6 Digital Logic (292)

Boolean algebra. Combinational and sequential circuits. Minimization. Number representations and computer arithmetic (fixed and floating point)

Mark Distribution in Previous GATE

Year	2024-1	2024-2	2023	2022	2021-1	2021-2	Minimum	Average	Maximum
1 Mark Count	2	2	2	1	2	3	1	2	3
2 Marks Count	2	2	2	2	2	2	2	2	2
Total Marks	6	6	6	5	6	7	**5**	**6**	**7**

6.1 Adder (9)

6.1.1 Adder: GATE CSE 1988 | Question: 4ii

Using binary full adders and other logic gates (if necessary), design an adder for adding 4-bit number (including sign) in $2's$ complement notation.

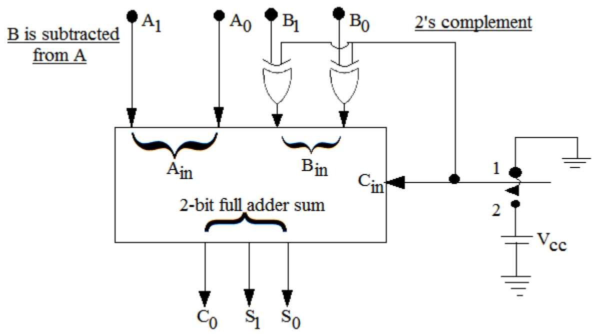
gate1988 digital-logic descriptive adder

Answer key

6.1.2 Adder: GATE CSE 1990 | Question: 1-i

Fill in the blanks:

In the two bit full-adder/subtractor unit shown in below figure, when the switch is in position 2 ___________ using __________ arithmetic.



gate1990 digital-logic adder fill-in-the-blanks

Answer key

6.1.3 Adder: GATE CSE 1997 | Question: 2.5

An N-bit carry lookahead adder, where N is a multiple of 4, employs ICs 74181 (4 bit ALU) and 74182 (4 bit carry lookahead generator).

The minimum addition time using the best architecture for this adder is

A. proportional to N

B. proportional to $\log N$

C. a constant

D. None of the above

gate1997 digital-logic normal adder

Answer key

6.1.4 Adder: GATE CSE 1999 | Question: 2.16

The number of full and half-adders required to add 16-bit numbers is

A. 8 half-adders, 8 full-adders

B. 1 half-adder, 15 full-adders

C. 16 half-adders, 0 full-adders

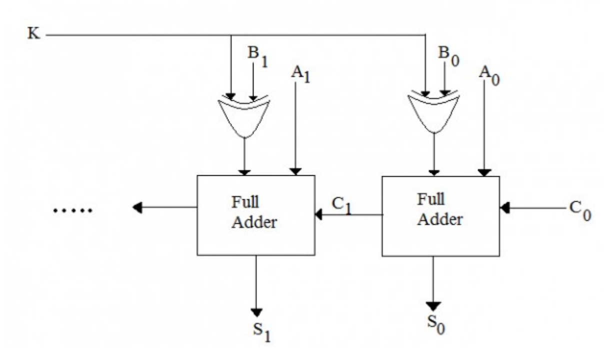
D. 4 half-adders, 12 full-adders

gate1999 digital-logic normal adder

Answer key

6.1.5 Adder: GATE CSE 2003 | Question: 46

Consider the ALU shown below.



If the operands are in $2's$ complement representation, which of the following operations can be performed by suitably setting the control lines K and C_0 only (+ and – denote addition and subtraction respectively)?

A. $A + B$, and $A – B$, but not $A + 1$
B. $A + B$, and $A + 1$, but not $A – B$
C. $A + B$, but not $A – B$ or $A + 1$
D. $A + B$, and $A – B$, and $A + 1$

gatecse-2003 digital-logic normal adder

Answer key

6.1.6 Adder: GATE CSE 2004 | Question: 62

A 4-bit carry look ahead adder, which adds two 4-bit numbers, is designed using AND, OR, NOT, NAND, NOR gates only. Assuming that all the inputs are available in both complemented and uncomplemented forms and the delay of each gate is one time unit, what is the overall propagation delay of the adder? Assume that the carry network has been implemented using two-level AND-OR logic.

