Natural Language Interfaces in Computer Games

A study of NLI accuracy in Risk

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Gränssnitt för naturligt språk i datorspel
En studie av NLI-noggrannhet i Risk

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Abstract

Developing a Natural Language Interface that can understand everything is a very challenging task due to the varied and ambiguous nature of natural language. However, when confined to a small setting, would it be possible to develop an NLI that through repeated iterations can reach perfect understanding? The chosen setting was Risk and was created in Java. The game used Regex to detect certain key elements in the input and interpreted them accordingly. User studies were used to determine the accuracy of the NLI and based on the incorrectly interpreted input the game was improved upon. This was iterated three times. The conclusion was that, while it would be difficult to have the NLI reach a completely perfect understanding, it is possible to achieve precision close to that.

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1 Introduction

In computer science a historically discussed and studied field is natural language processing (NLP) and natural language interfaces (NLI)\textsuperscript{[5]}. NLP and NLI are tools used to let people interact with computers as they would with another person. It allows the user to speak or type in correct and complete sentences to let the computer know what they are trying to do. In recent years NLI have begun to make a greater appearance in our everyday lives, perhaps best noticed through the use of speech-to-text recognition. It is prevalent in iPhones in the form of Siri and natural language is also used by search engines such as Wolfram Alpha and Google. NLI can also benefit people who are less experienced with computers, as it allows them to communicate with a computer in a more fulfilling way\textsuperscript{[5]}.

Because of the many variations of expressing your intent in natural language, developing a program that can understand everything can be very challenging\textsuperscript{[3]}. This is mainly due to the ambiguity of the expected input, which can be written in a number of ways. Given a confined setting, the amount of variations of the expected input could be decreased. Would it therefore be possible to develop an NLI and approach perfect understanding, given a closed setting? If this is the case this might indicate that it would also be possible in a larger setting.

1.1 Problem statement

Would it be possible to create a game of Risk using NLI that approaches 100% accuracy in understanding user input? This will be examined using an implementation of the board game Risk made by the authors, with a text-interpreter as input. Risk as a game is relatively limited in terms of what actions can be taken and should therefore have a fairly confined set of possible inputs.
2 Background

This section will cover the basics of natural language interface and give some examples of early games using them. It will also review the basics of the board game Risk.

2.1 Natural Language

A Natural Language is in broad terms our everyday use of language. A natural language is one that has been naturally developed by human use. This is in contrast to a standardized language, which has been developed by linguistic prescription. Natural Language Processing is the technique of making computers able to interpret our natural language and help computer and man communicate like two people would. Natural Language Interfaces are the way the computer takes input from the user.

Natural Language Processing is a way for computers to be able to process human input and convert it into something that the computer can somehow understand. NLP has been a research subject for more than 60 years, and can be used for retrieving data out of large texts or for translating a sentence from one language to another [2].

To make a human user able to communicate with the computer, a Natural Language Interface, or NLI, can be used. This allows the computer to read text input from the user, which will then be processed using NLP. An example of this is the command line interface that was used in early, text-based games.

2.1.1 NLI use in computer games

The very first computer games were text based using a very simple natural language interface. Colossal Cave Adventure was one of those games. It used simple command inputs consisting of one or two words, such as “go in” or “attack dragon”. The program acted as a narrator for the user, describing the environment and setting. The player could only use a number of preset commands to control the protagonist, and only with a specified syntax. This game was developed in 1976, and much has happened since[4].

Text-based games became quite popular during the 80’s but slowly faded to give way to games using graphics and thus the concept of typing in your commands faded as well. Users began using the mouse instead since this proved to be much more efficient, and above all made it easier for the developer to interpret what the user wants to do[6].

During recent years it has been difficult to find games that make good use of a natural language interface, but not for lack of trying. An example of a game like this is Façade. The creators of Façade call it an “artificial intelligence-based art/research experiment in electronic narrative”[1]. It is a story where the user gets invited to a dinner party at a couple’s house and the program encourages the user to interact with the couple as he or she would do in real life. Depending on how the user behaves the story may end differently each time. Although this game received quite a bit of praise it never really gained in popularity and it is hard to find other games that use NLI.
2.1.2 Other uses

NLI is not only used in games, but with the increase in computing power that has allowed even mobile phones to make more advanced computations, it has made its way into a more widespread usage, such as services like Apple’s Siri and to some extent Google’s voice to text search functions. We can also see it used in computational engines such as Wolfram Alpha. However, while the mentioned services have an AI-like behaviour, none of them actually understands what it is doing, instead relying on word recognition or pattern matching[2].

2.1.3 Issues with NLI

One of the difficulties with the processing of natural language by an NLI is the ambiguity of the parsed sentence. A different ordering of the words in a sentence can give it a whole new meaning, while even a single sentence can have multiple meanings. This is a problem that needs to be resolved for the NLI to be able to have a high understanding[5].

2.2 Risk

Risk is a strategy board game and was released in 1957, where the board is a representation of the world. It is a turn-based game where every player gets assigned starting provinces and a number of armies. The goal of the game is to rule the entire world.

Each player’s turn consists of three phases:

- Reinforcement phase
- Attacking phase
- Move phase

2.2.1 Reinforcement phase

In the beginning of each turn a player is assigned more armies, based on the number of controlled provinces that the player owns, plus additional units if the player controls an entire continent. The player then gets to reinforce the provinces of his or her choosing. During this phase players may also turn in Risk cards for additional armies. Risk cards are awarded at the end of a turn if the player captured at least one province.

2.2.2 Attacking phase

After placing your reinforcements a player may then choose to attack. You can only attack provinces adjacent to your own. The battle is decided by rolling dice. The attacker gets dices according to how many units are in the attack, although no more than three dices may be used at the same time. The defender also rolls dice according to how many units are in the defending province, with a maximum of two dices. Each player’s highest, and second highest dice is compared. In both comparisons the highest
dice wins, where if it is equal the defender wins. For each dice comparison lost the player loses an army.

If the attacker manages to defeat all the defenders he or she may enter the conquered province with as many units as he or she likes, but at least as many that were in the attack, originating from the province from which the attack came from. There must still be at least one unit left in the defending province. A player may choose to do as many attacks as he or she wishes.

2.2.3 Move phase

In this phase the player may choose to move any number of armies from one owned province to another, as long as these are adjacent. This may only be done once. The turn then passes on to the next player.
3 Method

In this section we will describe the implementation of our Natural Language Interface, starting with the creation of the game, followed by the user studies, and the iteration process.

3.1 Game implementation

Our implementation of Risk was produced in Java, and was made entirely by us. The game uses Regular Expressions to recognize certain elements in the input. Since the game’s rules limit what a player may do and usually follow a specific pattern we have different regular expressions for each action. Due to time constraints Risk cards were not added.

![Figure 1: Board with 6 players](image)

3.1.1 Placing Units

The game analyses the input and tries to match a province name anywhere in the input. If the game finds a province in the input that province is interpreted as the one that the player wants to put their army in. If there are multiple provinces in the input it matches the first one in the game’s internal list of provinces, starting with Alaska and ending with Eastern Australia. If the province found does not belong to the player the game claims it as an illegal move and asks the player to try again.
When it has found a province it also searches the input for a number. The first number found is interpreted as the number of units to place. This number can also be in text if it is ten or lower. If the game can not find any number in the input it is interpreted as: use all units that can legally be used. So if a player has five units to place and no number is detected the game places five units in the specified province.

3.1.2 Attacking

When attacking the game needs to find two different provinces in the input. The game first runs a spell check on the input where we try to correct any misspelled province names. The game then uses the same function as in placing units to find the first province, now with the correctly spelled sentence. See appendix B for the code. It then deletes the province name from the sentence. This spell check is done once more to find the last province. If the provinces are already correctly spelled it does not change the sentence, the game only removes the first province found from it.

When the game has found two provinces it then examines who the provinces belong to. If one of the provinces is found to belong to the player this province is interpreted as the province from which the attack comes from, the attacking province. The other province is then also investigated so to not be able to attack your own province, otherwise it is interpreted as the province that the player wishes to attack. If the attacker owns none of the provinces the game tells the player that the move is invalid.

If the game only identifies one province in the input the game checks that it does not belong to the player. If there is only one eligible province to attack from then we chose this province as the second province, so that it is still possible to attack if the player only specifies one province. If there are more than one province that the attack can originate from the game asks the player to be more specific.

3.1.3 Moving

The game uses the same process to find the two provinces as used in the attack phase. The code is exactly the same as the one in appendix B. Since both now need to belong to the player this is confirmed by the game before trying to execute a move order. There is also ambiguity in this case therefore the game also attempts to find the keywords “to” or “from”. It detects the character index of the first occurrence of “to” and examines whether or not the first province named in the input is before or after it. If “to” is before the first province that first province is interpreted as the one that the player wishes to move units to, with units from the second province. If “to” is after the opposite happens.

