Mengatur Palang Pintu Kereta Api Menggunakan Aplikasi Aljabar Boolean

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*Abstract*—Beruntungnya manusia lahir di zaman era modern ini kenapa tidak, semakin maju perkembangan zaman semakin mudah dan praktis. Salah satu kemajuan zaman pada era modern adalah alat transportasi. Seperti kereta api adalah kemajuan transportasi darat, tetapi masih ada bebrapa kendala pada keamanan setiap alat transportasi. Banyak dan sering di Indonesia kecelakaan kereta api, entah diakibatkan oleh pengaman lintasan atau pengguna jalan. Oleh sebab itu dalam makalah ini akan membahas Aljabar Boolean untuk mengatur palang pintu kereta api. Agar mengurangi tragedi penerobosan palang dan menyebabkan kecelakaan.

*Keywords*—Era modern,Transportasi,Palang pintu kereta api, Aljabar Boolean.

# I. PENDAHULUAN

Transportasi pertama diciptakan oleh penjelajah Australia untuk melintasi air, yaitu perahu. Dan orang pertama yang menyebrangi lautan, meskipun ada beberapa bukti pelayaran yang dilakukan 90.000 tahun yang lalu.

Perahu sederhana adalah perahu pertama yang dikenal, dibuat dengan cara melubangi batang pohon besar. Artefak yang membuktikan perahu pertama sekitae 7000-10.000 tahun yang lalu.

Semakin berkembangnya zaman dari beberapa ribu tahun akhirnya manusia mulai menjinakan kuda digunakan sebagai alat transportasi untuk mengangkut barang sekitar pada zaman itu juga manusiia mengenal roda untuk memudahkan transportasi. Pada 3500 SM catatan arkeologi menunjukan bahwa kendaraan beroda pertama kali digunakan, dengan bukti adanya alat yang ditemukan di Mesopotamina, Kaukus Utara, dan Eropa Tengah.

Lokomotif jalam raya ditemukan oleh penemu inggris Richard Trevithick pada tahun 1801, dengan memanfaatkan mesin uap yang telah ditemukan pada tahun 1769. 3 tahun kemudian Trevithick mendesain ulang lokomotif yang berjalan di atas rel dan dapat mengangkut 10 ton besi dengan kecepatan 4 mph.

Seiring perkembangan zaman, penemuan-penamuan semakin hebat dan praktis. Maka dari itu transportasi seperti kereta api harus memberikan rasa aman dan nyaman. Untuk itu maka harus dibangun sebuah gerbang pintu di setiap persimpangan kereta api. Agar mengurangi terjadinya kecelakaan antara kereta api dengan kendaraan lain atau pejalan kaki yang sedang melintas.

# II. ALJABAR BOOLEAN

Aljabar Boolean ditemukan oleh George Boole, pada tahun 1854. Boole melihat bahwa himpunan logika proposisi mempunyai sifat sifat yang serupa pada kemiripan antara hukum-hukum aljabar logika dan hukum-hukum aljabar himpunan. Boole juga menerapkan aturan aturan dasar logikanya di buku The Laws of Thought. Aljabar Boolean merupakan aljabar yang berhubungan dengan variabel-variabel biner dan operasi logika. Variabel-variabel diperlihatkan dengan huruf-huruf alfabet dan tiga operasi dasar dengan AND, OR, dan NOT.

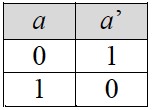
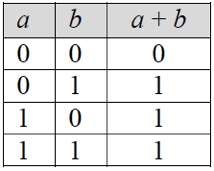
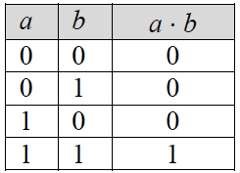
1. *PENGERTIAN*

Aljabar boolean adalah struktur aljabar yang memiliki basis biner(0 dan 1), sesuai dengan tipe data Boolean, 1 jika true dan 0 jika false. Berdasarkan definisi: misalkan B adalah himpunan yang didefinisikan pada dua operator biner + dan, sebuah operator uner, misalkan 0 dan 1 adalah dua elemen yang berbeda dari B. Maka tupel <B,+,0,1> disebut aljabar Boolean jika untuk setiap a,b,c B berlaku aksioma berikut:

1. Closure
2. a + b B
3. a b B
4. Identitas
5. a + 0 = a
6. a 1 = a
7. Komutatif
8. a + b = b + a
9. a b = b a
10. Distributif
11. a (b + c) = (a b) + (a c)
12. a + (b c) = (a + b) (a + c)
13. Komplemen
14. a + a’ = 1
15. a a’ = 0
16. *Hukum-hukum aljabar boolean*
17. Hukum Identitas
18. a + 0 = a
19. a 1 = a
20. Hukum Komplemen
21. a + a’ = 1
22. a a’ = 0
23. Hukum Idempoten
24. a + a = a
25. a a = a
26. Hukum Dominasi
27. a + 1 = 1
28. a 0 = 0
29. Hukum Involusi
30. (a’)’ = a
31. Hukum Penyerapan
32. a + ab = a
33. a(a + b) = a
34. Hukum Asosiatif
35. a + (b + c) = (a + b ) + c
36. a (b . c) = (a . b) c
37. Hukum Komukatif
38. a + b = b + a
39. a . b = b . a
40. Hukum Distributif
41. a (b + c = (a b) + (a c)
42. a + (b . c) = (a + b) (a + c)
43. Hukum De Morgan
44. (a + b)’ = a’ b’
45. (a b)’ = a’ + b’
46. Hukum 0/1
47. 0’ = 1
48. 1’ = 0
49. Aljabar Boolean dua nilai