A. 4 time units
B. 6 time units
C. 10 time units
D. 12 time units

gatecse-2004 digital-logic normal adder

Answer key

6.1.7 Adder: GATE CSE 2015 Set 2 | Question: 48

A half adder is implemented with XOR and AND gates. A full adder is implemented with two half adders and one OR gate. The propagation delay of an XOR gate is twice that of an AND/OR gate. The propagation delay of an AND/OR gate is 1.2 microseconds. A 4-bit-ripple-carry binary adder is implemented by using four full adders. The total propagation time of this 4-bit binary adder in microseconds is ______.

gatecse-2015-set2 digital-logic adder normal numerical-answers

Answer key

6.1.8 Adder: GATE CSE 2016 Set 1 | Question: 33

Consider a carry look ahead adder for adding two n-bit integers, built using gates of fan-in at most two. The time to perform addition using this adder is

A. $\Theta(1)$
B. $\Theta(\log(n))$
C. $\Theta(\sqrt{n})$
D. $\Theta(n))$

gatecse-2016-set1 digital-logic adder normal

Answer key

6.1.9 Adder: GATE CSE 2016 Set 2 | Question: 07

Consider an eight-bit ripple-carry adder for computing the sum of A and B, where A and B are integers represented in 2's complement form. If the decimal value of A is one, the decimal value of B that leads to the longest latency for the sum to stabilize is ___________ gatecse-2016-set2 digital-logic adder normal numerical-answers

Answer key

6.2 Array Multiplier (2)

6.2.1 Array Multiplier: GATE CSE 1999 | Question: 1.21

The maximum gate delay for any output to appear in an array multiplier for multiplying two n bit numbers is

A. $O(n^2)$ B. $O(n)$ C. $O(\log n)$ D. $O(1)$

gate1999 digital-logic normal array-multiplier

Answer key

6.2.2 Array Multiplier: GATE CSE 2003 | Question: 11

Consider an array multiplier for multiplying two n bit numbers. If each gate in the circuit has a unit delay, the total delay of the multiplier is

A. $\Theta(1)$ B. $\Theta(\log n)$ C. $\Theta(n)$ D. $\Theta(n^2)$

gatecse-2003 digital-logic normal array-multiplier

Answer key

6.3 Boolean Algebra (32)

6.3.1 Boolean Algebra: GATE CSE 1987 | Question: 1-II

The total number of Boolean functions which can be realised with four variables is:

A. 4 B. 17 C. 256 D. $65,536$

gate1987 digital-logic boolean-algebra functions combinatory

Answer key

6.3.2 Boolean Algebra: GATE CSE 1987 | Question: 12-a

The Boolean expression $A \oplus B \oplus A$ is equivalent to

A. $AB + \overline{A}\ \overline{B}$
B. $\overline{A}\,B + A\,\overline{B}$
C. B
D. $\overline{A}$

gate1987 digital-logic boolean-algebra easy

Answer key

6.3.3 Boolean Algebra: GATE CSE 1988 | Question: 2-iii

Let $*$ be defined as a Boolean operation given as $x * y = \overline{x}\ \overline{y} + xy$ and let $C = A * B$. If $C = 1$ then prove that $A = B$.

gate1988 digital-logic descriptive boolean-algebra

Answer key

6.3.4 Boolean Algebra: GATE CSE 1989 | Question: 4-x

A switching function is said to be neutral if the number of input combinations for which its value is 1 is equal to the number of input combinations for which its value is 0. Compute the number of neutral switching functions of n variables (for a given n).

gate1989 descriptive digital-logic boolean-algebra

Answer key

6.3.5 Boolean Algebra: GATE CSE 1989 | Question: 5-a

Find values of Boolean variables A, B, C which satisfy the following equations:

- A+ B = 1
- AC = BC
- A + C = 1
- AB = 0

gate1989 descriptive digital-logic boolean-algebra

Answer key

6.3.6 Boolean Algebra: GATE CSE 1992 | Question: 02-i

The operation which is commutative but not associative is:

A. AND
B. OR
C. EX-OR
D. NAND

gate1992 easy digital-logic boolean-algebra multiple-selects

Answer key

6.3.7 Boolean Algebra: GATE CSE 1994 | Question: 4

A. Let $*$ be a Boolean operation defined as $A * B = AB + \overline{A}\,\overline{B}$. If $C = A * B$ then evaluate and fill in the blanks:
   i. $A * A =$______
   ii. $C * A =$______

B. Solve the following boolean equations for the values of A, B and C :

$$AB + \overline{A}C = 1$$
$$AC + B = 0$$

gate1994 digital-logic normal boolean-algebra descriptive

Answer key

6.3.8 Boolean Algebra: GATE CSE 1995 | Question: 2.5

What values of A, B, C and D satisfy the following simultaneous Boolean equations?

$$\overline{A} + AB = 0, AB = AC, AB + A\overline{C} + CD = \overline{C}D$$

A. $A = 1, B = 0, C = 0, D = 1$
B. $A = 1, B = 1, C = 0, D = 0$
C. $A = 1, B = 0, C = 1, D = 1$
D. $A = 1, B = 0, C = 0, D = 0$

gate1995 digital-logic boolean-algebra easy

Answer key

6.3.9 Boolean Algebra: GATE CSE 1997 | Question: 2-1

Let $*$ be defined as $x * y = \bar{x} + y$. Let $z = x * y$. Value of $z * x$ is

A. $\bar{x} + y$
B. x
C. 0
D. 1

gate1997 digital-logic normal boolean-algebra

Answer key

6.3.10 Boolean Algebra: GATE CSE 1998 | Question: 1.13

What happens when a bit-string is XORed with itself n-times as shown:

$$[B \oplus (B \oplus (B \oplus (B \dots n \text{ times}]$$

A. complements when n is even
B. complements when n is odd

C. divides by 2^n always

D. remains unchanged when n is even

gate1998 digital-logic normal boolean-algebra

Answer key

6.3.11 Boolean Algebra: GATE CSE 1998 | Question: 2.8

Which of the following operations is commutative but not associative?

A. AND

B. OR

C. NAND

D. EXOR

gate1998 digital-logic easy boolean-algebra

Answer key

6.3.12 Boolean Algebra: GATE CSE 1999 | Question: 1.7

Which of the following expressions is not equivalent to $\bar{x}$?

A. $x \text{ NAND } x$

B. $x \text{ NOR } x$

C. $x \text{ NAND } 1$

D. $x \text{ NOR } 1$

gate1999 digital-logic easy boolean-algebra

Answer key

6.3.13 Boolean Algebra: GATE CSE 2000 | Question: 2.10

The simultaneous equations on the Boolean variables x, y, z and w,

- $x + y + z = 1$
- $xy = 0$
- $xz + w = 1$
- $xy + \bar{z}\bar{w} = 0$

have the following solution for x, y, z and w, respectively:

A. $0\ 1\ 0\ 0$

B. $1\ 1\ 0\ 1$

C. $1\ 0\ 1\ 1$

D. $1\ 0\ 0\ 0$

gatecse-2000 digital-logic boolean-algebra easy

Answer key

6.3.14 Boolean Algebra: GATE CSE 2002 | Question: 2-3

Let $f(A, B) = A' + B$. Simplified expression for function $f(f(x + y, y), z)$ is

A. $x' + z$

B. xyz

C. $xy' + z$

D. None of the above

gatecse-2002 digital-logic boolean-algebra normal

Answer key

6.3.15 Boolean Algebra: GATE CSE 2004 | Question: 17

A Boolean function $x'y' + xy + x'y$ is equivalent to

A. $x' + y'$

B. $x + y$

C. $x + y'$

D. $x' + y$

gatecse-2004 digital-logic easy boolean-algebra

Answer key

6.3.16 Boolean Algebra: GATE CSE 2007 | Question: 32

Let $f(w, x, y, z) = \sum(0, 4, 5, 7, 8, 9, 13, 15)$. Which of the following expressions are NOT equivalent to f?

