Boolean algebra and circuits pdf

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Boolean algebra is the mathematical foundation of the digital circuit. Boolean algebra specifies the relationship between boolean variables, which are used in the design of a combined logical circuit using Logic Gates. Boolean variables use values of 0 (false) or 1 (true) symbols are used to display Boolean variables such as A, B, C, X, Y, Z, there are three basic logic and operations, or, not boolean assemblies there. • + ¯A + B means A or B means A and B means no node in the circuit is displayed by the boolean variables used most of the practical algebra algebra, boolean is to reduce the complexity of boolean expression, which means that less than the logic of the circuit is used by the boolean circuit. The logic door is an electronic circuit that uses the basic functions of algebra-boolean. There are symbols for each logic level. (0 or 1) is represented by a high voltage level (5V, 3.3V, 2.5 V, etc.) is low voltage, 1 (0V) is 0, the fact table shows the output value for all input values. The 1st figure equivalent circuit is an example of four equivalent circuits, because their identical fact table (a) is the NOT AND circuit (b) is the NAND door, which gets the name from the not and configuration, uses the bubble to represent the door, not the output. (c) ใช้ฟังก์ชัน NAND ใช้และประตูไม่ (d) เป็นอีกวิธีหนึ่งในการวาด (c) โดยใช้ฟองเพื่อเป็นตัวแทนประตูไม่ที่โปรแกรมของตรรกะเกตส์ลอจิกจะใช้วงจรดิจิตอลต่อไปนี้ The bank alarm system wants to install an alarm system with 3 motion sensors to prevent false alarms caused by the activation of a single sensor, the alarm is triggered when at least two sensors are activated simultaneously. Other logical programs such as Odd Numbers, Multiplexers, Adders, BCD Up to 7 segment decoders ... which you learn how to use the logic door to use in minutes! With advertising revenue declining despite the increased number of visitors, we want you to help maintain and improve this site, which takes time, money and hard work. Thanks to the generosity of our visitors who previously provided you were able to use this site at no cost. If you benefit from this site and can, please give $10 via Paypal. It only takes a minute. I Want it! © 2020 Amant PT Co., Ltd. No. 200210155R | How to Write a Boolean Expression to Simplify Our first step in simplification is to write a Boolean expression for this cycle. This task is carried out easily step by step if we start by writing a sub-expression at the output of each door corresponding to the corresponding input signal for each door. Remember that the OR door is equivalent to boolean, also, while the door is equivalent to the boolean multiplier. For example, I will write a sub-expression at the result of the first three doors: . . . Then another sub-expression for the next door: the final output (Q) is seen to be equal to the expression AB + BC (B + C): now that we have a Boolean expression to work with us, the need for the rule of algebrabuline to reduce the expression to the simplest form (the easiest set is to require the least door to use): The final expression, B (A + C) is much simpler, but performs the same function. If you want to check this, you may create a fact table for both expressions and check the status of Q (output of the circuit). For all eight logical sets of states of A, B and C for both circuits, two reality tables should be the same. To create a map from a Boolean expression, we now need to create a schema diagram from this Boolean expression. To do this, evaluate the following expressions, the appropriate mathematical sequence of operations (multiply before addition, operations within parentheses before anything else) and draw a gate for each step. Remember again that the OR door is equivalent to Boolean, in addition, while the door is equivalent to a Boolean multiplier. In this case, we will start with the sub-expression A + C, which is the door, or: the next step in evaluating the expression B(A + C) is to multiply (and the door) signal B by the output of the previous door (A + C): of course, this circuit is more simple than ever, there are only two logical doors instead of five. Reducing such elements results in higher operating speeds (delayed times from switching signals into output switching). Less power consumption, less cost and more reliability. How to use Boolean Simplification for electric relay circuits, electrical circuits, electric relay circuits, often slow, more electricity consumption, more costly operation and shorter average life. Their semiconductor counterparts benefit greatly from boolean ease. Let's consider the sample cycle: as before, our first step in reducing this cycle in the simplest form is to develop boolean expression from the diagram. The easiest way I've found to do this is to follow the