

Modelling for changing transitive active imperative sentences to passive imperative sentences with algebraic structure approach

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ABSTRACT

The active imperative sentences often tend to sound harsh. The sentence has a commanding meaning and ends with an exclamation mark (!). In the Indonesian language, to be more polite, the sentence uses the word politeness and a different sentence structure. These more polite imperative sentences are called passive imperative sentences. Changing an active imperative sentence to a passive imperative sentence can be done mathematically through several stages. These stages are determining the set of word, and the set of word types, using binary operations to obtain the rules for changing the pronoun as an object to subject, determining the rules for substituting active verbs into passive verbs, determining algebraic structures for an active imperative sentence, specifying a set of politeness words, specifying rules for passive imperative sentence, transformation an active imperative sentence into a passive imperative sentence. The change method produces a mathematical model $p = KK \# S_p * P_p$ to construct the more polite imperative sentence.



KEYWORDS

Active imperative sentence;
Active and passive verb;
Sequence;
Semigroup



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1. Introduction

In everyday life, language is needed to communicate. Communication can be spoken orally or in writing. In written form, good and correct sentences are needed to convey the intent and purpose to be conveyed. Sentences in Indonesian language can be composed of words or phrases. A collection of all words, phrases or sentences in Indonesian language can form a semigroup. In the Indonesian language, the sentence is the smallest language unit in the spoken or written form that expresses the whole mind. Based on the syntactic form, sentence consists of four types. One types of sentence is an imperative sentence.

An imperative sentence is a sentence that contains the meaning of a command or sentence that give a command to someone to do something according to the speaker. This sentence has the character ending with an exclamation mark (!) [1]. In general, imperative sentences have two forms, i.e., active imperative sentences and passive imperative sentences. An active imperative sentence is also divided into a transitive active imperative sentence (has an object) and an intransitive active imperative sentence (has no object) [2]. The example of active transitive imperative sentences is, “Buang makanan itu ke tong sampah! (Throw the food in the trash!)”, the example of intransitive active imperative sentences is, “Buang itu ke tong sampah! (Throw it in the trash!)”, and the example of passive imperative sentences is, “Tolong makanan itu dibuang ke tong sampah! (Please throw the food in the trash!).” In everyday life, passive imperative sentences are better used than transitive active imperative sentences because they contain the word politeness.

The concept of mathematics has been applied in various sectors, especially in the sector of language. Marcus Kracht [3] has implemented research on the separation of natural language from cultural and social problems and viewed language as a collection of structured mathematical objects. Then, Rakesh Pandey et al. [4] constructed a mathematical model for changing active sentences to passive sentences. Moreover, Rakesh Pandey and H. S Dhimi [5] constructed a mathematical model for changing sentence forms from one form to another using set theory and algebraic structure. Furthermore, Rakesh Pandey and H. S Dhimi [6] also constructed a mathematical model of changing active imperative sentences to passive imperative sentences using topological homeomorphisms. The three researchers used algebraic concepts in constructing mathematical models for English. In this study, a mathematical model that can

convert the transitive active imperative sentences to passive imperative sentences in Indonesian is constructed using algebraic structures.

2. Method

An algebraic structure is a non-empty set together with one or two binary operations. An algebraic structure include sets, binary operations and relations. An example of an algebraic structure with one binary operation is a group and a ring. Binary operations are amid the oldest fundamental concepts in algebraic structures. A binary operation on a non-empty set A is any function from the cartesian product $A \times A$ into A [7]. An algebraic structure is a non-empty set together with one or two binary operations.

Definition 1 A semigroup is a nonempty set A equipped with a binary operation $*$ that satisfies the following axioms [8]:

1. *Closure: If $x, y \in A$, then $x * y \in A$.*
2. *Assosiativity: If $x, y, z \in A$, then $x * (y * z) = (x * y) * z$*

The characteristics of the imperative sentences in the Indonesian language include, 1) intonation marked by a low tones ending speech, 2) the use of particle affirmation, 3) softening and ordering words of solicitation, hope, request and prohibition, and 4) the order of inversion is not always revealed [9]. In the Indonesian language, the imperative sentences are divided into active imperative sentences and passive imperative sentences [10]. In this article, the verb used in the active imperative sentence is transitive. Transitive verbs require nouns as objects in active sentences, and they can serve as subjects in passive sentences. Based on the role of the subject, verbs in the Indonesia language are divided into active verbs and passive verbs. Succeeding based on the object, the active verbs can also be grouped into active transitive verbs and intransitive verbs [10]. Grammatical transformation is an operation that transforms a syntactic structure into another without altering the meaning [3]. In the Indonesian language, the sentence structure of transitive active imperative sentences started with P (predicate) followed by O (object), while the pattern of passive imperative sentence began with KK (politeness word) followed by S (subject) and P (predicate). Based on the pattern, then there is a change transitive active imperative sentences to passive imperative sentences.