P: $x'y'z' + w'xy' + wy'z + xz$

Q: $w'y'z' + wx'y' + xz$

R: $w'y'z' + wx'y' + xyz + xy'z$

S: $x'y'z' + wx'y' + w'y$

A. P only B. Q and S C. R and S D. S only

gatecse-2007 digital-logic normal boolean-algebra

Answer key

6.3.17 Boolean Algebra: GATE CSE 2007 | Question: 33

Define the connective $*$ for the Boolean variables X and Y as:

$$X * Y = XY + X'Y'.$$

Let $Z = X * Y$. Consider the following expressions P, Q and R.

$$P : X = Y * Z,$$
$$Q : Y = X * Z,$$
$$R : X * Y * Z = 1$$

Which of the following is **TRUE**?

A. Only P and Q are valid.
B. Only Q and R are valid.
C. Only P and R are valid.
D. All P, Q, R are valid.

gatecse-2007 digital-logic normal boolean-algebra

Answer key

6.3.18 Boolean Algebra: GATE CSE 2008 | Question: 26

If P, Q, R are Boolean variables, then
$(P + \bar{Q})(P.\bar{Q} + P.R)(\bar{P}.\bar{R} + \bar{Q})$ simplifies to

A. $P.\bar{Q}$ B. $P.\bar{R}$ C. $P.\bar{Q} + R$ D. $P.\bar{R} + Q$

gatecse-2008 easy digital-logic boolean-algebra

Answer key

6.3.19 Boolean Algebra: GATE CSE 2012 | Question: 6

The truth table

X	Y	(X,Y)
0	0	0
0	1	0
1	0	1
1	1	1

represents the Boolean function

A. X B. $X + Y$ C. $X \oplus Y$ D. Y

gatecse-2012 digital-logic easy boolean-algebra

Answer key

6.3.20 Boolean Algebra: GATE CSE 2013 | Question: 21

Which one of the following expressions does **NOT** represent exclusive NOR of x and y?

A. $xy + x'y'$
B. $x \oplus y'$
C. $x' \oplus y$
D. $x' \oplus y'$

gatecse-2013 digital-logic easy boolean-algebra

Answer key

6.3.21 Boolean Algebra: GATE CSE 2014 Set 2 | Question: 6

The dual of a Boolean function $F(x_1, x_2, \ldots, x_n, +, ., ')$, written as F^D is the same expression as that of F with $+$ and $\cdot$ swapped. F is said to be self-dual if $F = F^D$. The number of self-dual functions with n Boolean variables is

A. 2^n
B. 2^{n-1}
C. 2^{2^n}
D. $2^{2^{n-1}}$

gatecse-2014-set2 digital-logic normal dual-function boolean-algebra

Answer key

6.3.22 Boolean Algebra: GATE CSE 2014 Set 3 | Question: 55

Let $\oplus$ denote the exclusive OR (XOR) operation. Let '1' and '0' denote the binary constants. Consider the following Boolean expression for F over two variables P and Q:

$$F(P, Q) = ((1 \oplus P) \oplus (P \oplus Q)) \oplus ((P \oplus Q) \oplus (Q \oplus 0))$$

The equivalent expression for F is

A. $P + Q$
B. $\overline{P + Q}$
C. $P \oplus Q$
D. $\overline{P \oplus Q}$

gatecse-2014-set3 digital-logic normal boolean-algebra

Answer key

6.3.23 Boolean Algebra: GATE CSE 2015 Set 2 | Question: 37

The number of min-terms after minimizing the following Boolean expression is _______.

$[D' + AB' + A'C + AC'D + A'C'D]'$

gatecse-2015-set2 digital-logic boolean-algebra normal numerical-answers

Answer key

6.3.24 Boolean Algebra: GATE CSE 2016 Set 1 | Question: 06

Consider the Boolean operator # with the following properties :
$x\#0 = x, x\#1 = \overline{x}, x\#x = 0$ and $x\#\overline{x} = 1.$ Then $x\#y$ is equivalent to

A. $x\overline{y} + \overline{x}y$
B. $x\overline{y} + \overline{x}\,\overline{y}$
C. $\overline{x}y + xy$
D. $xy + \overline{x}\,\overline{y}$

gatecse-2016-set1 digital-logic boolean-algebra easy

Answer key

6.3.25 Boolean Algebra: GATE CSE 2016 Set 2 | Question: 08

Let, $x_1 \oplus x_2 \oplus x_3 \oplus x_4 = 0$ where x_1, x_2, x_3, x_4 are Boolean variables, and $\oplus$ is the XOR operator.
Which one of the following must always be **TRUE**?