If the game is unable to find an occurrence of “to” it tries to find the keyword “from” and in a similar way tries to decide in which direction the player wishes to move. If the first occurrence of “from” is before the first named province in the input the game interprets this as the player trying to move units from the first named province to the second named province.
3.1.4 Transitioning between phases

Before trying to interpret an attack or move command the game investigates whether or not the input contains specific keywords signaling that the player wants to transition to the next phase. See Appendix A.

3.1.5 Edit distance

A function that determines the closest distance to a word given a list of words. It can then return the word with the closest edit distance as well as the distance and index of that word in the input list. Distance is measured by how many changes are needed by either adding a letter, removing a letter, or changing a letter to achieve the correct word. See figure 2.

![Figure 2: Edit distance](image)

3.1.6 Understanding Misspelled Words

The implementation is able to handle slightly misspelled words and give fitting suggestions. This is done by measuring closest editing distance between every province and every word in the input sentence. Since there are quite a few provinces that are made up of more than one word the game also have to check the input sentences in pair of words, otherwise the editing distance will be too far to suggest misspelled provinces that consist of more than one word. This is also done a third time where the input is searched in groups of three, for provinces that consist of three words.

When the searching in groups of two and three the game weighs these heavier to compensate that the provinces names are longer. It decides that it is more likely that three words in succession that have a higher editing distance than one word still is the province that the user intended to write. Input may for example be: “Put 5 units in Westen Untied Stattes”. “in” is then three distance from India but “Westen Untied Stattes” is four. In this case it is much more likely that the user intended to write Western United States but without weighted editing distance the closest province is India or Siam.
If a province is found that has an edit distance of zero the game picks this province instantly, not checking the rest of the provinces.

**Input: “attack cnogo from north africa”**

Due to the similar names that some provinces have the interpreter may find more than one province with a low edit distance using the same part of the input. North Africa is only an edit distance of two from South Africa, which may result in the interpreter getting both provinces from the same words. If given the input shown in Figure 3, the interpreter would have found North Africa and South Africa, and not Congo and North Africa as intended. Instead, the interpreter uses the SpellCheck method (see Appendix B) which removes the part of the input that was used to find the first province so that the same words can not be used to find the second province. This is used for both the attack phase and move phase, where more than one province can be expected.

### 3.2 Measuring Accuracy

User testing was used to generate a natural selection of inputs. Logs were created by the game and then reviewed to examine the overall accuracy of the NLI. The test results were then added together to provide a better approximation of the overall accuracy of
the iteration. The errors were grouped together as to give an easy idea of what to fix and focus on for the next iteration.

One whole game were played per iteration, and the games were played one versus one. The users were not given any instructions on what commands to type or how to compose their input, other than in the first iteration where the users were told how to transition to the next phase either from the beginning or after attempting to transition once.

For every iteration we used a different pair of testers. We did this to make sure that the input would be as natural as possible, and that the users would not know what worked in the earlier iterations. The users were familiar with the rules of Risk and had good experience with computers.

3.3 Iterations

After every user test the game was improved upon based on the tests by trying to change the methods that gave a large amount of faulty interpretations. The words used to transition between phases were expanded with words used by the testers.
4 Results

In this section we will present the results of the user studies.

4.1 First Iteration

During the first round of testing, there were 156 commands recorded in the logs. Out of these, 15 were not interpreted as the user had meant. The most common errors was that a province not mentioned by the user was suggested for the current action, that move commands were interpreted as going in the wrong direction, or that the interpreter would not understand when the user wanted to switch to the next phase. Other errors included the interpreter not being able to handle certain commands in uppercase (such as 'YES' instead of 'yes') or suggesting provinces when input consisted of an empty string or whitespace.

<table>
<thead>
<tr>
<th>Table 1: First Iteration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total nr of inputs</td>
</tr>
<tr>
<td>Correctly interpreted</td>
</tr>
<tr>
<td>Wrongly interpreted</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2: First Iteration Errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suggested Province</td>
</tr>
<tr>
<td>Move Direction</td>
</tr>
<tr>
<td>Transition to next phase</td>
</tr>
<tr>
<td>Other</td>
</tr>
</tbody>
</table>

4.2 Second Iteration

In the second round of testing, 26 out of the 172 recorded commands were incorrectly interpreted. About 73% of the errors were failed interpretations of the user wanting to transition to the next phase, where the input would instead be interpreted as an attempted attack or move. For the first iteration this was only 20% of the errors. One type of error that was not encountered in the first iteration was that the user tried to attack a province without specifying from which province the attack should originate. This was not interpreted correctly, even though there only was one valid option. Therefore a new category of error was added.

<table>
<thead>
<tr>
<th>Table 3: Second Iteration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total nr of inputs</td>
</tr>
<tr>
<td>Correctly interpreted</td>
</tr>
<tr>
<td>Wrongly interpreted</td>
</tr>
</tbody>
</table>
Table 4: Second Iteration Errors

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Suggested Province</td>
<td>1</td>
</tr>
<tr>
<td>Move Direction</td>
<td>0</td>
</tr>
<tr>
<td>Transition to next phase</td>
<td>19</td>
</tr>
<tr>
<td>Only one province in input</td>
<td>4</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
</tr>
</tbody>
</table>
4.3 Third Iteration

In the third iteration the errors were down to 11 out of 171 inputs. The "other" category represents errors which did not really fit in with any of the specific categories.

Table 5: Third Iteration

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total nr of inputs</td>
<td>171</td>
</tr>
<tr>
<td>Correctly interpreted</td>
<td>160</td>
</tr>
<tr>
<td>Wrongly interpreted</td>
<td>11</td>
</tr>
</tbody>
</table>

Table 6: Third Iteration Errors

<table>
<thead>
<tr>
<th>Error Category</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suggested Province</td>
<td>1</td>
</tr>
<tr>
<td>Move Direction</td>
<td>0</td>
</tr>
<tr>
<td>Transition to next phase</td>
<td>3</td>
</tr>
<tr>
<td>Only one province in input</td>
<td>2</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
</tr>
</tbody>
</table>

Figure 4: Error percentage
5 Discussion

5.1 First Iteration

As mentioned in the results the most common error in the first iteration was that the suggested provinces were wrong. This was often due to the user attempting to place units in a province not belonging to them. The game did not suggest provinces not owned by the player, but instead found the player-owned province with the closest edit distance. This was changed in iteration two, so that the game would find the best matching provinces regardless of owner, and then decide whether or not the attempted move was valid. Transitions were not a problem in the early part of the testing since there only was one way of transitioning, hence the same phrase was used for every transition. This led to a relatively low transition error count in the first iteration compared to the second.

5.2 Second Iteration

For iteration two we changed the way the game search for provinces. If it finds a province it now removes it from the sentence, and then the edited sentence is searched again for the second province. This removed the problem where if there was an input that consisted of a misspelled province, say “Cogno”, and a province such as South Africa, the game would find that East Africa was closer than the misspelled province due to the weights used when calculating edit distance.

The earlier fault which meant some of the move commands were interpreted incorrectly was fixed. This improved the success rate of the move interpretations and left us with zero wrong interpretations of the move direction. The game was also adjusted to ignore empty input.

While in the first iteration the only way to move on to another phase was to use the word “stop”, for this round there were a few more commands that could be used. To enhance this feature and to be able to understand what type of input was to be expected, we allowed the testers to come up with their own commands. This naturally led to an increase in transition errors compared to the first iteration. Out of the 19 errors that were transition errors, 10 were some variation of the word “no” and 7 were variations of “do not”. Of the last two, one was the phrase “Yeah but i’m ok”, and the other was not really an attempt to answer the question stated by the game. Most of these are easily fixed, but it is important to take into consideration the similarities between phase-switching commands and the actual attack or move commands. From our tests we can see that there is often a fine line that separates these.

5.3 Third Iteration

Due to the improvements in the keyword set used for transitioning between phases, the number of errors relating to transitioning was only 3, down from 19 in the second iteration. 2 of these were attempts to transition using the keyword “end” and one was
“nope”, the latter having been added to the “attack-move” transition set, but acciden-
tally left out from the “move-end” phase. There was one error where the wrong province
was suggested, when one of the testers wanted to “place 2 in east aus”. Since the game
had no support for abbreviations of provinces, this was interpreted as an attempt to
deploy units in India, and not in Eastern Australia as intended. 3 of the ”other” errors
occurred when a user responded to a question that was meant for another player. The
last 2 errors were no real attempts to play the game.

We also added the possibility of only having one province in the input when attacking.
This was only possible if there was only one province eligible to attack the province in
the input.

The game now also ignores common words when trying to find misspelled provinces,
such as attack, invade, units and more. See appendix A.

5.4 General Discussion

We can see that the amount of errors increased from the first iteration to the second.
This was due to that in the first iteration there was only one way to transition between
phases and the testers were informed of this, so naturally there were a few amount of
errors in that category. In the second iteration the testers were given no information
about which keywords would allow them to transition to the next phase which also made
the errors increase significantly. We can however see that after just one more iteration
that type of error dropped from 19 to 3. When given even more iterations this number
will probably shrink even further.

Errors with the wrong suggested province were almost completely eliminated by the
second iteration, and the move direction errors was non existent in the second and third
iteration.

