine learning in Python. *Journal of Machine Learning Research*, 12:2825–2830.

Harshita Sharma, Pruthwik Mishra, and Dipti Sharma. 2022. HAWP: a dataset for Hindi arithmetic word problem solving. In *Proceedings of the Thirteenth Language Resources and Evaluation Conference*, pages 3479–3490, Marseille, France. European Language Resources Association.

Ashish Vaswani, Noam Shazeer, Niki Parmar, Jakob Uszkoreit, Llion Jones, Aidan N Gomez, Łukasz Kaiser, and Illia Polosukhin. 2017. Attention is all you need. *Advances in neural information processing systems*, 30.

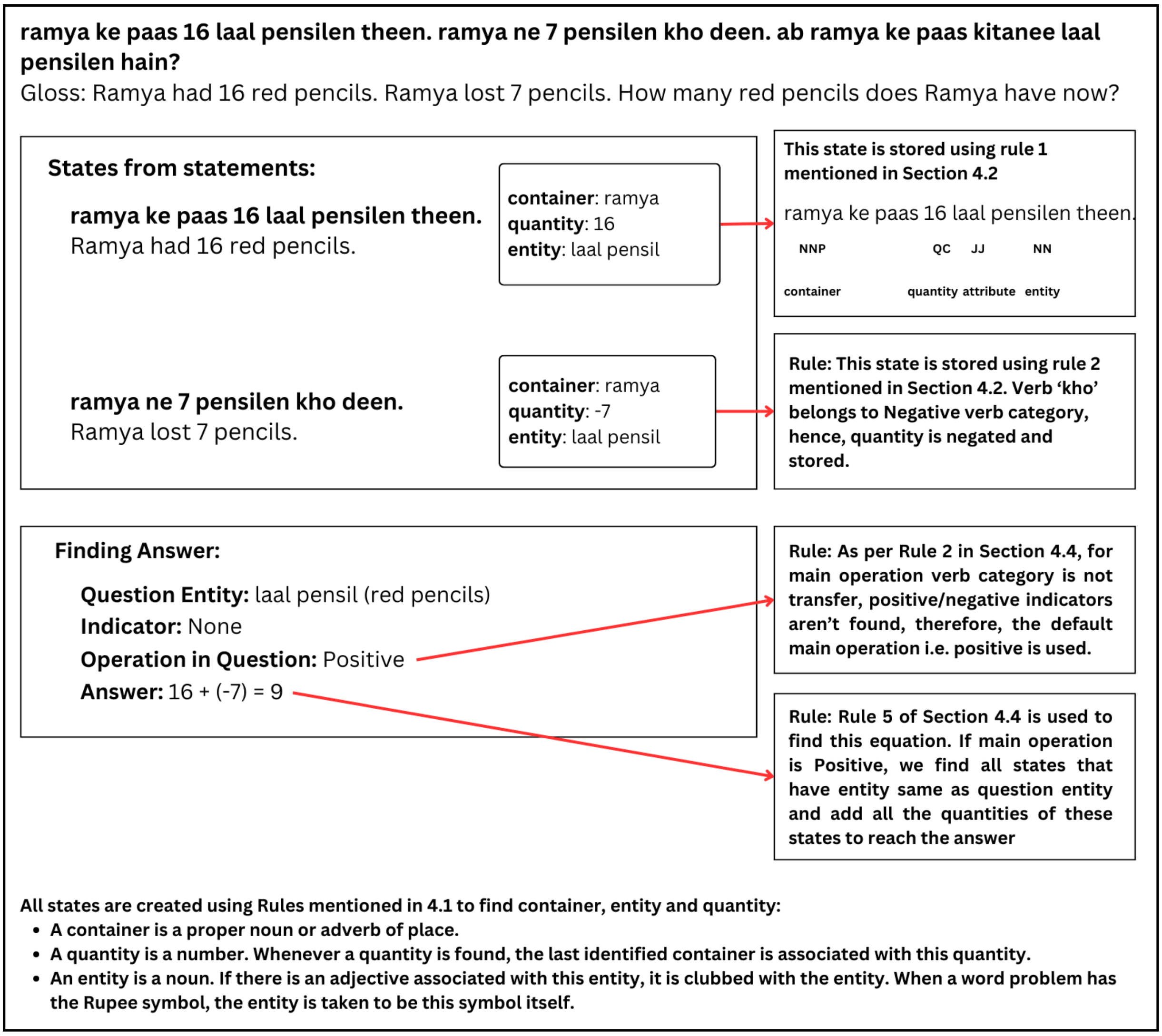

Figure 10: Example of solving word problem using negative verb category

Thomas Wolf, Lysandre Debut, Victor Sanh, Julien Chaumond, Clement Delangue, Anthony Moi, Pierric Cistac, Tim Rault, Rémi Louf, Morgan Funtowicz, et al. 2019. Huggingface's transformers: State-of-the-art natural language processing. *arXiv preprint arXiv:1910.03771*.