same steps I normally follow to reduce the network resistor set parallel to a single total resistance. For example, check the following resistor networks with resistors arranged in the same connection format. Relay list in the former circuit and corresponding resistance formula: in the figure above, the long dash symbol (—) is used to represent a set of connections of resistors. Keep in mind that parallel contacts are equal to Boolean plus, while the batch contacts are equal to boolean multipliers. Write a Boolean expression for this relay contact circuit in the same order of priorities that you will follow in reducing the parallel resistor network, all resistance sets. It may be useful to write a boolean sub-expression on the left side of each rung ladder to help organize your writing expressions: now that we have a Boolean expression to work with, we need to use the rules of algebra boolean to reduce expression in the simplest form (the easiest set as required, the minimal relay contact to use): A more mathematical trend should be able to see how the two-step employment rule + AB = A may be combined. At one stage, the rule of expansion was: A + AB + AC + + . = A As you can see, the lower circuit is much easier than the original, also performs the same logical function: REVIEW: Converting the door circuit into a Boolean expression, each sign out the door with a boolean sub-expression corresponds to the door's entrance signal until the final expression at the last door. To convert a Boolean expression to a gate cycle, evaluate the expression using the standard sequence of actions: pre-addition multiplication, and actions within parentheses before anything else. To convert the stair logic circuit to each boolean expression, the label with the Boolean sub-expression corresponds to the contacts' input signal until the final expression at the coil or final light. To determine the proper sequence of evaluations, treat contacts as if they are resistors, and if you have determined the total resistance of the parallel network set formed by them. In other words, look for contacts who are directly in the series or directly parallel to each other first, and then collapse them into equivalent Boolean sub-expressions before proceeding to other contacts to convert boolean expressions into a stair logic circuit. Create something!! Learning to analyze the digital circuit requires a lot of education and practice. Typically, students practice by working through many sample issues and checking their answers to those organized by textbooks or instructors. While this is good, there are many better ways. You'll learn more by creating and analyzing real circuits, giving your test equipment an answer. Or another person for a successful building cycle exercise, follow these steps: draw a digital circuit diagram to analyze. Create this circuit carefully on breadboard or other convenient media. Check the accuracy of the circuit construction of each line tracking to each access point and check these elements one by one diagram. Circuit analysis, defining all output logical status for a given input condition. Measure those logical states carefully to verify the accuracy of your analysis. If there are any errors, carefully inspect your circuit construction with the diagram, then carefully re-analyze the circuit and measure it again. Always make sure the power supply voltage level is within the specifications for the logical circuit that you plan to use. If the TTL power supply must be a 5V control power supply, adapting to a value as close to 5.0 volts DC as possible. One way you can save time and reduce the possibility of errors is to start with a very simple cycle and add components to increase the complexity of after each analysis, rather than creating a whole new cycle for each practical problem. Another time-saving technique is to use the same components to configure different circuits. This way, you won't have to measure any component more than once. Reveal the answer to the electrons themselves, give your own answers to practical problems! Note: My experience is that students need to practice a lot with circuit analysis to gain expertise. For this reason, teachers often give their students many practical problems to work through and provide answers for students to determine their work with. Students don't have to practice math. They also want to actually hand in the practical building circuit and use test equipment, so I recommend the following alternative methods: students should create their own practical problems with real components and try to predict various logical states. This way, digital theory comes alive, and students get practical abilities, they are not just obtained by solving boolean equations or simplifying the map. Another reason for the following methods of this practice is to teach the student's