The way we measure edit distance does still however present some issues when mis-
spelling short provinces. It is for example very common to use the words “in” or “put”
in the input sentences which is only edit distance three from Siam and Peru respectively.
Should a user input “Put 3 units in Scanidnava”, it is difficult for the interpreter to
know whether the user meant Siam, Peru or Scandinavia. The most common words can
be added to the ignore list to give a bit higher accuracy, but it is diffuclt to add every
single one.

At first we tried to remedy this by making basic checks such as if the suggested
province is not an eligible entry it might discard that suggestion. So in this case if the
user did not own Peru or Siam the game would not suggest those as misspelled words.
However the game could then suggest provinces that could be very far away in terms of
edit distance, and we also reasoned that if the user truly did mean an ineligible province
it should be possible for the game to understand that and then say that the move was
not valid.

There could possibly have been better results if the weights we used were expanded to
include single word provinces when measuring edit distance. If there is an eleven letter
word with edit distance three it would be more likely that this was the province that
the user intended to write, than a shorter word that also had an edit distance of three.
The algorithm for calculating edit distance could also be changed so that it fits our purposes better. Since there is no way for the interpreter to know which of the words in the input sentence are misspelled provinces we have to check the whole input sentence for matching provinces. It could therefore be wise to increase the cost of adding a letter, so that we better can avoid situations as the one mentioned above. Usually the more common mistake when spelling incorrectly is using the wrong letter or putting them in the wrong order. The algorithm could also be improved so that letters close together on the keyboard have less weight than a letter further away.

Given more time it could also be wise to add alternative name for the provinces, as we noticed in the third iteration. Typing W. Australia is very natural when referring to Western Australia.

These suggested improvements should be possible to implement given enough time and present us with close to perfect understanding during the game phases. The limiting factor is the transitions to the next phase, where the input does not follow any given pattern. Since there are so many different ways to tell the game that you want to continue you will probably never be able to cover every single way. However given enough iterations and assuming that user does not input anything extremely out of the ordinary you could probably make this function have close to perfect understanding.

All of this is assuming that the player does not intentionally try to deceive the NLI, since there are no actual interpretations of the sentence, only finding key elements in it. Due to this, if the player does something that the NLI is not expecting, it would have difficulties interpreting it. This occurred a few times during testing, when users would input text that was not relevant, such as attempts to chat or a smiley. Due to the nature of our interpreter, it would still try to find relevant data in these input strings. In these cases though, it would have been more suitable to analyze the sentence first, and try to determine if it contained any relevant data before proceeding.

While we used regular expressions for our implementation, there are other forms of Natural Language interpretation. For example The Natural Language Toolkit for python is a suite of libraries for symbolic and statistical natural language processing. We felt however that this was not needed for our implementation and that pattern matching with regex would be sufficient.

5.5 User testing

Although only three iterations were done, and the NLI is still in such an early stage the low amount of user testing still provided a great deal of information. Despite this there should probably have been at least one more pair of testers for each iteration, since the testers were quite different in how they approached the game. In the second iteration the testers tried to challenge the NLI and wrote increasingly harder inputs to see how varied input it could handle. In contrast to the testers in the third iteration, where they felt the main goal was to beat the other player, not to beat the NLI. This also contributed to a high amount of errors in the second iteration compared to the first. If there were more testers we could probably see more precise results of the performance of each iteration.
Many of the testers also had quite a lot of experience with computers and programming, which may have had an impact on our results. Even though they had no knowledge of how the game was coded and structured they might still have recognized patterns of what worked and what didn’t. Due to this experience they might have played or developed text-based games themselves, which may have required the player to follow a more strict syntax, rather than using natural language which was the aim of this study. This could lead to a higher accuracy of the NLI than if the users were not experienced with computers.

5.6 Conclusion

Due to the ambiguous nature of natural language, and the many ways a sentence can be formed, it is our opinion that it would be difficult to have the interpreter reach complete understanding. However, we believe that it would not be impossible for the NLI to achieve results close to that when given enough iterations.
References


## 6 Appendix A: Keywords

Table 7: List of Keywords to end attack phase

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>stop</td>
<td>stop</td>
</tr>
<tr>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>nope</td>
<td>nope</td>
</tr>
<tr>
<td>noo</td>
<td>noo</td>
</tr>
<tr>
<td>nah</td>
<td>nah</td>
</tr>
<tr>
<td>don’t</td>
<td>don’t</td>
</tr>
<tr>
<td>dont</td>
<td>dont</td>
</tr>
<tr>
<td>do not</td>
<td>do not</td>
</tr>
<tr>
<td>move</td>
<td>move</td>
</tr>
<tr>
<td>quit</td>
<td>quit</td>
</tr>
<tr>
<td>done</td>
<td>done</td>
</tr>
<tr>
<td>i’m ok</td>
<td>i’m ok</td>
</tr>
<tr>
<td>good</td>
<td>good</td>
</tr>
<tr>
<td>cool</td>
<td>cool</td>
</tr>
<tr>
<td>fine</td>
<td>fine</td>
</tr>
</tbody>
</table>

Table 8: List of Keywords to end move phase

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>stop</td>
<td>stop</td>
</tr>
<tr>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>nope</td>
<td>nope</td>
</tr>
<tr>
<td>nah</td>
<td>nah</td>
</tr>
<tr>
<td>end</td>
<td>end</td>
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<tr>
<td>don’t</td>
<td>don’t</td>
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<tr>
<td>quit</td>
<td>quit</td>
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<td>done</td>
<td>done</td>
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<td>can't</td>
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<td>cant</td>
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<td>cannot</td>
<td>cannot</td>
</tr>
<tr>
<td>can not</td>
<td>can not</td>
</tr>
<tr>
<td>satisfied</td>
<td>satisfied</td>
</tr>
</tbody>
</table>
Table 9: List of keywords to ignore

<table>
<thead>
<tr>
<th>attack</th>
</tr>
</thead>
<tbody>
<tr>
<td>attach</td>
</tr>
<tr>
<td>yes</td>
</tr>
<tr>
<td>no</td>
</tr>
<tr>
<td>invade</td>
</tr>
<tr>
<td>[0-9]*</td>
</tr>
<tr>
<td>with</td>
</tr>
<tr>
<td>armies</td>
</tr>
<tr>
<td>army</td>
</tr>
<tr>
<td>dudes</td>
</tr>
<tr>
<td>units</td>
</tr>
<tr>
<td>unit</td>
</tr>
<tr>
<td>one</td>
</tr>
<tr>
<td>two</td>
</tr>
<tr>
<td>three</td>
</tr>
<tr>
<td>four</td>
</tr>
<tr>
<td>five</td>
</tr>
<tr>
<td>six</td>
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<tr>
<td>seven</td>
</tr>
<tr>
<td>eight</td>
</tr>
<tr>
<td>nine</td>
</tr>
<tr>
<td>ten</td>
</tr>
</tbody>
</table>
7 Appendix B: Code

7.1 Spell Check

```java
String getClosestProvinces(String input) {
    String suggestedSentence = "";
    input = input.toLowerCase();
    String[] splitList = input.split(" ");
    if (splitList.length < 1) return "null";
    List<String> list = new ArrayList<String>();
    int minDist = Integer.MAX_VALUE;
    for (int i = 0; i < provinceNameList.size(); i++) {
        String temp = provinceNameList.get(i);
        ClosestProvince cp = new ClosestProvince(temp, splitList);
        if (cp.getMinDistance() <= minDist) {
            minDist = cp.getMinDistance();
            list.add(temp);
            suggestedSentence = input.replaceFirst(splitList[cp.getIndex()], temp);
            if (minDist == 0) {
                return suggestedSentence;
            }
        }
    }
    for (int i = 0; i < provinceNameList.size(); i++) {
        String temp = provinceNameList.get(i);
        if (temp.split(" ").length != 2) {
            continue;
        }
        String[] tmp = new String[0];
        if (splitList.length == 1) {
            tmp = splitList;
        }
        if (splitList.length > 1) {
            tmp = new String[splitList.length - 1];
            for (int j = 0; j < splitList.length - 1; j++) {
                tmp[j] = splitList[j] + " " + splitList[j + 1];
            }
        }
        ClosestProvince cp = new ClosestProvince(temp, tmp);
    }
}
```

if (cp.getMinDistance() - 1 <= minDist) {
    minDist = cp.getMinDistance() - 2;
    list.add(temp);
    suggestedSentence = input.replaceFirst(tmp[cp.getIndex()], temp);
    if (minDist == -2) {
        return suggestedSentence;
    }
}
}
for (int i = 0; i < provinceNameList.size(); i++) {
    String temp = provinceNameList.get(i);
    if (temp.split(" ").length != 3) {
        continue;
    }
    String[] tmp = new String[0];
    if (splitList.length == 1) {
        tmp = splitList;
    }
    if (splitList.length == 2) {
        tmp = new String[] {splitList[0] + " " + splitList[1]};
    }
    if (splitList.length > 2) {
        tmp = new String[splitList.length - 2];
        for (int j = 0; j < splitList.length - 2; j++) {
            tmp[j] = splitList[j] + " " + splitList[j + 1] + " " + splitList[j + 2];
        }
    }
    ClosestProvince cp = new ClosestProvince(temp, tmp);
    if (cp.getMinDistance() - 6 <= minDist) {
        minDist = cp.getMinDistance() - 6;
        list.add(temp);
        suggestedSentence = input.replaceFirst(tmp[cp.getIndex()], temp);
    }
} return suggestedSentence;
7.2 Regex to find a province in input

```java
Province matchProvincePlayerOwned(String input, Player player) throws IOException {
    for (Province province : provinces) {
        String regex = ".*\(?i\)" + province.name.toLowerCase() + ".*";
        if (Pattern.compile(regex).matcher(input).matches()) {
            return province;
        }
    }
}
```