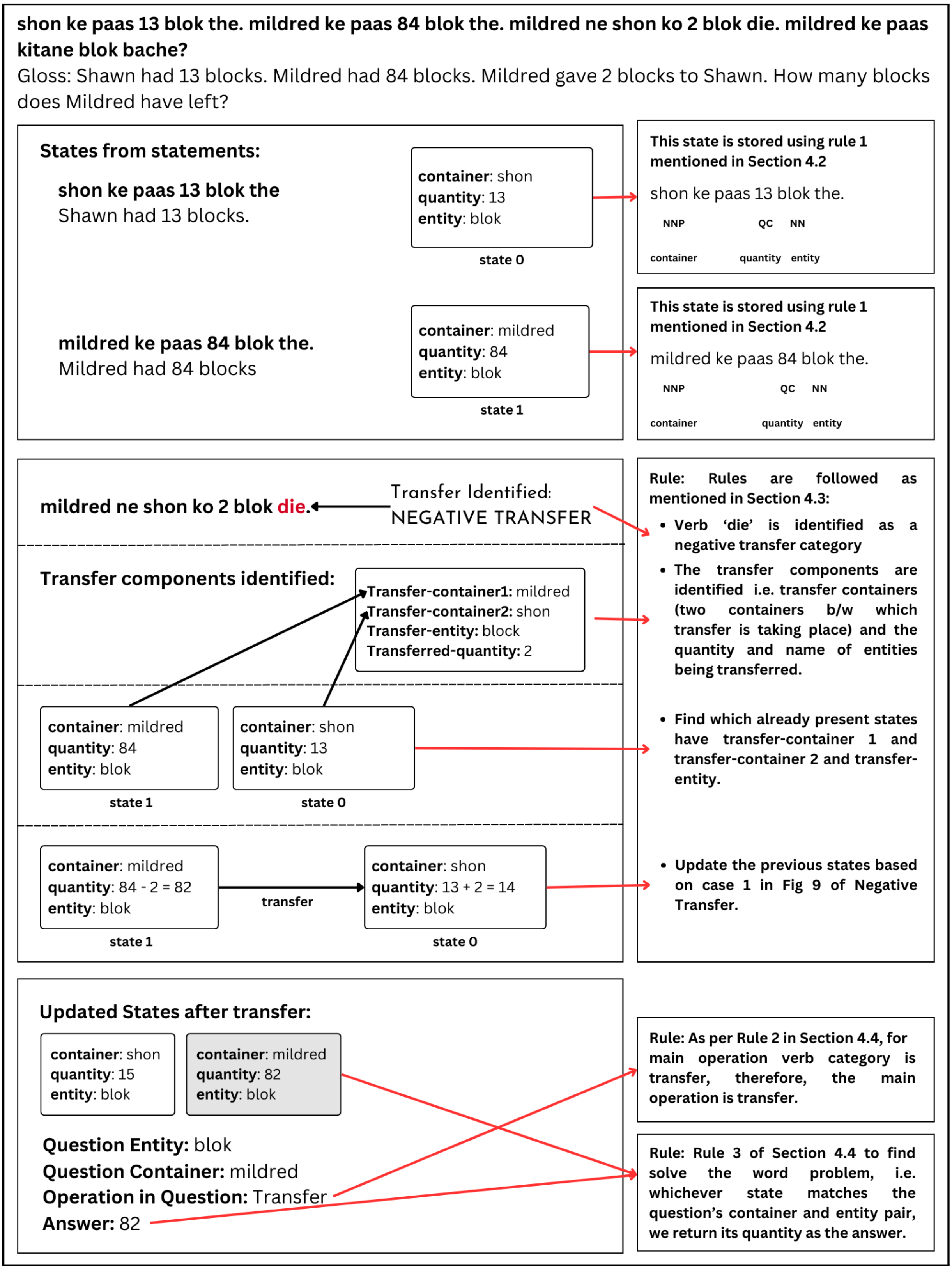

Figure 11: Example of solving word problem using transfer (negative) verb category

A Appendix

A.1 Examples of rules used in our Hindi Word Problem Solver

A.1.1 Example when Main Operation is Transfer

As mentioned in Section 4.4, the main operation is ‘transfer’ when a transfer verb category is encountered in the word problem. And, the Transfer Verb Category may have two types: Positive and Negative Transfer. An example for Negative Transfer is covered as part of Figure 10. Figure 12 illustrates an example of how a problem with positive transfer verb category is solved by the solver.

A.1.2 Examples when Main operation is Negative

Section 4.4 states that the main operation is Negative, when no transfer verb category is found and a negative indicator is present in question. Figure 13 states an example for the same.

A.1.3 Examples of rules mentioned in Section 4.5

- If the final answer calculated by solver is negative, we return its absolute value. Example in Figure 14.
- If the entity in the word problem is found to be one of ‘paisa’, ‘keemat’, ‘laagat’, and ‘rupay’, we change it to the Rupee symbol. Example in Figure 15.
- If a quantity is found without an entity or container, we retain the same entity and container from the last state and create a new state with the quantity found. Example in Figure 16.
- If the entity in question is not found in states, we assume the entity of the first state to be the entity in question and perform the steps of finding the answer. Example in Figure 17.

A.2 Examples of Errors made by Solver

Table 4 gives examples of errors made by the rule based solver.