A. $x_1 x_2 x_3 x_4 = 0$
B. $x_1 x_3 + x_2 = 0$
C. $\overline{x}_1 \oplus \overline{x}_3 = \overline{x}_2 \oplus \overline{x}_4$
D. $x_1 + x_2 + x_3 + x_4 = 0$

gatecse-2016-set2 digital-logic boolean-algebra normal

Answer key

6.3.26 Boolean Algebra: GATE CSE 2017 Set 2 | Question: 27

If w, x, y, z are Boolean variables, then which one of the following is INCORRECT?

A. $wx + w(x+y) + x(x+y) = x + wy$

B. $\overline{w\bar{x}(y+\bar{z})} + \bar{w}x = \bar{w} + x + \bar{y}z$

C. $(w\bar{x}(y+x\bar{z}) + \bar{w}\bar{x})y = x\bar{y}$

D. $(w+y)(wxy+wyz) = wxy + wyz$

gatecse-2017-set2 digital-logic boolean-algebra normal

Answer key

6.3.27 Boolean Algebra: GATE CSE 2018 | Question: 4

Let $\oplus$ and $\odot$ denote the Exclusive OR and Exclusive NOR operations, respectively. Which one of the following is NOT CORRECT?

A. $\overline{P \oplus Q} = P \odot Q$

B. $\overline{P} \oplus Q = P \odot Q$

C. $\overline{P} \oplus \overline{Q} = P \oplus Q$

D. $P \oplus \overline{P} \oplus Q = (P \odot \overline{P} \odot \overline{Q})$

gatecse-2018 digital-logic normal boolean-algebra 1-mark

Answer key

6.3.28 Boolean Algebra: GATE CSE 2019 | Question: 6

Which one of the following is NOT a valid identity?

A. $(x \oplus y) \oplus z = x \oplus (y \oplus z)$

B. $(x+y) \oplus z = x \oplus (y+z)$

C. $x \oplus y = x + y$, if $xy = 0$

D. $x \oplus y = (xy + x'y')'$

gatecse-2019 digital-logic boolean-algebra 1-mark

Answer key

6.3.29 Boolean Algebra: GATE CSE 2021 Set 1 | Question: 42

Consider the following Boolean expression.

$F = (X + Y + Z)(\overline{X} + Y)(\overline{Y} + Z)$

Which of the following Boolean expressions is/are equivalent to $\overline{F}$ (complement of F)?

A. $(\overline{X} + \overline{Y} + \overline{Z})(X + \overline{Y})(Y + \overline{Z})$

B. $X\overline{Y} + \overline{Z}$

C. $(X + \overline{Z})(\overline{Y} + \overline{Z})$

D. $X\overline{Y} + Y\overline{Z} + \overline{X}\ \overline{Y}\ \overline{Z}$

gatecse-2021-set1 multiple-selects digital-logic boolean-algebra 2-marks

Answer key

6.3.30 Boolean Algebra: GATE CSE 2024 | Set 2 | Question: 20

For a Boolean variable x, which of the following statements is/are FALSE?

A. $x.1 = x$

B. $x + 1 = x$

C. $x \cdot x = 0$

D. $x + \bar{x} = 1$

gatecse2024-set2 digital-logic boolean-algebra easy multiple-selects

Answer key

6.3.31 Boolean Algebra: GATE IT 2004 | Question: 44

The function $A\bar{B}C + \bar{A}BC + AB\bar{C} + \bar{A}\bar{B}C + A\bar{B}\bar{C}$ is equivalent to