scientific methods: the process of hypothesis testing (in this case, the prediction of the logical state) by conducting a real experiment. Students will develop real problem-solving skills because sometimes they make mistakes in the construction of the cycle. Take a moment with your class to check out some of the rules for the building cycle before you start. Discuss these issues with your students in the same Socratic manner, normally you will discuss questions in a worksheet rather than just. They should and shouldn't. I never stop to be surprised at how poorly learned the instructions when presented in a general lecture (monolog professor) format! I recommend the CMOS logic circuit for home experiments where students may not have access to a 5-volt control power supply, modern CMOS circuits are far more rugged about static emissions than the first CMOS circuit, so the fear of students hurting these devices without having a proper laboratory set up at home is largely unfounded. Note that instructors who may complain about wasting time require students to create a real cycle instead of just analyzing the theoretical mathematical cycle: What is the purpose of students taking your course? If your students are working with a real circuit, then they should learn about the actual circuit whenever possible. If your goal is to educate theoretical physics, then stick with abstract analysis by all means! But most of us plan for our students to do something in the real world with the education we provide them. Wasted time building a real circuit will pay huge dividends when it comes time for them to use their knowledge to actually trouble. In addition, students create their own practical problems teaching them how to conduct core research, thereby empowering them to continue their own electrical/electronic education. In most science, realistic experiments are more difficult and more expensive than electrical circuits. Nuclear physics, biology, geology and chemistry professors would surely love to allow their students to use advanced mathematics to experiment, actually posing no safety hazards and costing less than textbooks. They can't, but you can. Take advantage of the inherent comfort to your science and get your students to practice their math in a lot of real circuits! Question 2 identifies each of these logical doors by name and completes their fact table: revealing the answer, note: To make students familiar with the standard logic door types, I like them to treat them with identification and the fact table each day. Students must be able to recognize these logic door types quickly or else they will have trouble analyzing the circuits that use them. Students need to be able to recognize these logical sub-circuit logic quickly, or else they will have trouble analyzing the more complex relay circuits that use them. Question 4: The following set of mathematical expressions is a complete set of schedules. Boolean number system: $$0 × 0 = $$0\x 1 = $$1\0\0$0$0$0$0$$0$1\x\1=$$$1$, now there's nothing unusual at first about this table of expressions, since they seem to be the same as understanding our regular daily system number. However, what is unusual is that all four statements consist of a set of rules for multiplying all Booleans! Explain that this can be so that there is a statement that says no ×2 = 2 or 2 ×3 = 6 numbers all other than 0 and 1? Revealing boolean volume, the answer can be only one value out of two values: 0 or 1, there is no such thing as 2-- or any other digit other than 0 or 1 for that matter - in a series of Boolean numbers! Note: Some students with a background on the computer may ask if Boolean is the same as binary. The answer to this very good question is no, binary is just a numerical system for displaying real numbers, while Boolean is a completely different numerical system (i.e. integer numbers are too irrational numbers, etc.). It's possible to count arbitrarily high in binary, but you can count up to 1 in Boolean Boolean Question 5 Algebra Boolean is a strange sort of math. What are you going to say to him or her? How can the world be 1 + 1 = 1 and not 2? Where are the rules for 1 + 2 or 2 + 2? Revealing boolean volume, the answer can be only one value out of two values: 0 or 1. Note: Boolean algebra is an absolute strange math. However, when students understand the limited scope of boolean volume, the reason for the Boolean rule of arithmetic makes sense. 