This research can be completed with several steps:

1. Prove that the set of all words, phrases or sentences in Indonesian language is a semigroup.
2. Transforming transitive active imperative sentences into passive imperative sentences with the following steps.
3. Define the set for all types of words in Indonesian language.
4. Change of pronouns from object in the transitive active imperative sentence to the subject in the passive imperative sentence.
5. Change of verbs in transitive active imperative sentence to passive imperative sentence.
6. Define the algebraic structure of transitive active imperative sentences by using the sentence structure rule.
7. Define the set for all politeness words in Indonesian language.
8. Define passive imperative sentence structure rule in Indonesian language.
9. Transforming transitive active imperative sentence into passive imperative sentences in Indonesian language.

3. Results and Discussion

3.1. I is Semigroup

The template is designed so that author affiliations are not repeated each time for multiple authors of the same affiliation. Please keep your affiliations as succinct as possible (for example, do not differentiate among departments of the same organization). This template was designed for two affiliations.

A collection of all words, phrases or sentences in Indonesian language can be a set which is denoted by I . Then given a binary operation that is used to combine a word with another word. The binary operation is denoted by $*$ which can be written in the form:

$$\begin{aligned} * : I \times I &\rightarrow I \\ (x, y) &\mapsto *((x, y)) \\ &\mapsto x * y = xy \end{aligned}$$

where x, y is a word in Indonesian language.

Lemma 1 A collection of all words, phrases or sentences in Indonesian language (I) with a binary operation $*$ can form a semigroup.

Proof Based on **Definition 1**, it will be proven that I forms a semigroup with the following two axioms fulfilled:

1. Closure: If $x, y \in I$, then $x * y \in I$.

Take any $x, y \in I$, because $x, y \in I$ and I are the set of all words, phrases or sentences in Indonesian language then $x * y = xy \in I$. For example: let $x = \textit{pergi}$ and $y = \textit{sana}$ then $x * y = \textit{pergi} * \textit{sana} = \textit{pergi sana} \in I$.

2. Assosiativity: If $x, y, z \in A$, then $x * (y * z) = (x * y) * z$.

Take any $x, y, z \in I$, will bw shown $x * (y * z) = (x * y) * z$. Note that $x * (y * z) = x * yz = xyz$, and $(x * y) * z = xy * z = xyz$ so we get $x * (y * z) = (x * y) * z$. For example: let $x = \textit{buang}$, $y = \textit{sampah}$ and $z = \textit{itu}$ then $x * (y * z) = \textit{buang} * (\textit{sampah} * \textit{itu}) = \textit{buang} * \textit{sampah itu} = \textit{buang sampah itu}$, and $(x * y) * z = (\textit{buang} * \textit{sampah}) * \textit{itu} = \textit{buang sampah} * \textit{itu} = \textit{buang sampah itu}$.

Based on 1 and 2, prove that I is a semigroup.

3.2. Transforming Imperative Sentence

Let I be the set of all words, phrase or sentence; K is the type of any word, and S is a universe set whose elements are the type of words in the Indonesian language. Therefore, according to [6], [11] the set of each type of word can be mathematically expressed by S .

$$S = \{K_1, K_2, \dots, K_{11}\}$$

where $K_i, i = 1, 2, \dots, 11$ successively are nouns, pronouns, verbs, adjectives, adverbs, propositions, conjunctions, articulations, interjections, particles, and numerals.