7.3 Regex to find a number in input

```java
int matchNumber(String input) {
    String regex = "\d+";
    Pattern p = Pattern.compile(regex);
    Matcher m = p.matcher(input);
    m.find();
    int number = 0;
    try{
        number = Integer.parseInt(m.group());
    } catch (IllegalStateException e) {
        //No number in input
        number = -1;
    }
    return number;
}
```

7.4 Regex to find a number as a word

```java
int matchStringNumber(String input) {
    String[] inputWords = input.toLowerCase().split("[^a-zA-Z]");
    String[] words = {
        "one", "two", "three", "four", "five",
        "six", "seven", "eight", "nine", "ten"};
    for(int i = 0; i<words.length; i++) {
        for (String str : inputWords) {
            if (str.equals(words[i])) {
                return i+1;
            }
        }
    }
}
```
return -1;

8 Appendix C: Logs

8.1 Log from second iteration testing

INFO: Read as: "quebec"
INFO: Interpreted as province: "Quebec" Correct
INFO: Read as: "place 2 in indonesia"
INFO: Interpreted as province: "Indonesia" Wrong
INFO: Read as: "western australia"
INFO: Interpreted as province: "Western Australia" Correct
INFO: Read as: "place one in eastern aus"
INFO: Suggested Sentence: place one india eastern aus
INFO: Read as: "place in eastern australia"
INFO: Interpreted as province: "Eastern Australia" Correct
INFO: Read as: "place two guys in quebec"
INFO: Tolkade sätt enheter i: "Quebec, 2 units" Correct
INFO: Read as: "place three dudes in western united states"
INFO: Tolkade sätt enheter i: "Western United States, 3 units" Correct
INFO: Read as: "place all of them in western australia"
INFO: Tolkade sätt enheter i: "Western Australia, -1 units" Correct
INFO: Read as: "attack greenland from quebec"
INFO: Suggested Sentence: attack greenland from quebec
INFO: Suggested Sentence: alaska from quebec
INFO: Suggested Sentence: attack from quebec
INFO: Suggested Sentence: attack from quebec
INFO: Interpreted as: "Attack Greenland from Quebec" Correct
INFO: Read as: "attack central america from western united states"
INFO: Suggested Sentence: attack central america from western united states
INFO: Suggested Sentence: alaska central america from
INFO: Suggested Sentence: attack central alberta from
INFO: Suggested Sentence: attack central america peru
INFO: Suggested Sentence: attack central america ural
INFO: Suggested Sentence: attack central america siam
INFO: Suggested Sentence: attack central america from
INFO: Interpreted as: "Attack Central America from Western United States" Correct
INFO: Read as: "yeah but I’m ok"
INFO: Suggested Sentence: yeah but siam ok
INFO: Suggested Sentence: yeah but alaska
INFO: Suggested Sentence: yeah alberta ok
INFO: Suggested Sentence: yeah quebec ok
INFO: Suggested Sentence: yeah brazil ok
INFO: Suggested Sentence: peru but ok
INFO: Suggested Sentence: congo
INFO: Suggested Sentence: ural
INFO: Suggested Sentence: siam
INFO: Suggested Sentence: siam
INFO: Read as: "attack greenland from northwest territory"
INFO: Suggested Sentence: attack greenland from northwest territory
INFO: Suggested Sentence: alaska greenland from
INFO: Suggested Sentence: attack greenland from
INFO: Suggested Sentence: attack greenland from
INFO: Interpreted as: "Attack Greenland from Northwest Territory” Correct
INFO: Read as: "no I’m ok"
INFO: Suggested Sentence: no siam ok
INFO: Suggested Sentence: no alaska
INFO: Suggested Sentence: ontario ok
INFO: Suggested Sentence: no peru
INFO: Suggested Sentence: congo ok
INFO: Suggested Sentence: congo ok
INFO: Read as: "don’t"
INFO: Interpreted as: " Sluta anfall ” Correct
INFO: Read as: "no i’m good”
INFO: Suggested Sentence: no siam good
INFO: Suggested Sentence: no ural good
INFO: Interpreted as provinces: "Siam” + "Ural” Wrong
INFO: Read as: "i do not want to.”
INFO: Suggested Sentence: siam do not want to.
INFO: Suggested Sentence: ural do not want to.
INFO: Interpreted as provinces: "Siam” + "Ural” Wrong
INFO: Read as: "i reaally do not want to use the shortened version of do not”
INFO: Suggested Sentence: siam reaally do not want to use the shortened version of do not
INFO: Suggested Sentence: siam reaally do not want to ural the shortened version of do not
INFO: Interpreted as provinces: "Siam” + "Ural” Wrong
INFO: Read as: "ok i don’t want to”
INFO: Interpreted as: " No move ” Correct
INFO: Read as: "place 6 in south africa”
INFO: Tolkade sätt enheter i: ”South Africa, 6 units” Correct
INFO: Read as: "attack congo from south africa”
INFO: Suggested Sentence: attack congo from south africa
INFO: Suggested Sentence: attack from south alaska
INFO: Suggested Sentence: attack peru south africa
INFO: Suggested Sentence: attack ural south africa
INFO: Suggested Sentence: attack siam south africa
INFO: Suggested Sentence: attack from south africa
INFO: Interpreted as: "Attack Congo from South Africa" Correct
INFO: Read as: "attack east africa from congo"
INFO: Suggested Sentence: attack east africa from congo
INFO: Suggested Sentence: alaska from congo
INFO: Suggested Sentence: attack peru congo
INFO: Suggested Sentence: attack from congo
INFO: Suggested Sentence: attack from congo
INFO: Interpreted as: "Attack East Africa from Congo" Correct
INFO: Read as: "attack north africa from east africa"
INFO: Suggested Sentence: attack north africa from east africa
INFO: Suggested Sentence: attack from east alaska
INFO: Suggested Sentence: attack from peru africa
INFO: Suggested Sentence: attack from egypt africa
INFO: Suggested Sentence: attack ural east africa
INFO: Suggested Sentence: attack siam east africa
INFO: Suggested Sentence: attack from east africa
INFO: Interpreted as: "Attack North Africa from East Africa" Correct
INFO: Read as: "im done"
INFO: Interpreted as: " Sluta anfall " Correct
INFO: Read as: "nah. im done"
INFO: Interpreted as: " No move " Correct
INFO: Read as: "place 11 units in mongolia"
INFO: Tolkade sätt enheter i: "Mongolia, 11 units" Correct
INFO: Read as: "attack china from mongolia"
INFO: Suggested Sentence: attack china from mongolia
INFO: Suggested Sentence: alaska china from
INFO: Suggested Sentence: attack china peru
INFO: Suggested Sentence: attack congo from
INFO: Suggested Sentence: attack china ural
INFO: Suggested Sentence: attack china from
INFO: Suggested Sentence: attack china from
INFO: Interpreted as: "Attack China from Mongolia" Correct
INFO: Read as: "attack afghanistan from china"
INFO: Suggested Sentence: attack afghanistan from china
INFO: Suggested Sentence: alaska from china
INFO: Suggested Sentence: attack peru china
INFO: Suggested Sentence: attack from congo
INFO: Suggested Sentence: attack ural china
INFO: Suggested Sentence: attack from china
INFO: Suggested Sentence: attack from china
INFO: Interpreted as: "Attack Afghanistan from China" Correct
INFO: Read as: "attack middle east from egypt"
INFO: Suggested Sentence: attack middle east from egypt
INFO: Suggested Sentence: attack middle alaska from
INFO: Suggested Sentence: attack middle east peru
INFO: Suggested Sentence: attack middle east ural
INFO: Suggested Sentence: attack middle east siam
INFO: Suggested Sentence: attack middle east from
INFO: Read as: "attack middle east from afghanistan"
INFO: Suggested Sentence: attack middle east from afghanistan
INFO: Suggested Sentence: alaska from afghanistan
INFO: Suggested Sentence: attack peru afghanistan
INFO: Suggested Sentence: attack from afghanistan
INFO: Suggested Sentence: attack from afghanistan
INFO: Interpreted as: "Attack Middle East from Afghanistan" Correct
INFO: Read as: "attack egypt from middle east"
INFO: Suggested Sentence: attack egypt from middle east
INFO: Suggested Sentence: attack from middle alaska
INFO: Suggested Sentence: attack from middle peru
INFO: Suggested Sentence: attack ural middle east
INFO: Suggested Sentence: attack siam middle east
INFO: Suggested Sentence: attack from middle east
INFO: Interpreted as: "Attack Egypt from Middle East" Correct
INFO: Read as: "don’t want to"
INFO: Interpreted as: " Sluta anfall " Correct
INFO: Read as: "move 5 dudes from egypt to alaska"
INFO: Suggested Sentence: move 5 dudes from egypt to alaska
INFO: Suggested Sentence: move 5 dudes from egypt to alaska
INFO: Interpreted as provinces: "Alaska" + "Egypt"
INFO: Read as: "move from egypt to middle east"
INFO: Suggested Sentence: move from egypt to middle east
INFO: Suggested Sentence: move from egypt to middle east
INFO: Interpreted as provinces: "Egypt" + "Middle East"
INFO: Interpreted as move 5 to Middle East from Egypt"B Correct
INFO: Read as: "place 3 in kamchatka"
INFO: Tolkade sätt enheter i: "Kamchatka, 3 units" Correct
INFO: Read as: "place 4 in east africa"
INFO: Tolkade sätt enheter i: "East Africa, 4 units" Correct
INFO: Read as: "place 3 in east africa"
INFO: Tolkade sätt enheter i: "East Africa, 3 units" Correct
INFO: Read as: "attack alaska from kamchatka"
INFO: Suggested Sentence: attack alaska from kamchatka
INFO: Suggested Sentence: attack from northwest territory
INFO: Suggested Sentence: attack greenland kamchatka
INFO: Suggested Sentence: attack from alberta
INFO: Suggested Sentence: ontario from kamchatka
INFO: Suggested Sentence: attack brazil kamchatka
INFO: Suggested Sentence: attack peru kamchatka
INFO: Suggested Sentence: attack southern europe from
INFO: Interpreted as: "Attack Southern Europe from Middle East" Correct
INFO: Read as: "attack north africa from southern europe"
INFO: Suggested Sentence: attack north africa from southern europe
INFO: Suggested Sentence: alaska from southern europe
INFO: Suggested Sentence: attack peru southern europe
INFO: Suggested Sentence: attack from southern egypt
INFO: Suggested Sentence: attack ural southern europe
INFO: Suggested Sentence: attack siam southern europe
INFO: Suggested Sentence: attack from southern europe
INFO: Interpreted as: "Attack North Africa from Southern Europe" Correct
INFO: Read as: "attack brazil from north africa"
INFO: Suggested Sentence: attack brazil from north africa
INFO: Suggested Sentence: attack from north alaska
INFO: Suggested Sentence: attack from peru africa
INFO: Suggested Sentence: attack from congo africa
INFO: Suggested Sentence: attack ural north africa
INFO: Suggested Sentence: attack siam north africa
INFO: Suggested Sentence: attack from north africa
INFO: Interpreted as: "Attack Brazil from North Africa" Correct
INFO: Read as: "don't"
INFO: Suggested Sentence: congo
INFO: Suggested Sentence: alaska
INFO: Suggested Sentence: quebec
INFO: Suggested Sentence: brazil
INFO: Suggested Sentence: peru
INFO: Suggested Sentence: ural
INFO: Suggested Sentence: siam
INFO: Suggested Sentence: siam
INFO: Interpreted as: "Attack Congo from Siam" Wrong
INFO: Read as: "don't want to"
INFO: Interpreted as: " Sluta anfall " Correct
INFO: Read as: "don't want to"
INFO: Interpreted as: " No move " Correct
INFO: Read as: "place 5 in venezuela"
INFO: Tolkade sätt enheter i: "Venezuela, 5 units" Correct
INFO: Read as: "attack north africa from egypt"
INFO: Suggested Sentence: attack north africa from egypt
INFO: Suggested Sentence: alaska from egypt
INFO: Suggested Sentence: attack peru egypt