1 + 1 must be equal to 1, since there is no such thing as 2 in the Boolean world, and the answer certainly can not be 0, the rule survey for Boolean, in addition, the values 0 and 1 seem to resemble the real table of the very common logic door, which type of door is this, and what does this suggest about the relationship between the addition of boolean and the logical cycle? Rules for Boolean Add: $0 +0$$0+1$$$1$1$1 +1 +0 $$1 +0$$$$$1+1 = $1 Revealing this set of responses of Boolean expressions similar to the real table for the logical door circuit, or suggesting that Boolean added may be a symbol of logic or function. Note: Students must be able to associate basic Boolean operations with logical circuits. If they can see the relationship between the strange rules of Boolean arithmetic and what they are familiar with (such as the truth table), question 7 of the survey. For boolean multipliers, values 0 and 1 seem to resemble the real table of the very common logic door, which kind of door does this suggest about the relationship between boolean multiplication and logical circuitry? Rules for Boolean multiplication: $$0\x 0= $$0\x 1 = 0$$0$$0$$0$$0$1\0$0\x1 = $0 0\1 = $0 $0 $$0\x 1 = $0\1 = $0 $0 $0 $ 1 = $0 $ 0 $0 $0 $0 $0 = 1 = $1 Reveal this answer, a set of Boolean expressions similar to the real table for the logical door circuit, and suggest that boolean multipliers may be logical symbols and functions. Note: Students must be able to associate basic Boolean operations with logical circuits. If they can see the relationship between the strange rules of Boolean arithmetic and what they are familiar with (such as the fact table), question 8 What is the complement of boolean numbers? How do we represent boolean variables and which logical circuit functions perform auxiliary functions? Reveal boolean answers to fill This is either displayed by overbars or key marks next to a variable (for example, the complement of A may be written as either \(\overline{A}\) or A'): <Note: Students must be able to associate basic boolean operations with a logical cycle. If they can see the relationship between the strange rules of Boolean arithmetic and what they are familiar with (such as the fact table), Question 9 has three basic operations in Algebrabuly: in addition, multiplication and inversion. Draw a logical diagram, a goal and a corresponding ladder for each: reveal the answer Note: all three equivalencies will be important for students to master as they study the combined logic cycle and complex relay logic circuits! Question 10 Write a Boolean expression for each of these logical doors shows how to exit (Q) algebra related to inputs (A and B): Reveal the answer Note: To students with Boolean algebra and how to relate to the logic door circuit, I prefer to provide them with everyday practice with questions like this. Students must be able to quickly recognize these logic door types and can also link boolean expressions that suit each or other one, they will have trouble analyzing the logical circuit later. Question 11 Write a Boolean expression for each relay logic circuit, this shows how to exit (Q) algebra related to inputs (A and B): Reveal the answer Note: To make students familiar with Boolean algebra and how related to relay logic circuits, I like to give them everyday practice with questions like this. Students need to be able to think Each way, each of these circuit ladder logic works and will also be able to link the appropriate Boolean expressions to each one or the other, they will have trouble analyzing more complex relay circuits later on. Question 12 Converts the logic door circuit, the following is a Boolean expression, write a boolean sub-expression next to each exit door in the diagram: reveal the answer, note: the process of converting the door circuit into a Boolean expression is actually quite simple if you carry the door by door. Let your students share any methods or techniques they use to write idioms with the rest of the class. Let your students share any methods or techniques they use to write idioms with the rest of the class. Let your students share any methods or techniques they use to write idioms with the rest of the class. The following relay is a Boolean expression, writing a Boolean sub-expression next to each relay roll and bulb in the diagram: Reveal the answer Note: The process of converting a relay logic circuit into a Boolean expression is not as simple as it is to convert a gateing circuit into a boolean expression, but it can be handled, allowing your students to share any method or technique they use to write idioms with the rest of the class. The following relay is a Boolean expression, writing a Boolean sub-expression next to each relay roll and bulb in the diagram: Reveal the answer Note: The process of converting a relay logic circuit into a Boolean expression is not as simple as having a gateing circuit conversion into a boolean expression, but it can be manageable, allowing your students to share any method or technique they use to write idioms with the rest of the class. The following relay is a Boolean expression, writing a Boolean sub-expression next to each relay roll and bulb in the diagram: Reveal the answer Note: The process of converting a relay