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Demorgan theorem in boolean algebra pdf

De Morgan offered two theorems that are extremely useful in bullean algebra. Two theorems are discussed below. Theorem 1 The left side (LHS) of this theorem is the NAND gate with inputs A and B, while the right side (RHS) theorem is the OR gate with upside down inputs. It's either a gate called bubbled OR. A table showing the test of de Morgan's first theorem , theorem 2 LHS of this theorem, is the NOR gate with A and B inputs, while rhs represents the AND gate with upturned inputs. This gate is called Bubbled AND. A table showing a check of De Morgan's second theorem - boolean_algebra.htm Sarah L. Harris, David Money Harris, in digital design and computer architecture, 2016Theorems T6 to T12 in Table 2.3 describe how to simplify equations involving more than one logical variable. Table 2.3. Boolean theorems of several variablesTheoremDualNameT6B • C = C • BT6′B + C = C + BCommutativityT7(B • C) • D = B • (C • D)T7′(B + C)+ D = B + (C + D)AssociativityT8(B • C) + (B • D) = B • (C + D)T8′(B + C) • (B + D) = B + (C • D)DistributivityT9B • (2B +C) = BT9′B+ (B • C) = BCoveringT10(B • C) + (B • C) = BT10′(B+C) • (B + C) = BCombiningT 11(B • C) + (B) • D) + (C • D) = B • C + B • DT11′(B + C) • (B + D) • (C + D) = (B + C) • (B + D)ConsensusT12B0• B1•B2... =(B 0+B 1+B 2...) T12′B0+B1+B2... =(B 0•B 1•B 2...) De Morgan's Switching and Associativeness, T6 and T7, work the same way as in traditional algebra. Switching input order for AND or OR does not affect output values. By associativeness, specific input grouping does not affect output values. Distribution theorem, T8, the same as in traditional algebra, but its double, T8′× ≠ ×, is not. Coverage, amalgamation and consensus theorems, T9 to T11, allow us to eliminate excess variables. With some thought, you should be able to convince yourself that these theorems are correct. De Morgan's theorem, T12, is a particularly powerful tool in digital design. Theorem explains that the addition of the product of all terms is equal to the sum of addition of each term. Similarly, the addition of the sum of all terms is equal to the product addition of each term. According to De Morgan's theorime, the NAND gate is equivalent to an OR gate with upside down entrances. Similarly, the NOR gate is equivalent to an AND gate with upturned entrances. Figure 2.19 shows these equivalent De Morgan gates for nand and NOR gates. The two characters shown for each function are called duals. They are logically equivalent and can be used interchangeably. In Figure 2.19. De Morgan is the equivalent of a Gatebrillian mathematician, born in India. Blind in one eye. His father died He was 10. He attended Trinity College, Cambridge, aged 16, and was appointed professor of mathematics at the newly formed University of London at the age of 22. He wrote extensively on many mathematical subjects, including logic, algebra and paradoxes. De Morgan Crater on the moon is named for him. He offered a riddle for the year of his birth: I was 2 years old in year 2. The inversion circle is called a bubble. Intuitively, you can imagine that pushing bubbles through the gate causes it to come out the other side and flips the body gate from I to OR or vice versa. For example, the NAND gate in Figure 2.19 consists of an AND housing with a bubble at the exit. Pressing the bubble to the left leads to either a body with bubbles at the entrances. The main rules for bubble pushing are pushing bubbles backwards (from output) or forward (from inputs) changes the body of the gate from AND to OR or vice versa. ▼Pressing the bubble from the output back to the inputs puts bubbles at all gate inputs. ▼Pushing the bubbles at all gate inputs forward to the output puts a bubble on the output. Section 2.5.2 uses bubble pressing to help analyze diagrams. Example 2.4Derive product sums formFigure 2.20 shows the truth table of the logical function table Y and its addition Y¯. Using de Morgan theorem, remove the canonical form Y from form Y¯. In Figure 2.20. A table of truth