INFO: Suggested Sentence: attack from egypt
INFO: Suggested Sentence: attack from egypt
INFO: Interpreted as: "Attack North Africa from Egypt" Correct
INFO: Read as: "attack central america from venezuela"
INFO: Suggested Sentence: attack central america from venezuela
INFO: Suggested Sentence: alaska from venezuela
INFO: Suggested Sentence: attack from venezuela
INFO: Suggested Sentence: attack from venezuela
INFO: Interpreted as: "Attack Central America from Venezuela" Correct
INFO: Read as: "im done"
INFO: Interpreted as: " Sluta anfall " Correct
INFO: Read as: "no im done"
INFO: Interpreted as: " No move " Correct
INFO: Read as: "place everything in brazil"
INFO: Tolkade sätt enheter i: "Brazil, -1 units" Correct
INFO: Read as: "attack argentina with three guys"
INFO: Suggested Sentence: attack argentina with three guys
INFO: Suggested Sentence: alaska with three guys
INFO: Suggested Sentence: attack with three peru
INFO: Suggested Sentence: attack with three egypt
INFO: Suggested Sentence: attack with three ural
INFO: Suggested Sentence: attack with china guys
INFO: Suggested Sentence: attack siam three guys
INFO: Suggested Sentence: attack siam three guys
INFO: Interpreted as: "Attack Argentina from Siam" Wrong(1 PROVINCE)
INFO: Read as: "attack argentina from brazil with three guys"
INFO: Suggested Sentence: attack argentina from brazil with three guys
INFO: Suggested Sentence: alaska argentina from brazil with three guys from
INFO: Suggested Sentence: attack argentina from three guys peru
INFO: Suggested Sentence: attack argentina with three guys from
INFO: Suggested Sentence: attack argentina from with three guys from
INFO: Suggested Sentence: attack argentina from with three guys from
INFO: Interpreted as: "Attack Argentina from Brazil" Correct
INFO: Read as: "attack argentina from brazil with three guys"
INFO: Suggested Sentence: attack argentina from brazil with three guys
INFO: Suggested Sentence: alaska argentina from with three guys
INFO: Suggested Sentence: attack argentina from with three guys
INFO: Suggested Sentence: attack argentina from with three guys
INFO: Suggested Sentence: attack argentina from with three guys
INFO: Interpreted as: "Attack Argentina from Brazil" Correct
INFO: Read as: "attack venezuela from brazil"
INFO: Suggested Sentence: attack venezuela from brazil
INFO: Suggested Sentence: alaska from brazil
INFO: Suggested Sentence: attack from brazil
INFO: Suggested Sentence: attack from brazil
INFO: Interpreted as: "Attack Venezuela from Brazil" Correct
INFO: Read as: "attack central america from venezuela"
INFO: Suggested Sentence: attack central america from venezuela
INFO: Suggested Sentence: alaska from venezuela
INFO: Suggested Sentence: attack from venezuela
INFO: Suggested Sentence: attack from venezuela
INFO: Interpreted as: "Attack Central America from Venezuela" Correct
INFO: Read as: "no I don’t"
INFO: Interpreted as: "Sluta anfall"
INFO: Read as: "move two guys from argentina to brazil"
INFO: Suggested Sentence: move two guys from argentina to brazil
INFO: Suggested Sentence: move two guys from argentina to brazil
INFO: Interpreted as provinces: "Brazil" + "Argentina"
INFO: Interpreted as move 2 to Brazil from Argentina"B Correct
INFO: Read as: "place all of them in north africa"
INFO: Tolkade sätt enheter i: "North Africa, -1 units" Correct
INFO: Read as: "attack brazil from north africa"
INFO: Suggested Sentence: attack brazil from north africa
INFO: Suggested Sentence: attack from north alaska
INFO: Suggested Sentence: attack from peru africa
INFO: Suggested Sentence: attack from congo africa
INFO: Suggested Sentence: attack ural north africa
INFO: Suggested Sentence: attack siam north africa
INFO: Suggested Sentence: attack from north africa
INFO: Interpreted as: "Attack Brazil from North Africa" Correct
INFO: Read as: "attack argentina with 3 units from brazil"
INFO: Suggested Sentence: attack argentina with 3 units from brazil
INFO: Suggested Sentence: alaska argentina with 3 units from
INFO: Suggested Sentence: attack argentina with 3 units peru
INFO: Suggested Sentence: attack argentina with 3 units from
INFO: Suggested Sentence: attack argentina with 3 units from
INFO: Interpreted as: "Attack Argentina from Brazil" Correct
INFO: Read as: "attack peru with argentina"
INFO: Suggested Sentence: attack peru with argentina
INFO: Suggested Sentence: alaska with argentina
INFO: Suggested Sentence: attack with argentina
INFO: Suggested Sentence: attack with argentina
INFO: Interpreted as: "Attack Peru from Argentina" Correct
INFO: Read as: "attack venezuela from brazil"
INFO: Suggested Sentence: attack venezuela from brazil
INFO: Suggested Sentence: alaska from brazil
INFO: Suggested Sentence: attack from brazil
INFO: Suggested Sentence: attack from brazil
INFO: Interpreted as: "Attack Venezuela from Brazil" Correct
INFO: Read as: "attack central america from venezuela"
INFO: Suggested Sentence: attack central america from venezuela
INFO: Suggested Sentence: alaska from venezuela
INFO: Suggested Sentence: attack from venezuela
INFO: Read as: "attack madagascar from south africa"
INFO: Suggested Sentence: attack madagascar from south africa
INFO: Suggested Sentence: alaska madagascar from
INFO: Suggested Sentence: attack madagascar peru
INFO: Suggested Sentence: attack madagascar from
INFO: Interpreted as: "Attack Madagascar from South Africa" Correct
INFO: Read as: "attack east africa from madagascar"
INFO: Suggested Sentence: attack east africa from madagascar
INFO: Suggested Sentence: alaska from madagascar
INFO: Suggested Sentence: attack peru madagascar
INFO: Suggested Sentence: attack from madagascar
INFO: Interpreted as: "Attack East Africa from Madagascar" Correct
INFO: Read as: "attack egypt from east africa"
INFO: Suggested Sentence: attack egypt from east africa
INFO: Suggested Sentence: attack from east alaska
INFO: Suggested Sentence: attack from peru africa
INFO: Suggested Sentence: attack ural east africa
INFO: Suggested Sentence: attack siam east africa
INFO: Interpreted as: "Attack Egypt from East Africa" Correct
INFO: Read as: "no it’s ok"
INFO: Suggested Sentence: congo it’s ok
INFO: Suggested Sentence: it’s alaska
INFO: Suggested Sentence: it’s peru
INFO: Suggested Sentence: it’s ural
INFO: Suggested Sentence: it’s siam
INFO: Suggested Sentence: india ok
INFO: Suggested Sentence: india ok
INFO: Read as: "don’t"
INFO: Suggested Sentence: congo
INFO: Suggested Sentence: alaska
INFO: Suggested Sentence: quebec
INFO: Suggested Sentence: brazil
INFO: Suggested Sentence: peru
INFO: Suggested Sentence: ural
INFO: Suggested Sentence: siam
INFO: Suggested Sentence: siam
INFO: Read as: "don’t want to"
INFO: Suggested Sentence: congo want to
INFO: Suggested Sentence: alaska to
INFO: Suggested Sentence: want ontario
INFO: Suggested Sentence: brazil to
INFO : Suggested Sentence: want peru
INFO : Suggested Sentence: egypt to
INFO : Suggested Sentence: want ural
INFO : Suggested Sentence: japan to
INFO : Suggested Sentence: want siam
INFO : Suggested Sentence: want siam
INFO : Read as: "don’t want to attack"
INFO : Interpreted as: " Sluta anfall " Correct
INFO : Read as: "no"
INFO : Interpreted as: " No move " Correct
INFO : Read as: "place all in brazil"
INFO : Tolkade sätt enheter i: "Brazil, -1 units" Correct
INFO : Read as: "attack north africa from brazil"
INFO : Suggested Sentence: attack north africa from brazil
INFO : Suggested Sentence: attack north alaska from
INFO : Suggested Sentence: attack north africa peru
INFO : Suggested Sentence: attack congo africa from
INFO : Suggested Sentence: attack north africa ural
INFO : Suggested Sentence: attack north africa siam
INFO : Suggested Sentence: attack north africa from
INFO : Interpreted as: "Attack North Africa from Brazil" Correct
INFO : Read as: "attack congo from north africa"
INFO : Suggested Sentence: attack congo from north africa
INFO : Suggested Sentence: alaska congo from
INFO : Suggested Sentence: attack congo peru
INFO : Suggested Sentence: attack congo from
INFO : Suggested Sentence: attack congo from
INFO : Interpreted as: "Attack Congo from North Africa" Correct
INFO : Read as: "attack south africa from congo"
INFO : Suggested Sentence: attack south africa from congo
INFO : Suggested Sentence: attack south alaska from
INFO : Suggested Sentence: attack south africa peru
INFO : Suggested Sentence: attack south africa ural
INFO : Suggested Sentence: attack south africa siam
INFO : Suggested Sentence: attack south africa from
INFO : Interpreted as: "Attack South Africa from Congo" Correct
INFO : Read as: "no"
INFO : Interpreted as: " Sluta anfall " Correct
INFO : Read as: "what army"
INFO : Suggested Sentence: what japan
INFO : Suggested Sentence: peru japan
INFO : Interpreted as provinces: "Japan" + "Peru" Wrong
INFO : Read as: "stop taunting me"
INFO : Suggested Sentence: alaska from yakutsk
INFO : Suggested Sentence: attack peru yakutsk
INFO : Suggested Sentence: attack ural yakutsk
INFO : Suggested Sentence: attack from yakutsk
INFO : Suggested Sentence: attack from yakutsk
INFO : Interpreted as: "Attack Siberia from Yakutsk" Correct
INFO : Read as: "attack eastern australia from western austraila"
INFO : Suggested Sentence: attack eastern australia from western austraila
INFO : Suggested Sentence: alaska from western austraila
INFO : Suggested Sentence: attack peru western austraila
INFO : Suggested Sentence: attack ural western austraila
INFO : Suggested Sentence: attack siam western austraila
INFO : Suggested Sentence: attack from western austraila
INFO : Interpreted as: "Attack Eastern Australia from Western Australia" Correct
INFO : Read as: "attack eastern australia from western austraila"
INFO : Suggested Sentence: attack new guinea from eastern australi
INFO : Suggested Sentence: attack new guinea from eastern australi
INFO : Suggested Sentence: alaska new from eastern australi
INFO : Suggested Sentence: attack peru from eastern australi
INFO : Suggested Sentence: attack ural from eastern australi
INFO : Suggested Sentence: attack siam from eastern australi
INFO : Suggested Sentence: attack from eastern australi
INFO : Interpreted as: "Attack Guinea from Eastern Australia" Correct
INFO : Read as: "attack indonesia from new guinea"
INFO : Suggested Sentence: attack indonesia from new guinea
INFO : Suggested Sentence: alaska from new guinea
INFO : Suggested Sentence: attack from new quebec
INFO : Suggested Sentence: attack from peru guinea
INFO : Suggested Sentence: attack ural new guinea
INFO : Suggested Sentence: attack from new china
INFO : Suggested Sentence: attack siam new guinea
INFO : Suggested Sentence: attack from new guinea
INFO : Suggested Sentence: attack from new guinea
INFO : Interpreted as: "Attack Indonesia from Guinea" Correct
INFO : Read as: "no I may not"
INFO : Suggested Sentence: no i siam not
INFO : Suggested Sentence: no i alberta
INFO : Suggested Sentence: no i alaska
INFO : Suggested Sentence: no brazil not
INFO : Suggested Sentence: no i peru
INFO : Suggested Sentence: no i egypt
INFO : Suggested Sentence: congo i not
INFO : Suggested Sentence: congo i not
INFO : Interpreted as: "Attack Congo from Siam" Wrong