Error Category	Example
Irrelevant Information	raam is maheene 11 kriket ke maich dekhane gaya. vah pichhale maheene 17 maich dekhane gaya tha aur agale maheene 16 maich dekhane jaaega. vah ab tak kul kitane maich dekh chuka hai? Gloss: Ram went to watch 11 cricket matches this month. He went to watch 17 matches last month and next month he will go to watch 16 matches. How many matches has he watched till now? *Error: Solver returns answer as X=11+17+16. 16 matches that Ram will see next month is irrelevant to the question being asked in the word problem.*
Error in entity/container/action identification	shurooaat mein jen ke paas 87 kele the. 7 1 ghode dvaara khae gae. ant mein jen ke paas kitane kele bache? Gloss: Initially Jane had 87 bananas. 7 were eaten by 1 horse. How many bananas are left with Jane at the end? *Error: 7 is not mapped to 'kele' by the solver and is therefore missed in calculation.*
Set Completion	4 bachchon, 2 karmachaariyon aur 3 adhyaapakon ka 1 samooh chidiyaaghar ja raha hai. chidiyaaghar kitane log ja rahe hain? Gloss: 1 group consisting of 4 children, 2 staff and 3 teachers is going to zoo. How many people are going to the zoo? *Error: Here, bacche (children), karmachaari (staff) and adhyaapak (teachers) form a set - log (people), which solver is not capable of identifying.*
Parsing Errors	evalin ke paas shuruaat mein 76 taaaifiyaan theen. kristeen ne evalin ko 72 taaaifiyaan deen. evalin ke paas kitanee taaaifiyaan hain? Gloss: Evelyn initially had 76 candies. Christine gave 72 candies to Evelyn. How many candies does Evelyn have? *Error: 'taaaifiyaan' gets tagged as VM i.e. verb in first statement and is missed from calculation.*