A. $A\bar{C} + AB + \bar{A}C$

B. $A\bar{B} + A\bar{C} + \bar{A}C$

C. $\bar{A}B + A\bar{C} + A\bar{B}$

D. $\bar{A}B + AC + A\bar{B}$

gateit-2004 digital-logic boolean-algebra easy

Answer key

6.3.32 Boolean Algebra: GATE IT 2005 | Question: 7

Which of the following expressions is equivalent to $(A \oplus B) \oplus C$

A. $(A+B+C)(\bar{A}+\bar{B}+\bar{C})$
B. $(A+B+C)(\bar{A}+\bar{B}+C)$
C. $ABC+\bar{A}(B \oplus C)+\bar{B}(A \oplus C)$
D. None of these

gateit-2005 digital-logic normal boolean-algebra

Answer key

6.4 Booths Algorithm (6)

6.4.1 Booths Algorithm: GATE CSE 1990 | Question: 8b

State the Booth's algorithm for multiplication of two numbers. Draw a block diagram for the implementation of the Booth's algorithm for determining the product of two 8-bit signed numbers.

gate1990 descriptive digital-logic booths-algorithm

Answer key

6.4.2 Booths Algorithm: GATE CSE 1996 | Question: 1.23

Booth's algorithm for integer multiplication gives worst performance when the multiplier pattern is

A. $101010 \ldots 1010$
B. $100000 \ldots 0001$
C. $111111 \ldots 1111$
D. $011111 \ldots 1110$

gate1996 digital-logic booths-algorithm normal

Answer key

6.4.3 Booths Algorithm: GATE CSE 1999 | Question: 1.20

Booth's coding in 8 bits for the decimal number -57 is:

A. $0-100+1000$
B. $0-100+100-1$
C. $0-1+100-10+1$
D. $00-10+100-1$

gate1999 digital-logic number-representation booths-algorithm normal

Answer key

6.4.4 Booths Algorithm: GATE IT 2005 | Question: 8

Using Booth's Algorithm for multiplication, the multiplier -57 will be recoded as

A. 0 -1 0 0 1 0 0 -1
B. 1 1 0 0 0 1 1 1
C. 0 -1 0 0 1 0 0 0
D. 0 1 0 0 -1 0 0 1

gateit-2005 digital-logic booths-algorithm normal

Answer key

6.4.5 Booths Algorithm: GATE IT 2006 | Question: 38

When multiplicand Y is multiplied by multiplier $X = x_{n-1}x_{n-2} \ldots x_0$ using bit-pair recoding in Booth's algorithm, partial products are generated according to the following table.

Row	x_{i+1}	x_i	x_{i-1}	Partial Product
1	0	0	0	0
2	0	0	1	Y
3	0	1	0	Y
4	0	1	1	2Y
5	1	0	0	?
6	1	0	1	-Y
7	1	1	0	-Y
8	1	1	1	?

The partial products for rows 5 and 8 are

A. $2Y$ and Y
B. $-2Y$ and $2Y$
C. $-2Y$ and 0
D. 0 and Y

gateit-2006 digital-logic booths-algorithm difficult

Answer key

6.4.6 Booths Algorithm: GATE IT 2008 | Question: 42

The two numbers given below are multiplied using the Booth's algorithm.

Multiplicand : $0101\ 1010\ 1110\ 1110$
Multiplier: $0111\ 0111\ 1011\ 1101$

How many additions/Subtractions are required for the multiplication of the above two numbers?

A. 6
B. 8
C. 10
D. 12

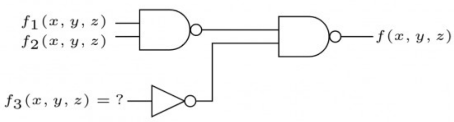
gateit-2008 digital-logic booths-algorithm normal

Answer key

6.5 Canonical Normal Form (9)

6.5.1 Canonical Normal Form: GATE CSE 2002 | Question: 2-1

Consider the following logic circuit whose inputs are functions f_1, f_2, f_3 and output is f



Given that

- $f_1(x,y,z) = \Sigma(0,1,3,5)$
- $f_2(x,y,z) = \Sigma(6,7)$, and
- $f(x,y,z) = \Sigma(1,4,5)$.

f_3 is

A. $\Sigma(1,4,5)$
B. $\Sigma(6,7)$
C. $\Sigma(0,1,3,5)$
D. None of the above

gatecse-2002 digital-logic normal canonical-normal-form circuit-output

Answer key

6.5.2 Canonical Normal Form: GATE CSE 2007 | Question: 48

Which of the following is TRUE about formulae in Conjunctive Normal Form?