logic circuit into a Boolean expression is not as simple as it is to convert the gateing circuit into boolean expressions, but it can be manageable, allowing your students to share any method or technique they use to write idioms with the rest of the class. Engineers want to design a logical circuit that prohibits the engine in the car from starting unless the driver presses the clutch pedal while switching the ignition switch to the position. Get started The purpose of this feature will prevent the car from moving forward while it is starting, if ever the transmission is accidentally left in the gearbox. Assuming we determine the status of the ignition switch, start position with Boolean variable S (1 = start 0 = run or off) and clutch pedal position with variable Boolean C (1 = clutch pedal; (Clutch pedal in normal position not pressed) Write a Boolean expression for the default solenoid state, give the start switch (S) and clutch (C) state, and then draw the logical door circuit to use this Boolean function. Reveal the answer to the Boolean expression: Logic door circuit: Note: This is not a very complex function to display or use the point of this question, mainly instructing students on the actual use of logic doors and boolean algebra. Question 19 Engineer hands you a piece of paper with the following Boolean expression on it and tells you to create a door circuit to perform that function: $$A \overline {B} + overline { C } (A + B) $ Draw a logical door circuit for this function. Open answer note: The process of converting a Boolean expression into a logical door circuit is not easy as converting a door circuit into a Boolean expression, but it can be manageable for your students to share any method or technique they use to write idioms with the rest of the class. Since the diode system is powered by an existing power supply (IES) to a critical system, the system sees a disruption in power if one or even two of the power supply stops the voltage output. It would be great if we had some sort of alarm system installed to alert technicians of any problems of the power supply, long before the critical system was in danger of losing power completely. Engineers decided that the relay could be installed at the output of each power supply before the diode. Contacts from these relays may then be connected to some sort of alarm device (flashing lights, bells, etc.) to alert maintenance personnel of any problem: Part 1: Draw a ladder diagram of the relay list, turn on the warning light in such a way that the lamp energizes if any one or more of the power supply loses the output voltage. Write the corresponding Boolean expression for this cycle using the letters A, B, and C to display. Status of cr1, CR2 and CR3 relay coils, respectively. Part 2: The solution, Part 1, works, unfortunately it creates a nuisance reminder. Whenever a mechanic drives one of the material down for normal maintenance. Engineers decided that a two-out alarm system, three failures, would be enough to warn the problem while allowing regular maintenance without creating unnecessary alarms. Draw a ladder diagram of the relay list, turn on the warning light, such as lamp energizes, if two or more power supply loses the output voltage. The Boolean expression for this is \(\overline{A} \ \overline{B}+\overline{B}\ \ \overline{C} + \overline{A} \ \overline{C}\) Part 3: This place management changed their minds about the safety of two out of the three alarm system failed. They want to wake up to power if any one of the power supply fails. However, they also realize that nuisance alarms created during routine maintenance are also unacceptable. Asked by the maintenance team to come up with a solution, one technician suggested putting a maintenance switch that would disable the alarm during the period of maintenance, allowing any of the power supply to be powered down without creating an annoying alarm. Modify the alarm circuit of solution Part 1 to include such a switch and modify the Boolean expression for the new circuit (called the M maintenance switch) Part 4: During the maintenance cycle, one accidental mechanic left the alarm bypass switch (M) actuated after he made it. The system operates with a failed electric alarm, disabling it for several weeks. When the administration discovered this, they were angry. Their next suggestion is to have the bypass switch change the conditions for such alarms that actuating this M switch to turn on the system from one out of three alarms fail as two out of three alarm failures. In this way, any one of the power supply may be removed from service for normal maintenance, but the alarm will not completely deactivate. The system will continue to warn if two power supplyes will fail. The simple Boolean expression for this function is quite complex: \(\overline{A} \ \overline{B}+\overline{C}\\\overline{M}}) draws