Furthermore, to define the rules for changing the pronouns as an object to subject, we must define the pronoun set, the pronoun replacement operation, the verb set, and the verb substitution operation. The set of pronoun is

$$K_2 = \{g_1, g_2, g_3, e\}$$

where $g_i, i = 1, 2, 3$ successively are the first personal pronoun, “*saya/aku* (I), *kita* (we)”, the second personal pronoun, “*engkau/kamu/kau* (you), *kalian* (we)”, the third personal pronoun, “*ia/dia/beliau* (he/she), and e is K_1 . The pronoun (K_2) is also included in the noun (K_1) Table 1.

Table 1. Insert Captions

g_1	g_2	g_3	g_1^{-1}	g_2^{-1}	g_3^{-1}
saya	engkau	ia	Saya	engkau	ia
aku	kamu	dia	Aku	kamu	dia
kita	Kau	beliau	Kita	kau	beliau
-	kalian	-	-	kalian	-

Thomas [12] conveyed that $g_i * g_i^{-1} = e$ for each $g_i \in K_2$. The operation applies to change pronoun as an object to subject [4]. For example, if $g_1 = \textit{aku}$ (me) then $g_1^{-1} = \textit{aku}$ (I) and $e = K_2 \subset K_1$. Therefore, if the subject is, “*aku* (I)” then the object is also “*aku* (me)” and on the other hand, if the object is, “*aku* (me)” then the subject is also “*aku* (I).” So the results are $g_i = g_i^{-1}$. It means the subject and the object are in common. Mathematically, the object replacement is denoted by $f(g_i)$ [3], [4]. Because the object changes to the subject, then $f(g_i) = g_i^{-1}$. As a result $f(g_i) = g_i^{-1} = g_i$.

Later, because of the verbs in two, imperative sentences (active transitive and passive), the K_3 verb set can be expressed by

$$K_3 = \{k_3, k_3^{-1}\}$$

where k_3 is a transitive active verb and k_3^{-1} is a passive verb. The transitive active verb form can be a root verb or formed from a combination of a root verb with the prefixes “me” or “ber”, while passive verbs are formed by combining the prefixes, “di” or “ter” with the root verb [10], [13]. Examples of the two verbs are shown in Table 2 below.

Table 2. Transformation Verbs

k_3 (Transitive Active Verbs)	k_3^{-1} (Passive Verbs)
Siram	di siram
memasak	di masak
abaikan	terabaikan

The passive verb used in the passive imperative sentence depends on the active transitive imperative sentence. Moreover, because $h(k_3)$ indicates the replacement of a transitive active verb, the change of a transitive active verb to a passive verb is $h(k_3) = k_3^{-1}$ [3,4].

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In a sentence, another subject can be formed from a combination of articulations (K_8) and the noun (K_1) itself. As an example

$$para (K_8) * hadirin (K_1) = para hadirin (K_1),$$

other verbs can also be formed from combining a verb (K_3) with a particle (K_{10}), as an example

$$pergi (K_3) * lah (K_{10}) = pergilah (K_3).$$

To obtain the algebraic structure of the transitive active imperative sentence, assume that P_a is a set of words to form a predicate, which consists of a root verb or a combination of verbs with particles, O_a is a set of words to form an object consisting of nouns, pronouns, or articulations, and Kt_l is a set of all words other than elements P_a and O_a . The three sets sequentially form the sequence rules for writing the transitive active imperative sentence. The sequence rule is expressed in a controlled form, namely

$$AI = \{P_a, O_a, Kt_l\}.$$

Basic transitive active imperative sentence pattern is $P + O$. Furthermore, by using the elements in the set AI , the algebraic structure with this basic pattern is

$$a = P_a * O_a$$

where a states the transitive active imperative sentence and $*$ is a binary operation between P_a and O_a . Furthermore, the set of words for politeness KK is defined as follows

$KK = \{silahkan, mohon, tolong, \dots\}$. Any politeness word or element from KK can be selected and then placed at the beginning of the passive imperative sentence.

To find the algebraic structure of the passive imperative sentence, consider that KK is a set of all politeness words, S_p is a set of words that make up a subject consisting of nouns, pronouns, or articulations, and P_p is a set of words that form a predicate in a passive imperative sentence whose members are a root verb or a combination of verbs with particles. Then, the sequence rule for passive imperative sentence in the set form is

$$PI = \{KK, S_p, P_p, Kt_l\}.$$

By using the PI sequence rule, changing the transitive active imperative sentence to the passive imperative sentence can algebraically be expressed by the following transformation

$$T(a) = T(P_a * O_a) = KK \# S_p * P_p$$

where $\#$ and $*$ is a binary operation between sentence structure and other sentence structure. Therefore, a formula of mathematical model for passive imperative sentences is

$$p = KK \# S_p * P_p$$

Where p states the passive imperative sentence.