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INFO: Read as: "attack central america from venezuela"
INFO: Suggested Sentence: attack central america from venezuela
INFO: Suggested Sentence: alaska from venezuela
INFO: Suggested Sentence: attack from venezuela
INFO: Suggested Sentence: attack from venezuela
INFO: Interpreted as: "Attack Central America from Venezuela" Correct
INFO: Read as: "just do it dammit"
INFO: Suggested Sentence: just do siam dammit
INFO: Suggested Sentence: alaska do dammit
INFO: Suggested Sentence: quebec do dammit
INFO: Suggested Sentence: just do brazil
INFO: Suggested Sentence: peru just do dammit
INFO: Suggested Sentence: egypt do dammit
INFO: Suggested Sentence: just congo dammit
INFO: Suggested Sentence: ural just do dammit
INFO: Suggested Sentence: japan do dammit
INFO: Suggested Sentence: just india dammit
INFO: Suggested Sentence: just india dammit
INFO: Read as: "just stop"
INFO: Interpreted as: " Sluta anfall " Correct
INFO: Read as: "no"
INFO: Interpreted as: " No move " Correct
INFO: Read as: "place all of my shit in south africa"
INFO: Tolkade sätt enheter i: "South Africa, -1 units" Correct
INFO: Read as: "attack congo from south africa"
INFO: Suggested Sentence: attack congo from south africa
INFO: Suggested Sentence: attack from south alaska
INFO: Suggested Sentence: attack peru south africa
INFO: Suggested Sentence: attack ural south africa
INFO: Suggested Sentence: attack siam south africa
INFO: Suggested Sentence: attack from south africa
INFO: Interpreted as: "Attack Congo from South Africa" Correct
INFO: Read as: "attack north africa from congo"
INFO: Suggested Sentence: attack north africa from congo
INFO: Suggested Sentence: alaska from congo
INFO: Suggested Sentence: attack peru congo
INFO: Suggested Sentence: attack from congo
INFO: Suggested Sentence: attack from congo
INFO: Interpreted as: "Attack North Africa from Congo" Correct
INFO: Read as: "attack brazil from north africa"
INFO: Suggested Sentence: attack brazil from north africa
INFO: Suggested Sentence: attack from north alaska
INFO: Suggested Sentence: attack from peru africa
INFO: Suggested Sentence: attack from congo africa
INFO: Suggested Sentence: attack ural north africa
INFO: Suggested Sentence: attack siam north africa
INFO: Suggested Sentence: attack from north africa
INFO: Interpreted as: "Attack Brazil from North Africa" Correct
INFO: Read as: "attack venezuela with three guys"
INFO: Suggested Sentence: attack venezuela with three guys
INFO: Suggested Sentence: alaska with three guys
INFO: Suggested Sentence: attack with three peru
INFO: Suggested Sentence: attack with three egypt
INFO: Suggested Sentence: attack with three ural
INFO: Suggested Sentence: attack with china guys
INFO: Suggested Sentence: attack siam three guys
INFO: Suggested Sentence: attack from north africa
INFO: Interpreted as: "Attack Venezuela from Siam" Wrong
INFO: Read as: "attack venezuela with three guys from brazil"
INFO: Suggested Sentence: attack venezuela with three guys from brazil
INFO: Suggested Sentence: alaska with three guys from brazil
INFO: Suggested Sentence: attack with three guys from brazil
INFO: Suggested Sentence: attack with three guys from brazil
INFO: Suggested Sentence: attack with three guys from brazil
INFO: Interpreted as: "Attack Venezuela from Brazil" Correct
INFO: Read as: "attack argentina from brazil"
INFO: Suggested Sentence: attack argentina from brazil
INFO: Suggested Sentence: alaska argentina from
INFO: Suggested Sentence: attack argentina peru
INFO: Suggested Sentence: attack argentina from
INFO: Suggested Sentence: attack argentina from
INFO: Interpreted as: "Attack Argentina from Brazil" Correct
INFO: Read as: "I do not want to attack"
INFO: Suggested Sentence: siam do not want to attack
INFO: Suggested Sentence: do not want to alaska
INFO: Suggested Sentence: do not want peru attack
INFO: Suggested Sentence: do not egypt to attack
INFO: Suggested Sentence: do not congo attack
INFO: Suggested Sentence: do not want ural attack
INFO: Suggested Sentence: do not japan to attack
INFO: Suggested Sentence: do not china to attack
INFO: Suggested Sentence: do india want to attack
INFO: Suggested Sentence: do india want to attack
8.2 Log from third iteration testing