Aljabar Boolean dua nilai merupakan himpunan B yang memenuhi kaidah aksioma aljabar Boolean yang memiliki dua elemen yaitu 0 dan 1 (B = {0,1}), memiliki operator binner + dan ,serta operator uner’. Kaidah operator uner adalah sebagai berikut:

Tabel 2.1 Operator binner dan Operator uner



1. *Fungsi Boolean*

Suatu fungsi yang dibentuk dari beberapa variable boolean. Setiap perubah di dalam fungsi boolean, termasuk dalam bentuk komplemennya, disebut literal.

Contoh-contoh fungsi boolean :

f(x) = x

f(x, y) = x’y + xy’ + y’

f(x, y) = x’y’

f(x, y) = (x + y)’

f(x, y, z) = xyz’

Fungsi h (x, y, z) = xyz’ terdiri dari 3 buah literal, yaitu x, y, dan z.

Jika diberikan x = 1, y = 1, z = 0, maka nilai fungsinya:

h(1, 1, 0) = 1. 1. 0’ = (1. 1) . 1 = 1.1= 1

1. *Bentuk Kanokik*

Ekspresi Boolean yang menspesifikasikan suatu fungsi dapat disajikan dalam dua bentuk berbeda. Pertama sebagai penjumlahan dari hasil kali dan kedua sebagai perkalian dari hasil jumlah.

f(x, y, z) = x’ y’ z’ +xy’z’ + xyz

dan

g(x, y, z) = (x+y+z)(x+y’+z)(x+y’+z’)(x’+y+z’)(x’+y’ )

dua contoh diatas adalah dua buah fungsi yang sama.

Bentuk kanokik yang dapat dibagi menjadi dua jenis, yaitu:

1. SOP (Sum of Product)

Merupakan perkalian dari hasil jumlah. Dapat disebut juga *maxterm* dengan lambing M.

Bentuknya : X1 + X2 + …. + Xn

Notasi : ∑

1. POS (Product of Sum)

Merupakan perkalian dari hasil jumlah. Dapat disebut juga *minterm* dengan lambing m.

Bentuknya : X1 X2 …..Xn

Notasi : ∏

Maxterm : Suku (term) di dalam ekspresi Boolean mengandung literal yang lengkap dalam bentuk hasil jumlah

Minterm : Suku (term) di dalam ekspresi Boolean mengandung literal yang lengkap dalam bentuk hasil kali

Cara membentuk Minterm dan Maxterm dari tabel kebenaran untuk dua perubah

# III. Helpful Hints

## A. Figures and Tables

Large figures and tables may span both columns. Place figure captions below the figures; place table titles above the tables. If your figure has two parts, include the labels “(a)” and “(b)” as part of the artwork. Please verify that the figures and tables you mention in the text actually exist. Please do not include captions as part of the figures. Do not put captions in “text boxes” linked to the figures. Do not put borders around the outside of your figures. Use the abbreviation “Fig.” even at the beginning of a sentence. Do not abbreviate “Table.” Tables are numbered with Roman numerals.

Figure axis labels are often a source of confusion. Use words rather than symbols. As an example, write the quantity “Magnetization,” or “Magnetization *M*,” not just “*M*.” Put units in parentheses. Do not label axes only with units. As in Fig. 1, for example, write “Magnetization (A/m)” or “Magnetization (Am1),” not just “A/m.” Do not label axes with a ratio of quantities and units. For example, write “Temperature (K),” not “Temperature/K.”

Multipliers can be especially confusing. Write “Magnetization (kA/m)” or “Magnetization (103 A/m).” Do not write “Magnetization (A/m)  1000” because the reader would not know whether the top axis label in Fig. 1 meant 16000 A/m or 0.016 A/m. Figure labels should be legible, approximately 8 to 12 point type.

## B. References

Number citations consecutively in square brackets [1]. The sentence punctuation follows the brackets [2]. Multiple references [2], [3] are each numbered with separate brackets [1]–[3]. When citing a section in a book, please give the relevant page numbers [2]. In sentences, refer simply to the reference number, as in [3]. Do not use “Ref. [3]” or “reference [3]” except at the beginning of a sentence: “Reference [3] shows ... .”