Table 4: Examples of erroneous cases

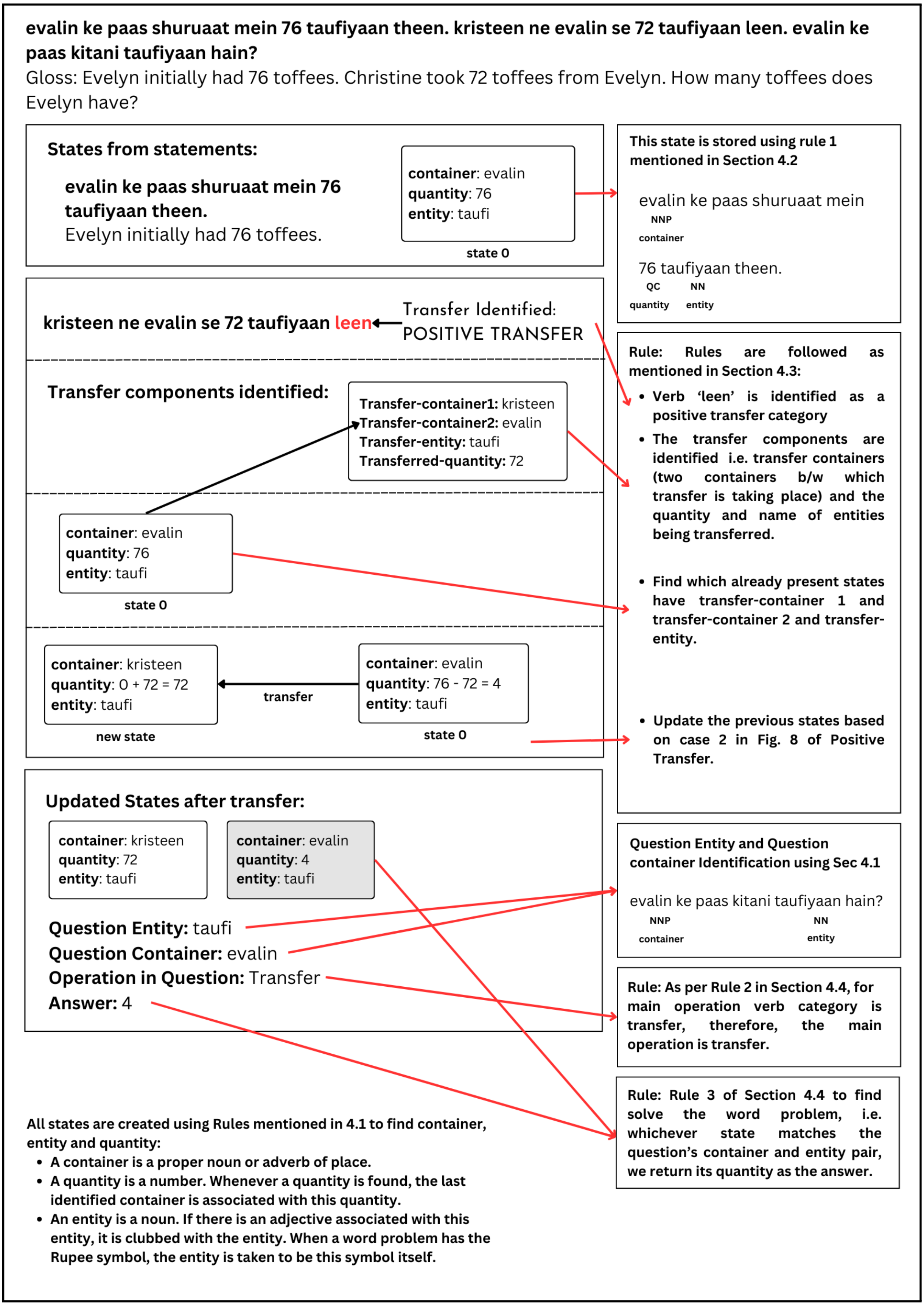

Figure 12: Example of solving word problem using negative transfer verb category

raalph ke paas 50 panno kee 1 kitaab hai. usake paas jangalee jaanavaron kee 26 tasveeren hain. raalph ke dost derik ke paas jangalee jaanavaron kee 34 tasveeren hain. derik kee tulana mein raalph ke paas jangalee jaanavaron kee kitanee kam tasveeren hain?

Gloss: Ralph has 1 book of 50 pages. He has 26 pictures of wild animals. Ralph's friend Derrick has 34 pictures of wild animals. How many fewer pictures of wild animals does Ralph have than Derrick?

States from statements:

raalph ke paas 50 panno kee 1 kitaab hai.
Ralph has 1 book of 50 pages

container: raalph
quantity: 50
entity: panna

raalph ke paas 50 panno kee 1 kitaab hai.
Ralph has 1 book of 50 pages

container: raalph
quantity: 1
entity: kitab

usake paas jangalee jaanavaron kee 26 tasveeren hain
He has 26 pictures of wild animals.

container: ralph
quantity: 26
entity: tasveer

raalph ke dost derik ke paas jangalee jaanavaron kee 34 tasveeren hain.
Ralph's friend Derrick has 34 pictures of wild animals.

container: derik
quantity: 34
entity: tasveer

Finding Answer:

Question Entity: tasveer
Negative Indicator: tulna
Operation in Question: Negative

container: ralph
quantity: 26
entity: tasveer

container: derik
quantity: 34
entity: tasveer

Answer: 34 - 26 = 8

Rule: As per Rule 2 in Section 4.4, for main operation verb category is not transfer and a negative indicators is found, main operation is negative.