A. For any formula, there is a truth assignment for which at least half the clauses evaluate to true.
B. For any formula, there is a truth assignment for which all the clauses evaluate to true.

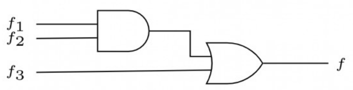
C. There is a formula such that for each truth assignment, at most one-fourth of the clauses evaluate to true.
D. None of the above.

gatecse-2007 digital-logic normal conjunctive-normal-form canonical-normal-form

Answer key

6.5.3 Canonical Normal Form: GATE CSE 2008 | Question: 8

Given f_1, f_3 and f in canonical sum of products form (in decimal) for the circuit



$f_1 = \Sigma m(4,5,6,7,8)$
$f_3 = \Sigma m(1,6,15)$
$f = \Sigma m(1,6,8,15)$
then f_2 is

A. $\Sigma m(4,6)$
B. $\Sigma m(4,8)$
C. $\Sigma m(6,8)$
D. $\Sigma m(4,6,8)$

gatecse-2008 digital-logic canonical-normal-form easy

Answer key

6.5.4 Canonical Normal Form: GATE CSE 2010 | Question: 6

The minterm expansion of $f(P,Q,R) = PQ + Q\bar{R} + P\bar{R}$ is

A. $m_2 + m_4 + m_6 + m_7$
B. $m_0 + m_1 + m_3 + m_5$
C. $m_0 + m_1 + m_6 + m_7$
D. $m_2 + m_3 + m_4 + m_5$

gatecse-2010 digital-logic canonical-normal-form normal

Answer key

6.5.5 Canonical Normal Form: GATE CSE 2015 Set 3 | Question: 43

The total number of prime implicants of the function $f(w,x,y,z) = \sum(0,2,4,5,6,10)$ is __________

gatecse-2015-set3 digital-logic canonical-normal-form normal numerical-answers

Answer key

6.5.6 Canonical Normal Form: GATE CSE 2015 Set 3 | Question: 44

Given the function $F = P' + QR$, where F is a function in three Boolean variables P, Q and R and $P' = !P$, consider the following statements.
$(S1) F = \sum(4,5,6)$
$(S2) F = \sum(0,1,2,3,7)$
$(S3) F = \Pi(4,5,6)$
$(S4) F = \Pi(0,1,2,3,7)$
Which of the following is true?

A. (S1)-False, (S2)-True, (S3)-True, (S4)-False
B. (S1)-True, (S2)-False, (S3)-False, (S4)-True
C. (S1)-False, (S2)-False, (S3)-True, (S4)-True
D. (S1)-True, (S2)-True, (S3)-False, (S4)-False

gatecse-2015-set3 digital-logic canonical-normal-form normal

Answer key

6.5.7 Canonical Normal Form: GATE CSE 2019 | Question: 50

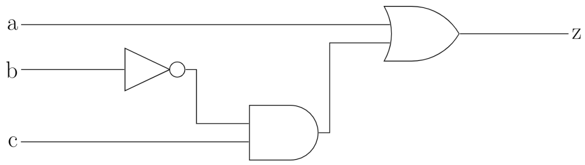
What is the minimum number of 2-input NOR gates required to implement a 4 -variable function expressed in sum-of-minterms form as $f = \Sigma(0, 2, 5, 7, 8, 10, 13, 15)$? Assume that all the inputs and their complements are available. Answer: _______

gatecse-2019 numerical-answers digital-logic canonical-normal-form 2-marks

Answer key

6.5.8 Canonical Normal Form: GATE CSE 2020 | Question: 28

Consider the Boolean function $z(a, b, c)$.



Which one of the following minterm lists represents the circuit given above?