showing Y and Y Figure 2.21 shows mintermas (circled) contained in Y¯. The amount of canonical Y products is 2.21 2.21. A table of truth showing minterma for Y Repirement of both sides and the application of De Morgan Theorem twice, we receive: (2.5)Y ¯=Y=A B¯+A B¯=(A B¯)(A B)=(A+B)(A+B)John Crowe, Barry Hayes-Gill, in the introduction to Digital Electronics, the 1998De Morgan state theorem (Equation 1.16), which complements the or'ing variable result together equivalent to the AND'ing addition of individual variables. Additionally (Equation 1.17), which complements the result of the AND'ing variables together, is equivalent to OR'ing complementing individual variables. Use the logical algebra and de Morgan theorem for two variables, A+B ¯=A¯ to show that the shape specified in Equation 1.16 for three variables is also correct. SolutionA+B+C ¯=(A+B)+C ¯Associative Law=(A+B)-C ¯Theorem De Morgan=(A ¯B)]C ¯De Morgan's Theorem=A¯ · B ¯C ¯associative lawSaving schemes that will perform the functions described by both sides of the first De Morgan theorem (Equation 1.16) given in Table 1.4, and demonstrate the theorem correctly using the truth table. SolutionsThe expression and tables of truth are shown in Fig. 2. The solution to Example 1.10 on De Morgan's theorem About Morgan theorem will prove very useful for simplifying logical expressions of logical expressions because of how they can break an inversion that can be an addition to a complex boolean expression. Use De Morgan theorems to create an expression equivalent to only one inversion is required. SolutionA¯+(B +C) ¯=A¯)(B)¯De Morgan's theorem=A](B¯+C) De Theorem Morgan=A=A N) =A&B+A+C ¯The distribution law theoremDe Morgan can also be used to express logical expressions that do not initially contain inversion terms in a different way. This may again prove useful in simplifying logical equations. When used in this way, make sure not to forget the final inversion, which is easy to avoid, complementing both sides of the expression to be simplified before applying de Morgan's theorem and then supplementing again after simplification. The following example illustrates this moment. Use de Morgan's theorem to express Y=A+B, OR operation, in another form. The Conversion solution can be executed directly, but when used on more complex expressions, it's easy to forget the inversion as mentioned above. Therefore, we first invert both sides of the expression by giving Y ¯= A + B¯. The application of de Morgan's theorem gives Y ¯=A¯, at the same time, both sides are flipped again to give the final expression Y=A¯¯. Finally, we note that one way to interpret De Morgan's theorem is that any AND/OR operation can be treated as an OR/AND operation as long as the gate is not used (see latest example). This approach will be discussed later in this section when we review the duality principle in section 1.6.Barry Dwyer, in System Analysis and Synthesis, 20161.Complete Proof equation (2.1.28).2.Prove Equation (2.1.11). (Hint: Use Axim (2.1.7) and resolution theorem. Set your proof as a vertical stack of suggestions.) 3.Use Axim (2.1.7) to reduce P⇒Q to CNF, and then use Theorema De Morgan to find a logical addition. How to interpret your result?4.Why does the set of cardinality n have 2n possible sub-polymers? (See 2.3.1.) 5.In what special circumstances R1 does; R−1=R0? (See Inequality (2.4.26.) (Hint: Consider the difference between a child's connection to a family relationship and a child's connection to entrenched trees such as Figure 2.19). 