Number footnotes separately in superscripts (Insert | Footnote)[[1]](#footnote-1). Place the actual footnote at the bottom of the column in which it is cited; do not put footnotes in the reference list (endnotes). Use letters for table footnotes.

Please note that the references at the end of this document are in the preferred referencing style. Give all authors’ names; do not use “*et al*.” unless there are six authors or more. Use a space after authors' initials. Papers that have not been published should be cited as “unpublished” [4]. Papers that have been submitted for publication should be cited as “submitted for publication” [5]. Papers that have been accepted for publication, but not yet specified for an issue should be cited as “to be published” [6]. Please give affiliations and addresses for private communications [7].

## C. Abbreviations and Acronyms

Define abbreviations and acronyms the first time they are used in the text, even after they have already been defined in the abstract. Abbreviations that incorporate periods should not have spaces: write “C.N.R.S.,” not “C. N. R. S.” Do not use abbreviations in the title unless they are unavoidable.

## D. Equations

Number equations consecutively with equation numbers in parentheses flush with the right margin, as in (1). First use the equation editor to create the equation. Then select the “Equation” markup style. Press the tab key and write the equation number in parentheses. To make your equations more compact, you may use the solidus ( / ), the exp function, or appropriate exponents. Use parentheses to avoid ambiguities in denominators. Punctuate equations when they are part of a sentence, as in

 (1)

Be sure that the symbols in your equation have been defined before the equation appears or immediately following. Italicize symbols (*T* might refer to temperature, but T is the unit tesla). Refer to “(1),” not “Eq. (1)” or “equation (1),” except at the beginning of a sentence: “Equation (1) is ... .”

## E. Other Recommendations

Use one space after periods and colons. Hyphenate complex modifiers: “zero-field-cooled magnetization.” Avoid dangling participles, such as, “Using (1), the potential was calculated.” [It is not clear who or what used (1).] Write instead, “The potential was calculated by using (1),” or “Using (1), we calculated the potential.”

Use a zero before decimal points: “0.25,” not “.25.” Use “cm3,” not “cc.” Indicate sample dimensions as “0.1 cm  0.2 cm,” not “0.1  0.2 cm2.” The abbreviation for “seconds” is “s,” not “sec.” Do not mix complete spellings and abbreviations of units: use “Wb/m2” or “webers per square meter,” not “webers/m2.” When expressing a range of values, write “7 to 9” or “7-9,” not “7~9.”

A parenthetical statement at the end of a sentence is punctuated outside of the closing parenthesis (like this). (A parenthetical sentence is punctuated within the parentheses.) In American English, periods and commas are within quotation marks, like “this period.” Other punctuation is “outside”! Avoid contractions; for example, write “do not” instead of “don’t.” The serial comma is preferred: “A, B, and C” instead of “A, B and C.”

If you wish, you may write in the first person singular or plural and use the active voice (“I observed that ...” or “We observed that ...” instead of “It was observed that ...”). Remember to check spelling. If your native language is not English, please get a native English-speaking colleague to proofread your paper.

# IV. Some Common Mistakes

The word “data” is plural, not singular. The subscript for the permeability of vacuum µ0 is zero, not a lowercase letter “o.” The term for residual magnetization is “remanence”; the adjective is “remanent”; do not write “remnance” or “remnant.” Use the word “micrometer” instead of “micron.” A graph within a graph is an “inset,” not an “insert.” The word “alternatively” is preferred to the word “alternately” (unless you really mean something that alternates). Use the word “whereas” instead of “while” (unless you are referring to simultaneous events). Do not use the word “essentially” to mean “approximately” or “effectively.” Do not use the word “issue” as a euphemism for “problem.” When compositions are not specified, separate chemical symbols by en-dashes; for example, “NiMn” indicates the intermetallic compound Ni0.5Mn0.5 whereas “Ni–Mn” indicates an alloy of some composition NixMn1-x.

Be aware of the different meanings of the homophones “affect” (usually a verb) and “effect” (usually a noun), “complement” and “compliment,” “discreet” and “discrete,” “principal” (e.g., “principal investigator”) and “principle” (e.g., “principle of measurement”). Do not confuse “imply” and “infer.”

Prefixes such as “non,” “sub,” “micro,” “multi,” and “"ultra” are not independent words; they should be joined to the words they modify, usually without a hyphen. There is no period after the “et” in the Latin abbreviation “*et al.*” (it is also italicized). The abbreviation “i.e.,” means “that is,” and the abbreviation “e.g.,” means “for example” (these abbreviations are not italicized).

# V. Conclusion

A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

# VI. Appendix

Appendixes, if needed, appear before the acknowledgment.

# VII. Acknowledgment

The preferred spelling of the word “acknowledgment” in American English is without an “e” after the “g.” Use the singular heading even if you have many acknowledgments. Avoid expressions such as “One of us (S.B.A.) would like to thank ... .” Instead, write “F. A. Author thanks ... .” Sponsor and financial support acknowledgments are placed in the unnumbered footnote on the first page.

# References

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# PeRNYATAAN

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