Rule: Rule 4 of Section 4.4 is used to find this equation. If main operation is Negative, find all states that have entity same as question entity. Then, keeping the quantity in the first state as it is, we subtract the quantities of the states that follow from it to finally reach the answer.

Figure 13: Example of solving word problem with negative indicator

bhaavana aaj 8 ghante soee aur kal vah thakaan hone ke kaaran 10 ghante soee thee. bhaavana ne in dinon mein kul kitane ghanton kee neend lee?

Gloss: Bhavna slept for 8 hours today and yesterday she slept for 10 hours due to tiredness. How many hours of sleep did Bhavna take during these days?

States from statements:

bhaavana aaj 8 ghante soee **aur kal**
vah thakaan hone ke kaaran 10 ghante soee thee.
Bhavna slept for 8 hours today and yesterday
she slept for 10 hours due to tiredness

container: bhavana
quantity: -8
entity: ghante

bhaavana aaj 8 ghante soee aur ***kal***
vah thakaan hone ke kaaran 10 ghante soee thee**.**
Bhavna slept for 8 hours today and *yesterday*
she slept for 10 hours due to tiredness

container: bhavana
quantity: -10
entity: ghante

Finding Answer:

Question Entity: ghante
Positive Indicator: kul
Operation in Question: Positive
Answer: (-8) + (-10) = - 18 take absolute: abs(-18) = 18

Figure 14: Example of solving word problem with negative indicator

raajabeer ne apana maidaan kee ghaas kaatane ka vyavasaay shuroo kiya. vasant mein usane ghaas kaatakar 2 rupaye kamae aur garmiyon mein usane 27 rupaye kamae. agar use naee ghaas bichhaane ke 5 rupaye aur mile, to usake paas kitana paisa tha?
Rajbir started his own lawn mowing business. In spring he earned Rs 2 by cutting grass and in summer he earned Rs 27. If he got Rs 5 more for laying new grass, how much money did he have?