6.By analogy with the equation (2.4.22), define the attitude of the uncle.7.Introducing the marked graph figure 2.21 as a matrix, with records 0, 1, 0,1 or blank.8.Sketch of the structure of the data of the graphic corresponding to Figure 2.21 in the style of Figure 2.34, Marking its edges '0' or '1'.9.Graph G has tops V, W, X, Y and Z, as well as the edges of V→W, V→X, W→V, W→X, X→Y, X→Z, X→Y, Y→Z and Z→Y. Find the strongly connected G components and draw a reduced graph. (See Section 2.5.5.) John Crowe, Barry Hayes-Gill, in the introduction to Digital Electronics, 1998So far away in this section we approached all topics using positive level logic. In other words, we have always considered output and minimization of combined logical expressions in terms of input combinations, which gives output 1. (For example, we looked at the minterm positions on the Carno maps.) Given the principle of duality, it is not surprising that instead used negatively level logic appproach. As we will now see, this approach is related to the use of a fundamental product of sum expressions, and the position of maxterms (maximum area 1, and therefore the position of one zero) on the Karnaugh map. Using the feature discussed earlier: from its truth table shown again in Table 3.36, we can see (similar to what is used when receiving the fundamental amount of product form) that Y = 0 if:Table 3.36. True table Y = A B + B C¯ABCY0000011010101111100011100111011110((A = 0) And (B = 0) And (C = 0)) OR ((A = 1) And (B = 0) And (C = 0))OR((A=1)AND(B=1)AND(C=0))OR ((A=1)AND(B=1)AND(C=1)), which is logical: This means that Y ¯=1 (i.e. Y=0) if any of these basic product conditions are 1. (This is the fundamental amount of product expression for Y) This expression can be doubly given:Y=(A+B+C)(A¯+B+C)(A¯+B¯ +C)(A¯+B ¯+C), which expresses Y in a fundamental product of the amount form (i.e. fundamental terms of the amount (since they contain all three variables) and they together give their product). (Note that · has been used to emphasize that the amount of terms is now and would be together.) This and the fundamental amount of expression produces identical expressions for Y in different forms. Despite the fact that the aforementioned dual communication process can be performed directly, by replacing all operators and inverting all variables, it is instructive to consider it in more detail. First, De Morgan's theorem, P ¯=P+Q¯, applies to certain basic product conditions, to give:Y ¯=(A+B+C) ¯+(A¯+B+C) ¯+(A¯+B ¯+C) ¯+(A¯+B ¯$C) ¯For de Morgan's second theorem, P ¯+Q ¯=P+Q¯, used to give:Y ¯=(A+B+C) ¯+(A¯ +B+C) ¯"(A¯¯=A (A¯+B¯¯+C) ¯+C) ¯Fin , inverting both sides gives: Y =(A+B+C)(A¯+B+C)(A¯+B ¯+C)(A¯+B ¯+C)With the sum of the product form, if any of the terms of product 1, the output will be 1, because any logical expression OR'd of 1 gives the result 1 (Equation 1.9). As for the product form of sums, the important point is that anything from 0 gives 0 (Equation 1.6). So, in the form of the main product amounts, if any of the conditions amount 0, then Y = 0.These processes are illustrated in Table 3.37. This shows how or'ing (on the left side) of the Karnaugh card for individual product terms in the basic product expression amount for Y leads to a common card for Y, along with how AND'ing (product formation) individual terms amounts in a fundamental product expression amounts for Y also leads to a single card. Table 3.37. Production of a common Karnaugh card for Y with cards of individual fundamental product and timing bags. The amount of product form is displayed on the left, with the product form amounts on the rightDetermined moments note that the main terms of the product indicate where minters are on the final map, while the main terms of the amount indicate where zero appears on the final map. However, an alternative way to review this is that the fundamental timing of the amount rather than that all cells except one have 1 in them. It is for this reason that the fundamental terms of the sum are known as maxterms because they indicate a maximum area of 1 (i.e. all cells except one) on the Carno map. In the same way that we could describe any combined boolean expression as a list of minterms, we can also describe it as a list of sum terms (maxterms). These will be the ones that were not minters. So Y=A¯B+B¯C can be written as Y=Σ(1,2,3,5) or Y=P(0,4,6,7)In sections 3.1 and 3.2.1, the boolean expression Y=A¯C+A¯B was is used as an example. Write out the fundamental amount of expression products for Y ¯and then double it to give the fundamental product an expression of sadness for Y. Also give an expression for Y in terms of codes for