INFO: Read as: "I don’t want to"
INFO: Interpreted as: " Sluta anfall " Correct
INFO: Read as: "i don’t want to"  
INFO: Interpreted as: " No move " Correct
INFO: Read as: "," 
INFO: Suggested Sentence: siam
INFO: Read as: "yes"
INFO: Suggested Sentence: peru
INFO: Read as: ",?"

INFO: Read as: "north afri"
INFO: Interpreted as province: "North Africa"
INFO: Read as: "indonesia"
INFO: Interpreted as province: "Indonesia"
INFO: Read as: "north africa"
INFO: Interpreted as province: "North Africa"
INFO: Read as: "indoneindonesia"
INFO: Interpreted as province: "Indonesia"
INFO: Read as: "place 5 in siam"
INFO: Interpreted as put units in: "Siam, 5 units"
INFO: Read as: "place 2 in east aus"
INFO: SuggestedProvince: place 2 india east aus
INFO: Read as: "eastern australia"
INFO: Interpreted as put units in: "Eastern Australia, -1 units"
INFO: Read as: "attack congo"
INFO: Interpreted as: "Attack Congo from North Africa"
INFO: Read as: "attack indonesia"
INFO: Interpreted as: "Attack Indonesia from Siam"
INFO: Read as: "attack western australia"
INFO: Interpreted as: "Attack Western Australia from Eastern Australia"
INFO: Read as: "attack indonesia"
INFO: Interpreted as: "Attack Indonesia from Western Australia"
INFO: Read as: "attack south africa"
INFO: Interpreted as: "Attack South Africa from Congo"
INFO: Read as: "all your base is belong to us"
INFO: Interpreted as: "Attack Ural from Siam"
INFO: Read as: "no"
INFO: Interpreted as: " Stop attack "
INFO: Read as: "end attack"
INFO: Interpreted as provinces: "India" + "Guinea"
INFO: Read as: "nope"
INFO: Interpreted as provinces: "India" + "Guinea"
INFO: Read as: "stop"
INFO: Interpreted as: "No move"
INFO: Read as: "six in indonesia"
INFO: Interpreted as put units in: "Indonesia, 6 units"
INFO: Read as: "attack western australia with 4 units"
INFO: Interpreted as: "Attack Western Australia from Indonesia"
INFO: Read as: "attack eastern australia from western australia"
INFO: Interpreted as: "Attack Eastern Australia from Western Australia"
INFO: Read as: "attack new guinea from eastern australia"
INFO: Interpreted as: "Attack Guinea from Eastern Australia"
INFO: Read as: "attack siam from indonesia"
INFO: Interpreted as: "Attack Siam from Indonesia"
INFO: Read as: "attack china from siam"
INFO: Interpreted as: "Attack China from Siam"
INFO: Read as: "attack india from china"
INFO: Interpreted as: "Attack India from China"
INFO: Read as: "no thanks"
INFO: Interpreted as: "Stop attack"
INFO: Read as: "no thanks"
INFO: Interpreted as: "No move"
INFO: Read as: "pls"
INFO: Read as: "place 6 in india"
INFO: Interpreted as put units in: "India, 6 units"
INFO: Read as: "attack afghanistan"
INFO: Interpreted as: "Attack Afghanistan from India"
INFO: Read as: "attack ural"
INFO: Interpreted as: "Attack Ural from Afghanistan"
INFO: Read as: "no"
INFO: Interpreted as: "Stop attack"
INFO: Read as: "no"
INFO: Interpreted as: "No move"
INFO: Read as: "no"
INFO: Read as: "ten in china"
INFO: Interpreted as put units in: "China, 10 units"
INFO: Read as: "nine in china"
INFO: Interpreted as put units in: "China, 9 units"
INFO: Read as: "attack india from china with 6"
INFO: Interpreted as: "Attack India from China"
INFO: Read as: "attack afghanistan from india"
INFO: Interpreted as: "Attack Afghanistan from India"
INFO: Read as: "end"
INFO: Read as: "no"
INFO: Interpreted as: "Stop attack"
INFO: Read as: "no"
INFO : Interpreted as: " No move 
INFO : Read as: "no"
INFO : Read as: "place 6 in afghanistan"
INFO : Interpreted as put units in: "Afghanistan, 6 units"
INFO : Read as: "attack middle east"
INFO : Interpreted as: "Attack Middle East from Afghanistan"
INFO : Read as: "attack india"
INFO : Interpreted as: "Attack India from Middle East"
INFO : Read as: "attack siam"
INFO : Interpreted as: "Attack Siam from India"
INFO : Read as: "attack indonesia"
INFO : Interpreted as: "Attack Indonesia from Siam"
INFO : Read as: "no"
INFO : Interpreted as: " Stop attack 
INFO : Read as: "no"
INFO : Read as: "8 in indonesia"
INFO : Interpreted as put units in: "Indonesia, 8 units"
INFO : Read as: "attack siam from indonesia"
INFO : Interpreted as: "Attack Siam from Indonesia"
INFO : Read as: "attack india from china"
INFO : Interpreted as: "Attack India from China"
INFO : Read as: "attack middle east from india"
INFO : Interpreted as: "Attack Middle East from India"
INFO : Read as: "attack afghanisatn from middle esat"
INFO : Interpreted as: "Attack Afghanistan from Middle East"
INFO : Read as: "no"
INFO : Interpreted as: " Stop attack 
INFO : Read as: "move from siam to china"
INFO : Interpreted as provinces: "China" + "Siam"
INFO : Interpreted as move 6 to China from Siam"B
INFO : Read as: "place 4 in siberia"
INFO : Interpreted as put units in: "Siberia, 4 units"
INFO : Read as: "place 2 in scandinavia"
INFO : Interpreted as put units in: "Scandinavia, 2 units"
INFO : Read as: "attack iceland"
INFO : Interpreted as: "Attack Iceland from Scandinavia"
INFO : Read as: "attack northern europe"
INFO : Interpreted as: "Attack Northern Europe from East Africa"
INFO : Read as: "attack northern europe"
INFO : Read as: "attack yakutsk"
INFO : Interpreted as: "Attack Yakutsk from Siberia"
INFO : Read as: "attack kamchatka"
INFO: Interpreted as: "Attack Kamchatka from Yakutsk"
INFO: Read as: "no"
INFO: Interpreted as: "Stop attack"
INFO: Read as: "move 2 from Iceland to Scandinavia"
INFO: Interpreted as provinces: "Iceland" + "Scandinavia"
INFO: Read as: "move 1 from Iceland to Scandinavia"
INFO: Interpreted as provinces: "Iceland" + "Scandinavia"
INFO: Interpreted as move 1 to Scandinavia from Iceland"
INFO: Read as: "9 in Middle East"
INFO: Interpreted as put units in: "Middle East, 9 units"
INFO: Read as: "attack Siberia from China"
INFO: Interpreted as: "Attack Siberia from China"
INFO: Read as: "attack Ukraine from Middle East with 5"
INFO: Interpreted as: "Attack Ukraine from Middle East"
INFO: Read as: "attack Ural from Siberia with 2"
INFO: Interpreted as: "Attack Ural from Siberia"
INFO: Read as: "attack Ural from Ukraine with 1"
INFO: Interpreted as: "Attack Ural from Ukraine"
INFO: Read as: "attack Yakutsk from Siberia"
INFO: Interpreted as: "Attack Yakutsk from Siberia"
INFO: Read as: "no"
INFO: Interpreted as: "Stop attack"
INFO: Read as: "no"
INFO: Interpreted as: "No move"
INFO: Read as: "place 4 in East Africa"
INFO: Interpreted as put units in: "East Africa, 4 units"
INFO: Read as: "place 1 in Congo"
INFO: Interpreted as put units in: "Congo, 1 units"
INFO: Read as: "attack South Africa"
INFO: Read as: "attack South Africa from Congo"
INFO: Interpreted as: "Attack South Africa from Congo"
INFO: Read as: "attack Egypt"
INFO: Interpreted as: "Attack Egypt from East Africa"
INFO: Read as: "attack Northern Europe"
INFO: Interpreted as: "Attack Northern Europe from Scandinavia"
INFO: Read as: "stop"
INFO: Interpreted as: "Stop attack"
INFO: Read as: "no"