States from statements:

vasant mein usane ghaas kaatakar 2 rupaye kamae aur garmiyon mein usane 27 rupaye kamae.
In spring he earned Rs. 2 by cutting grass and in summer he earned Rs. 27.

container: raajabeer
quantity: 2
entity: ₹

vasant mein usane ghaas kaatakar 2 rupaye kamae aur garmiyon mein usane 27 rupaye kamae.
In spring he earned Rs. 2 by cutting grass and in summer he earned Rs. 27.

container: raajabeer
quantity: 27
entity: ₹

agar use naee ghaas bichhaane ke 5 rupaye aur mile, to usake paas kitana paisa tha?
If he got Rs 5 more for laying new grass, how much money did he have?

container: raajabeer
quantity: 5
entity: ₹

Finding Answer:

Question Entity: ₹

Indicator: None

Operation in Question: Positive

Answer: 2 + 27 + 5 = 34

Figure 15: Example of solving word problem with negative indicator

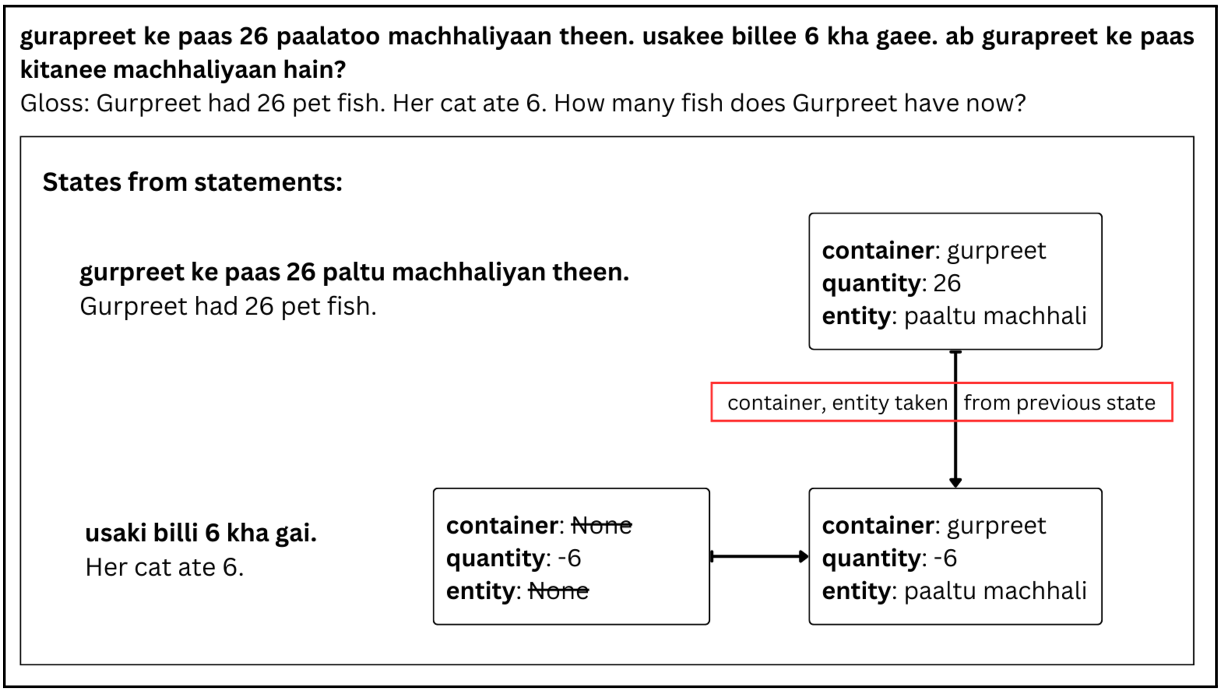

Figure 16: Example of solving word problem with negative indicator

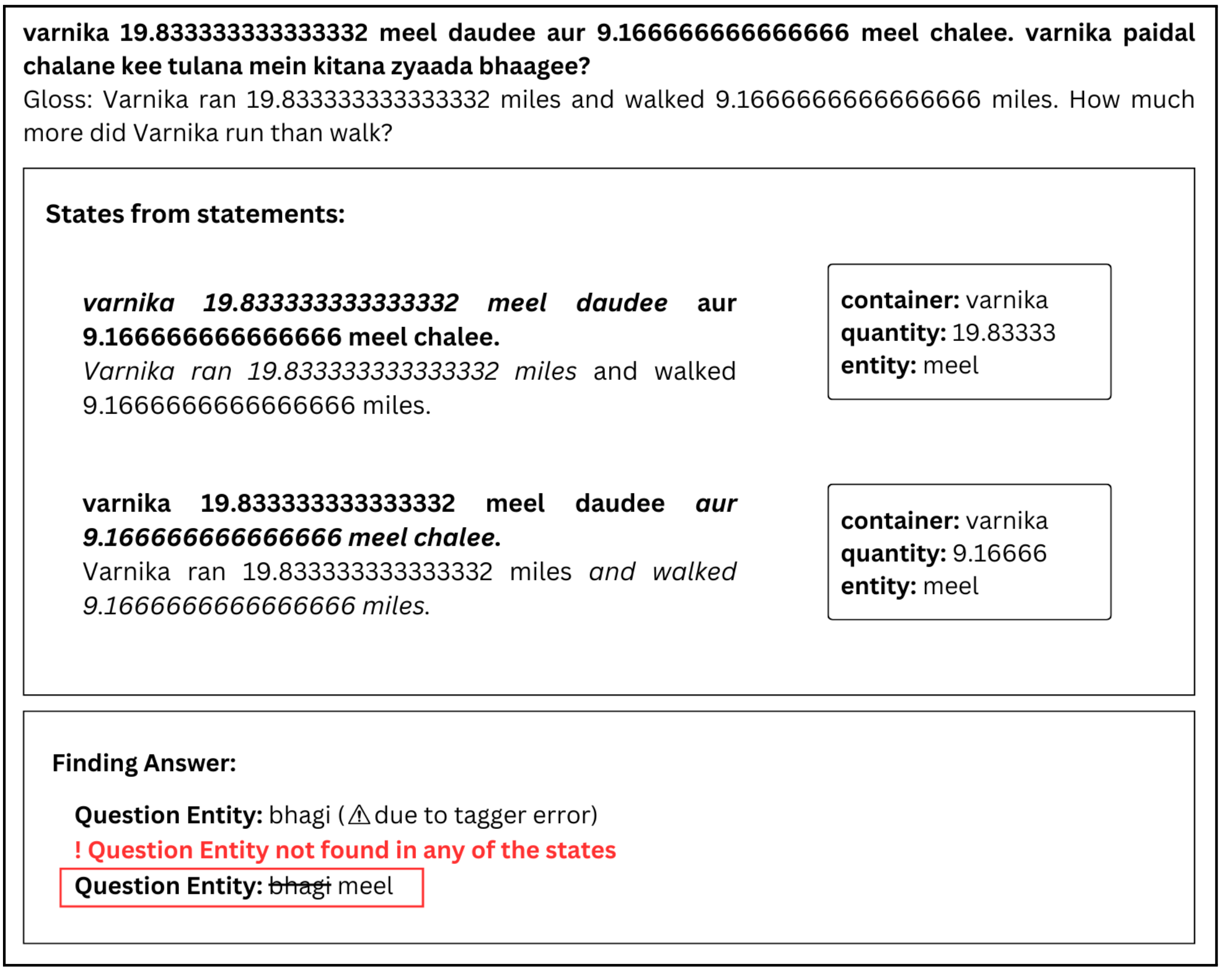

Figure 17: Example of solving word problem with negative indicator