maxterms. SolutionsFashion From the previous table of truth to Fig ¯¯¯¯¯. +C)-(A¯+B+C)=(A¯+B+C))(A¯+B ¯+C)1(A¯+B ¯+C)Finally, Y = P (2,4,5,6,7). Minimizing the fundamental product of expression of amounts, of course, can be performed algebraically. To do this, it is easiest to simplify the expression for Y :Y=A¯B ¯C ¯+AB ¯C ¯+ABC ¯+ABC=(A¯+A)B ¯C ¯+(B ¯+B)AC ¯+AB(C ¯+C)=B ¯C ¯+AC ¯Duling gives:The final expression for Y ¯decorates product conditions that meet the three main implicators for the 0s on the Carnau map. This is because it is the sum of product expression forin ¯. Product expression sums for Y consists of the first values that are the corresponding expressions of the sum for prime ilicants. Importantly, while prime implicits for Y ¯indicate where 0 are on the Carnau map (for each term of the product), see <a0><a1></a1></a0>. It's clear from the Carnau map that this is not a minimized sum expression product for Y, as AC ¯is a non-inconsequentive premier. This is confirmed by logical algebra as follows:Y ¯=B ¯C ¯+AC ¯+AB=B ¯C ¯ +AB ¯C ¯+ABC ¯+AB=B ¯C ¯ <5>C ¯(1+A)+AB(1+C ¯)=B ¯C ¯+ABDualling gives:The sum of products and product form amounts is additional, and both produce the same logical function with two-tier schemes. The scheme of minimise the product of the form Y is shown in Fig. 2. The two-tier scheme for Y=(B+C)'(A¯+B)Above illustrates how we can use the Carnau map to create a sum expression minimizer. Basically, the process is exactly the same as usual, except for the 0s grouped and cyclically, not 1st. This gives the amount of expression products to Y ¯, which is then simply double to give the product minimization amounts form for Y.Minimise a fundamental sum expression product with example 3.3:Y =(A+B ¯+C)(A¯A ¯+B+C)=(A¯+B+C)(A¯+B ¯+C)(A¯+B ¯+C) first for with the help of algebra bouleans, followed by Carnau cards. Then draw a diagram, implementing a minimalistical form Y.SolutionUsing dual Y (from previous example)Y ¯=A¯B¯ +AB ¯C ¯+AB ¯C+ABC ¯+ABC=(A¯¯B¯ +(B ¯+B)AC ¯+(B ¯+B)AC=BC ¯+AC ¯+AC=A+BC ¯Sounding this expression gives:From carnau map Y in table 3.38, looping and grouping 0 givesTable 3.38. Carnau map for the function discussed in example 3.29Why can doubly give the same result as above. The scheme for the implementation of this minimization of the product form of sums is shown in Fig. 2. Minimized product of logical expression sum form discussed in Example 3.3Barry Dwyer in System Analysis and Synthesis 20161.Completion of equation confirmation (2.1.27). Using Axioms (2.1.8), we receive (P⇒Q)∧(P⇐Q)=(¬P∨Q)∧(∨P). We can then use theorem (2.1.13) to change the order of terms by providing (¬P∨Q)∧(¬Q∨P)=(P∨¬Q)∧(Q∨¬P) that we needed to prove.2.Prove equations (2.1.11). (Hint: Use Axiima (2.1.7) and resolution theorem.) We use Axiom (2.1.7) to get offers in CNF and then use the permission: Q and ¬Q cancel, leaving ¬P∨R as relaxent and then Axiom (2.1.7) used to put the result in the desired form. We can also use the Euler scheme to illustrate the theorem. Draw three concentric circles. Mark the innermost P, intermediate Q, and outer R.3.Use Axiom (2.1.7) to reduce P⇒Q to CNF, and then use Theorema De Morgan to find a logical addition. How do you interpret your result? ¬(P⇒Q)=∨V)=P∧'Q. The resulting connection is the only time that P⇒Q is defined as false in page 25.4 truth table.Why does a set of cardinality n have 2n possible sub-minutes? (See Section 2.3.1.) Each participant of the set may or may not belong to a given subset. Consequently, there are independent binary options giving 2n possible subsets.5.In what special circumstances R1 does; R−1=R0? (See Inequality (2.4.26.) (Hint: Consider the difference between a child's connection to a family relationship and a child's connection to entrenched trees such as Figure 2.19). In case R−1 is a function. R can map a member of x domain X to any number of y1.y2 members ... in code-Y, but R−1 displays a given member Y to only one X member. associated with x and only x. (although R1; R−1 can match x to itself as many times as there are clear values of y1.y2..., since relationships are sets, it's intangible.) 