As an illustration, given the transitive active imperative sentence, “*Kunjungi aku setiap hari!* (Visit me every day!).” In that sentence, the word, *kunjungi* (visit) $\in k_3 \in P_a$, the word, *aku* (me) $\in g_1 \in K_2 \in O_a$, and the word, *setiap hari* (every day) $\in Kt_1$. Since the k_3 is, “*kunjungi* (visit)” then k_3^{-1} is, “*dikunjungi* (visited).” Also, because the object is the same as the subject then in this example $O_a = S_p$. However, Kt_1 has not changed concerning the word or concerning its location. It persists at the end of the sentence. For passive imperative sentences, the pattern begins with the word politeness. The word politeness (KK) chosen and are used in this example is the word, “*tolong* (please).” Finally, using the constructed algebraic transformation model, i.e.

$$T(a) = T(k_3 * O_a) = KK \# S_p * k_3^{-1}$$

the passive imperative sentence for, “*Kunjungi aku setiap hari!* (Visit me every day!)” is, “*Tolong aku dikunjungi setiap hari!* (Please, I’m visited every day!).”

4. Conclusion

In this study it can be concluded that the collection of all words, phrases or sentences in Indonesian language can form a semigroup and in transitive active imperative sentence with the P + O pattern can be mathematically converted into passive imperative sentence with the KK + S + P pattern using the $p=KK\#S_p*P_p$. The change in the sentence does not change the meaning of the sentence.

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References

- [1] Muhammand Fajri Hidayatullah and Dedi Rahman Nur, “An Analysis of Imperative Sentence in ‘Uang Panai’ Movie,” *IJOLTL Indones. J. Lang. Teach. Linguist.*, vol. 4, no. 3, pp. 180–192, Sep. 2019, doi: [10.30957/IJOLTL.V4I3.609](https://doi.org/10.30957/IJOLTL.V4I3.609).
- [2] I. M. Simorangkir and Y. M. Passandaran, “THE IMPERATIVE SENTENCE IN DOLOKSANGGUL TOBA BATAK LANGUAGE,” *Pujangga J. Bhs. dan Sastra*, vol. 2, no. 2, p. 13, Apr. 2018, doi: [10.47313/PUJANGGA.V2I2.389](https://doi.org/10.47313/PUJANGGA.V2I2.389).
- [3] “Marcus Kracht, The Mathematics of Language.”
- [4] “(PDF) Mathematical Model for Transformation of Sentences from Active Voice to Passive Voice.”
- [5] “(PDF) Some Mathematical Models for Transformation of Sentences from One Form to Other.”
- [6] “Conversion Of Imperative Sentences from Active to Passive Voice by Topological Homeomorphism | Request PDF.”
- [7] M. Yettou, A. Amroune, and L. Zedam, “A binary operation-based representation of a lattice,” *Kybernetika*, vol. 55, no. 2, pp. 252–272, 2019, doi: [10.14736/KYB-2019-2-0252](https://doi.org/10.14736/KYB-2019-2-0252).
- [8] “BASIC ABSTRACT ALGEBRA.” Press Syndicate of the University of Cambridge, Cambridge.
- [9] S. Aziez, “VERB FEATURE DIFFERENCES IN INDONESIAN AND ENGLISH IMPERATIVE SENTENCES: A CONTRASTIVE ANALYSIS STUDY,” *Lexeme J. Linguist. Appl. Linguist.*, vol. 1, no. 1, pp. 1–7, Mar. 2019, doi: [10.32493/LJLAL.V1I1.2477](https://doi.org/10.32493/LJLAL.V1I1.2477).
- [10] “Indonesian Reference Grammar | WorldCat.org.”
- [11] C. C. Pinter, “A Book of Set Theory (Dover Books on Mathematics),” 1971.

- [12] T. W. . Hungerford, “Abstract algebra : an introduction / third edition,” 2013.
- [13] “Pembentukan kata dalam bahasa indonesia / Harimurti Kridalaksana | OPAC Perpustakaan Nasional RI.”