INFO: Interpreted as: "No move"
INFO: Read as: "4 in Kamchatka"
INFO: Interpreted as put units in: "Kamchatka, 4 units"
INFO: Read as: "1 in Ukraine"
INFO: Interpreted as put units in: "Ukraine, 1 units"
INFO: Read as: "4 in Middle East"
INFO : Interpreted as: "Attack Egypt from North Africa"
INFO : Read as: "no"
INFO : Interpreted as: "Stop attack"
INFO : Read as: "move from yakutsk to kamchatka"
INFO : Interpreted as provinces: "Yakutsk" + "Kamchatka"
INFO : Interpreted as move 2 to Kamchatka from Yakutsk"
INFO : Read as: "place 5 in ontario"
INFO : Interpreted as put units in: "Ontario, 5 units"
INFO : Read as: "attack eastern united states with 3"
INFO : Interpreted as: "Attack Eastern United States from Ontario"
INFO : Read as: "attack alberta with 3"
INFO : Interpreted as: "Attack Alberta from Ontario"
INFO : Read as: "attack alberta with 2"
INFO : Interpreted as: "Attack Alberta from Ontario"
INFO : Read as: "attack north africa from egypt with 3"
INFO : Interpreted as: "Attack North Africa from Egypt"
INFO : Read as: "yesattack brazil with 1"
INFO : Read as: "attack brazil with 1"
INFO : Interpreted as: "Attack Brazil from North Africa"
INFO : Read as: "no"
INFO : Interpreted as: "Stop attack"
INFO : Read as: "move from north africa to egypt"
INFO : Interpreted as provinces: "North Africa" + "Egypt"
INFO : Interpreted as move 1 to Egypt from North Africa"
INFO : Read as: "place 16 in venezuela"
INFO : Interpreted as put units in: "Venezuela, 16 units"
INFO : Read as: "attack brazil with 15"
INFO : Interpreted as: "Attack Brazil from Venezuela"
INFO : Read as: "attack north africa"
INFO : Interpreted as: "Attack North Africa from Brazil"
INFO : Read as: "attack egypt from north africa with 6"
INFO : Interpreted as: "Attack Egypt from North Africa"
INFO : Read as: "no"
INFO : Interpreted as: "Stop attack"
INFO : Read as: "no"
INFO : Interpreted as: "No move"
INFO : Read as: "place 5 in western united states"
INFO : Interpreted as put units in: "Western United States, 5 units"
INFO : Read as: "place 1 in northwest territory"
INFO : Interpreted as put units in: "Northwest Territory, 1 units"
INFO : Read as: "attack alaska"
INFO : Interpreted as: "Attack Alaska from Northwest Territory"
INFO : Read as: "attack central america with 5"
INFO : Interpreted as: "Attack Central America from Western United States"
INFO : Read as: "no"
INFO : Interpreted as: " Stop attack ">
INFO : Read as: "move 1 from east africa to egypt"
INFO : Interpreted as provinces: "Egypt" + "East Africa"
INFO : Interpreted as move 1 to Egypt from East Africa”B
INFO : Read as: "18 in kamchatka"
INFO : Interpreted as put units in: "Kamchatka, 18 units"
INFO : Read as: "attack alaska from kamchatka with 18"
INFO : Interpreted as: "Attack Alaska from Kamchatka"
INFO : Read as: "attack alberta"
INFO : Interpreted as: "Attack Alberta from Alaska"
INFO : Read as: "attack northwest territory with 5"
INFO : Interpreted as: "Attack Northwest Territory from Alberta"
INFO : Read as: "attack western united states with 7"
INFO : Interpreted as: "Attack Western United States from Alberta"
INFO : Read as: "attack central america"
INFO : Read as: "attack central america from western united states”
INFO : Interpreted as: "Attack Central America from Western United States”
INFO : Read as: "attack souther europe from middle east with 4”
INFO : Interpreted as: "Attack Southern Europe from Middle East”
INFO : Read as: "attack egypt from north africa”
INFO : Interpreted as: "Attack Egypt from North Africa”
INFO : Read as: "attack east africa from egypt”
INFO : Interpreted as: "Attack East Africa from Egypt”
INFO : Read as: "attack northern europe from ukraine with 4”
INFO : Interpreted as: "Attack Northern Europe from Ukraine”
INFO : Read as: "no"
INFO : Interpreted as: " Stop attack “
INFO : Read as: "move 1 from souther europe to ukraine”
INFO : Interpreted as provinces: "Ukraine” + "Southern Europe”
INFO : Interpreted as move 1 to Ukraine from Southern Europe”B
INFO : Read as: "place 4 in east africa”
INFO : Interpreted as put units in: "East Africa, 4 units”
INFO : Read as: "attack egypt”
INFO : Interpreted as: "Attack Egypt from East Africa”
INFO : Read as: "attack north africa”
INFO : Interpreted as: "Attack North Africa from Egypt”
INFO : Read as: "attack brazil”
INFO : Interpreted as: "Attack Brazil from North Africa”
INFO : Read as: "attack peru”
INFO : Interpreted as: "Attack Peru from Brazil”
INFO : Read as: "attack western united states”
INFO : Interpreted as: "Attack Western United States from Central America”
INFO : Read as: "no"
INFO : Interpreted as: "Stop attack"
INFO : Read as: "no"
INFO : Interpreted as: "No move"
INFO : Read as: "all in middle east"
INFO : Interpreted as put units in: "Middle East, -1 units"
INFO : Read as: "attack egypt from middle east"
INFO : Interpreted as: "Attack Egypt from Middle East"
INFO : Read as: "attack east africa"
INFO : Interpreted as: "Attack East Africa from Egypt"
INFO : Read as: "attack madagascar"
INFO : Interpreted as: "Attack Madagascar from East Africa"
INFO : Read as: "attack south africa"
INFO : Interpreted as: "Attack South Africa from Madagascar"
INFO : Read as: "attack congo"
INFO : Interpreted as: "Attack Congo from South Africa"
INFO : Read as: "attack north africa"
INFO : Read as: "attack north africa from congo"
INFO : Interpreted as: "Attack North Africa from Congo"
INFO : Read as: "attack brazil from north africa with 2"
INFO : Interpreted as: "Attack Brazil from North Africa"
INFO : Read as: "attack western europe from north africa"
INFO : Interpreted as: "Attack Western Europe from North Africa"
INFO : Read as: "attack northern europe from souther europe"
INFO : Interpreted as: "Attack Northern Europe from Southern Europe"
INFO : Read as: "attack scandinavie from ukraine"
INFO : Interpreted as: "Attack Scandinavia from Ukraine"
INFO : Read as: "attack great britain from western europe"
INFO : Interpreted as: "Attack Great Britain from Western Europe"
INFO : Read as: "attack iceland from great britain"
INFO : Interpreted as: "Attack Iceland from Great Britain"
INFO : Read as: "attack ontaria from alberta"
INFO : Interpreted as: "Attack Ontario from Alberta"
INFO : Read as: "attack ontaria from northwest territory"
INFO : Interpreted as: "Attack Ontario from Northwest Territory"
INFO : Read as: "attack greenland from iceland"
INFO : Interpreted as: "Attack Greenland from Iceland"
INFO : Read as: "attack quebec from greenland"
INFO : Interpreted as: "Attack Quebec from Greenland"
INFO : Read as: "attack eastern united states from quebec"
INFO : Interpreted as: "Attack Eastern United States from Quebec"
INFO : Read as: "attack central america from venezuela"
INFO : Interpreted as: "Attack Central America from Venezuela"
INFO : Read as: "attack central america from eastern united states"
INFO : Interpreted as: "Attack Central America from Eastern United States"