an alarm stairway diagram based on this expression. Reveal the answer Part 1 Solution: Part 2 Solution: Part 3 Solution: Part 4 Solution: Tracking Question: How many contacts in each relay (and in the M maintenance switch) are required to use any of these alarm functions? The challenge question: Can you see how we can reduce the number of relay contacts needed in the cycle of solution 2, still still achieving the same logical work (albeit with different Boolean expressions)? Note: To be honest, I have fun writing different situations. of this problem. The evolution of this alarm system is normal for the organization. People come up with ideas, but it doesn't meet all the needs of others, so they enter their own suggestions and so on, etc. Presenting this situation not only prepares students for the politics of real work, but also underscores the need to what if? Think: To test the proposed solutions before proceeding, so that unnecessary problems are avoided. Question 21 uses the following Boolean expression in the form of a digital logic circuit: $$\overline{{\overline{{AB}}} B$$Form circuit format by making the necessary connections between the pins of these integrated circuits on the soldering breadboard: Revealing circuit answers that show the solution is not only possible to fix this problem: Note: First thing: Do not remember the students to include each IC power supply connection? In order to successfully develop this solution, of course, students need to research the pinouts of each integrated circuit. If most students simply present the answers shown to them in the worksheet, challenge them during the conversation to present a solution alternative. Also ask them this question: Should we connect unused inputs to the ground or VCC, or is it allowed to leave the inputs floating? Students should not provide answers to this question, but can support their answers for reasons based on the construction of this type of logic cycle. Question 22 Complete the fact table for two Boolean expressions: $$Output = \overline{A}+B$B Output 0 0 1 0 1 1 1 1 $$Output = A+\overline{A}BBB Result B 0 0 1 0 1 0 1 1 Reveal answer $$Output =\overline{A}+B$B Export B 0 1 0 1 1 1 0 0 1 1 1 1 = $Output A + \ overline {A} B$B Output A 0 0 0 1 1 1 0 1 1 1 1 Note: Ask students to explain what they think of the output status, to fill the gaps in the reality table for different input combinations. Table for these two Boolean expressions: $ $Output =\overline{A}+overline{B}+C$C Output 0 0 0 0 0 0 1 0 1 0 0 1 1 1 1 0 1 0 1 1 1 1 1 0 1 1 1 $$Output =A(B+AC+\overline{A})$B C Output 0 0 0 0 0 1 0 0 0 0 1 1 1 0 1 0 1 0 1 0 1 0 0 0 0 1 1 to disclose Answer $$Output =\overline{A}+\overline{B}+C$B C Output 0 0 0 1 1 1 0 1 0 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 $Output 1 1 1 1).1(B+AC+over+AC+AC+\line){A}}$B C Output 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 1 0 1 0 1 1 1 1 1 1 Note: Ask students to explain how they think about output status to fill gaps in the table for a combination of input values and contrast processes. It is especially educational if you ask your students to recommend techniques for defining a quick state reality table, based on certain features of boolean expression. For example, there is a way that we can tell the first four state outputs in the fact table (read top to bottom) to 0 without plugging the value into expressions for B and C. Talk to your students that we can look at expression, see A as a multiplier for the sum within the brackets, and immediately conclude half of the results of the actual table will be 0 questions 24 like algebra, the actual number algebrabua is subject to the law of association travel and distribution. These laws allow us to create different logical circuits that act the same logic. For the equivalent two circuit pairs, each show writes the next corresponding Boolean law: Note: Three short parallel lines show ëquivalent go in mathematics. Reveal the answers in order from above: $$AB=BA$$$$(AB)C=A(BC)$$$$$(A+B)C=C=C$$A+B=B=$$$$$$$(A+C)B=AB=CB$$$$$$$(A+B) + C = C = A + C$ Note $: Alternating, related laws and algebra-boolean publishing are the same as the laws involved in the actual number algebra. These should not be difficult concepts for your students to understand. The real advantage of working through these examples is to link the door and the relay logic circuit with the Boolean expression, and to see if the Boolean algebra is anything more than a symbol of a split-state electrical display (on/off). In an otherwise abstract mathematical concept, for something tangible, students create a very good understanding of the concept. Question 25 Like algebra, the actual number of Boolean algebra may have some rules that may apply to simplify (degrading) expression. For each equivalent circuit pair shown, write the next