6.By analogy with the equation (2.4.22), determine the relationship has an uncle. Has an uncle=(has a great father; has a son) \Has Father7.Represent marked figure graph 2.21 as matrix, with entries 0, 1, 0.1 or blank. 8.Draw a graphic data structure corresponding to Figure 2.21 in figure style 2.34, Marking its edges '0' or '1'.9.Graph G has tops V, W, X, Y and Z, as well as the edges of V→W, V→X, W→V, W→X, X→Y, X→Z, X→Y, Y→Z and Z→Y. Find the strongly connected G components and draw a reduced graph. (See Section 2.5.5.) If the answer isn't immediately obvious, we begin by forming an adjacent graphics matrix: The next step is to search for reflex closure: We then use warshall algorithm to find its reflexive transitive but it does not enter any new entries in the matrix. Rows Rows акуратно відсортовані, тому ми робимо висновок, що сильно підключені компоненти : {V,W}, {X} і {Y,Z}, з краями {V,W}→{X}→{Y,Z}.B. HOLDSWORTH BSc (Eng), MSc, FIEE, R.C. WOODS MA, DPhil, in Digital Logic Design (Четверте видання), 20022.1Використання теопарків булеанної алгебри спрощують такі вирази: f1 (A, B, C, D) = B + BCD + B CD + AB + ĀB + B Cf2(A, B, C, D) = (AB +C + D)(C + D)(C + D)(C + D + E)f3(A, B, C) = BC (C + AC) + (() Ā + C)(ĀB + ĀC)2.23береження кожного з наступних виразів за допомогою методу додаткових продуктів:f1(A, B, C, D) = AC + BC D + AB C + ACDf2(A, B, C, D) = B + ĀB + ACD + AC f3(A) , B, C, D) = B + ĀBD + ABC + AB D + AC D2.3Prove, що (A + B)(Ā + C) = AC + ĀB без використання ідеальної індукції.2.4Конструкція таблиці істини для наступних функцій і з таблиці істини отримати вираз для обернених функцій:f1(A, B, C) = A + BC f2(A, B, C) = AC + BC + ABf3(A, B, C) = (A + B)(Amacr + B + C)f4(A, B, C, D) = BD + ĀC + B B 2.5Виявіть обернений наступний вираз і не спрощуйте свій resultf1(A, B, C) = A + B Cf2(A, B, C, D) = A(B + C) + BD (0Ā + C)f3(A, B, C, D, E) = [AB + C(Ā + DE)][B + AC(C + B D)]2.6Експанд і спростити наступні вирази за допомогою теореми Де Моргана.f1(A , B, C) = (A + B) (ABC)(A C) f2 (A, B, C) = (AB + B C) +(BC + AB) f3 (A, B, C) = (AB +B C)+(AC+A C)2.7Проведжте наступні посвідчення(1)ĀB + AB = (Ā + B)(A + B)(2)(AB + C)B = ABC + ĀBC + ABC(3)) BC + AD = (B+ A)(B + A)(B + D)(A + C)(C + D)2.8Для наступних двох функцій 4-змінної f2 = A+B +C+D f2 = A + C + BDhow багато вхідних мінтерм включені в кожну з цих функцій, а скільки ні? Які вирази мінтермів для двох функцій? Спростіть обидві функції за допомогою теорем логічної алгебри.2.9Важте схему хронометражу, показану на малюнку P2.9, знайдіть відображену функцію, виражену як сума мінтермів, а також знайдіть функцію як продукт maxterms. Спростіть вираз minterm, використовуючи логічні теореми, і знайдіть обернений спрощений вираз.2.10Викнути (i) схеми контактів перемикача та (ii) реалізацію AND/OR для наступних логічних функцій.f1(A, B, C) = Ā + B(C + D)f2(A, B, C) = (Ā + B)(B + C) + (AB + C)f3(A, B, C, D) = (A + B + C)(Ā + D) + BC + A(B + D)(C + D)2.11Єдина сходи в блоці квартир має три вимикачі для управління ліхтарями. Вимикач A розташований у верхній частині сходів, вимикач B розташований наполовину вгору по сходах і вимикач C розташований внизу сходів. Створіть логічну мережу для керування вогнями на сходовій клітці.2.12Sketch наступні функції на діаграмі Венна:f1(A, B) = AB + ĀBf2(A, B, C) = AB C + ĀBC + ĀBC + ABC + ĀB Cf3(A, B, C) = ĀC + AC + BC + ĀBf4(A, B, C) = AB + ĀC 2.13ProveAmacr⊕B = A⊕B A⊕B=Amacr⊕B AB + ĀB = AB+A B 2.14A управління дверима ліфта має працювати наступним чином. Коли ліфт зупиняється на підлозі, двері відчиняться і генерується сигнал, який залишається на місці, поки всі пасажири не будуть вмикати або вимикати Elevator. An additional signal is also generated to ensure that the door does not close on the passenger in the doorway. The door will close if the call button is pressed on another floor or if the passenger of the elevator pressed the button for another floor. Customize the truth table to check the lifting control and display the appropriate switching equation. Equation.

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