corresponding Boolean rule: Note: Three short parallel lines represent the equivalent in mathematics. Reveal answers in order from top down, bottom to right: $$A + A= $$$AA =$$A=$$A+0=$$$A+1=1$$$$$$$$$$$$$$$$$$$$overline{{==$$$A\x0=$$$A $A $A: Most of these Boo $A $A lean rules are the same as the laws involved in the real number of algebras. These should not be difficult concepts for your students to understand. Some, however, are unique of algebra-boolean, with no real number of algebra analogues. These unique rules make students the most problematic! The key advantage of working through these samples is to link the gate and the relay logic circuit with Expression and to see if algebra Boolean is nothing more than a symbol of the discrete-state electrical display (on/off). In an otherwise abstract mathematical concept, for something tangible, students create a very good understanding of the concept. คำถาม 26 แสดงที่นี่มีหกกฎของที่ชุดเฉิดบูลีน (เหล่านี้ไม่ได้เป็นกฎเพียงอย่างเดียวของหลักสูตร) $$A+\overline{A} = 1$$ $$A+A = A$$ $$A+1 = 1$$ $$AA = A$$ $$A+AB = A$$ $$A+ \overline{A}B = A+B$$ Determine which rule (or rules) are being used in the following Boolean reductions: $$\overline{DF}+\overline{DFC}=\overline{DF}$$ $$1+G = 1$$ $$B+AB = B$$ $$\overline{FE}+\overline{FE}=\overline{FE}$$ $$XYZ+\overline{XYZ}=1$$ $$GQ+Q = Q$$ $$\overline{H} \ \overline{H}=\overline{H}$$ $$\overline{CD}+ \overline{CD}=\overline{CD}$$ $$EF(EF) = EF$$ $$CD+\overline{C}=\overline{C}+D$$ $$LNM+ML = LM$$ $$A\overline{G}F\overline{C}+F\overline{C}\ \overline{G}$$ $$\overline{M}+1=1$$ $$\overline{BC}+BC=1$$ $$ABC+CAB = BCA$$ $$S+STV\overline{Q}=S$$ $$\overline{DE}(R+1)=\overline{DE}$$ $$\overline{RS}\ \overline{SR}=\overline{RS}$$ $$ABC\overline{D}+D=D+ABC$$ $$AC\overline{B}+CAD\overline{B}=A\overline{B}C$$ $$A+T+\overline{W}+\overline{A}+X=1$$ $$X\overline{YZ}+\overline{X}=\overline{X}+\overline{YZ}$$ $$\ overline{GFH} \ \overline{HGF}=\overline{FHG}$$ $$C\overline{AB}+AB=AB+C$$ Reveal answer $$\overline{DF}+\overline{DFC}=\overline{DF} \ \ \ \ \ \ \ \ \ \ \ \ \ Rule: A+AB=A$$ $$1+G=1 \ \ \ \ \ \ \ \ \ \ \ \ \ Rule: A+1=1$$ $$B+AB=B \ \ \ \ \ \ \ \ \ \ \ \ \ Rule: A+A=A$$ $$\overline{FE}+\overline{FE}=\overline{FE} \ \ \ \ \ \ \ \ \ \ \ \ \ Rule: A+A=A$$ $$XYZ+\overline{XYZ}=1 \ \ \ \ \ \ \ \ \ \ \ \ \ Rule: A+AB=A$$ $$\overline{H} \ \overline{H} = \overline{H} \ \ \ \ \ \ \ \ \ \ \ \ \ Rule: AA=A$$ $$\overline{CD} + \overline{CD}=\overline{CD} \ \ \ \ \ \ \ \ \ \ \ \ \ Rule: A+A=A$$ $$EF(EF)=EF \ \ \ \ \ \ \ \ \ \ \ \ \ Rule: AA=A$$ $$CD+\overline{C}=\overline{C}+D \ \ \ \ \ \ \ \ \ \ \ \ \ Rule: A+\overline{A}B=A+B$$ $$LNM+MK=LM \ \ \ \ \ \ \ \ \ \ \ \ \ Rule: A+AB=A$$ $$A\overline{G}F\overline{C}+F\overline{C}\ \overline{G}=F\overline{C} \ \overline{G} \ \ \ \ \ \ \ \ \ \ \ \ \ Rule : A+AB=$$$$\overline{M}+1=\ \ \ \ \ \ \ \ \ \ \ \ \ Rule: A+\overline{A}$$$$$$$$$$$$$$$$$$$$ $ABC$$$ABC =BCA \ \ \ \ \ \ \ \ \ \ \ \ \ Rule: A+A=$ $$S+STV\Q\\\\\\\\\\\\Rules: A+AB=A$$$\Exceeds LINE DE}(R+1)\DE} \ \ \ \ \ \ \ \ \ \ \ \ \ Rule: A+1=\Overline{RS}\\Exceeds Line SR}\\\\ \ \ \ \ \ \ \ \ \ \ \ \ Rules: AA$$$ABC\overline{D}+D=D=D=D\C\\ \ \ \ \ \ \ \ \ \ \ \ \ Rule: A++\B}={Line Exceed{B}B=A+B$$$$AC\Overline CAD\\++CAD}={B}B}}C\ \ \ \ \ \ \ \ \ \ \ \ \ Rule: A+AB=A$$$$A+T=Overline{W}\Overline{A\\\\\\\\\\\\

carried out by the combination of and or the door, for example: use DeMorgan's theorem to prove that this NAND door circuit performs the exact same function: reveal the answer I will leave the evidence up to you! Note: This is a very practical application of DeMorgan's theorem, the ability to use all NAND doors to use the SOP function as a bonus, rather than requiring a separate circuit package, and or (one IC instead of two in this particular case) question 66 write a boolean expression for this logical door circuit, and then reduce the expression as the simplest form using the applicable Boolean law and theorem. Finally, redraw. A circuit diagram based on a simple Boolean expression that performs exactly the same logic. Reveal the answer to the original Boolean expression: \(\overline{AB} \ \overline{BC}\) Circuit Breaker: Note: This particular circuit is an example of how a combination of logical functions may be used, but the NAND door question 67 writes a Boolean expression for this logical door circuit, and then reduces the expression that is the simplest form using the applicable Boolean law and theorem. Finally, draw a new door circuit diagram based on a simple Boolean expression that performs the exact same logic. Reveal the answer to the original Boolean expression: \(\overline\overline{\overline{AB}}\) Reduced Door Cycle: Note: This particular circuit is an example of how a combination of logical functions may be used using anything other than NAND gates gates.

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