A. $z = \sum(0, 1, 3, 7)$
B. $z = \sum(1, 4, 5, 6, 7)$
C. $z = \sum(2, 4, 5, 6, 7)$
D. $z = \sum(2, 3, 5)$

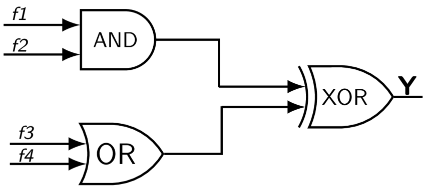
gatecse-2020 digital-logic canonical-normal-form 2-marks

Answer key

6.5.9 Canonical Normal Form: GATE CSE 2024 | Set 2 | Question: 40

Consider 4-variable functions $f1, f2, f3, f4$ expressed in sum-of-minterms form as given below.

$$f1 = \sum(0, 2, 3, 5, 7, 8, 11, 13)$$
$$f2 = \sum(1, 3, 5, 7, 11, 13, 15)$$
$$f3 = \sum(0, 1, 4, 11)$$
$$f4 = \sum(0, 2, 6, 13)$$



With respect to the circuit given above, which of the following options is/are CORRECT?

A. $\boldsymbol{Y} = \sum(0, 1, 2, 11, 13)$
B. $\boldsymbol{Y} = \Pi(3, 4, 5, 6, 7, 8, 9, 10, 12, 14, 15)$
C. $\boldsymbol{Y} = \sum(0, 1, 2, 3, 4, 5, 6, 7)$
D. $\boldsymbol{Y} = \Pi(8, 9, 10, 11, 12, 13, 14, 15)$

gatecse2024-set2 digital-logic canonical-normal-form multiple-selects

Answer key

6.6 Carry Generator (2)

6.6.1 Carry Generator: GATE CSE 2006 | Question: 36

Given two three bit numbers $a_2a_1a_0$ and $b_2b_1b_0$ and c the carry in, the function that represents the *carry* generate function when these two numbers are added is:

A. $a_2b_2 + a_2a_1b_1 + a_2a_1a_0b_0 + a_2a_0b_1b_0 + a_1b_2b_1 + a_1a_0b_2b_0 + a_0b_2b_1b_0$
B. $a_2b_2 + a_2b_1b_0 + a_2a_1b_1b_0 + a_1a_0b_2b_1 + a_1a_0b_2 + a_1a_0b_2b_0 + a_2a_0b_1b_0$
C. $a_2 + b_2 + (a_2 \oplus b_2)(a_1 + b_1 + (a_1 \oplus b_1) + (a_0 + b_0))$
D. $a_2b_2 + \overline{a_2}a_1b_1 + \overline{a_2a_1}a_0b_0 + \overline{a_2}a_0\overline{b_1}b_0 + a_1\overline{b_2}b_1 + \overline{a_1}a_0\overline{b_2}b_0 + a_0\overline{b_2b_1}b_0$

gatecse-2006 digital-logic normal carry-generator adder

Answer key

6.6.2 Carry Generator: GATE CSE 2007 | Question: 35

In a look-ahead carry generator, the carry generate function G_i and the carry propagate function P_i for inputs A_i and B_i are given by:

$$P_i = A_i \oplus B_i \text{ and } G_i = A_i B_i$$

The expressions for the sum bit S_i and the carry bit C_{i+1} of the look ahead carry adder are given by:

$$S_i = P_i \oplus C_i \text{ and } C_{i+1} = G_i + P_i C_i, \text{ where } C_0 \text{ is the input carry.}$$

Consider a two-level logic implementation of the look-ahead carry generator. Assume that all P_i and G_i are available for the carry generator circuit and that the AND and OR gates can have any number of inputs. The number of AND gates and OR gates needed to implement the look-ahead carry generator for a 4-bit adder with S_3, S_2, S_1, S_0 and C_4 as its outputs are respectively:

A. $6,3$ B. $10,4$ C. $6,4$ D. $10,5$

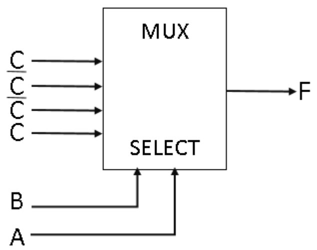
gatecse-2007 digital-logic normal carry-generator adder

Answer key

6.7 Circuit Output (39)

6.7.1 Circuit Output: GATE CSE 1987 | Question: 1-IV

The output F of the below multiplexer circuit can be represented by



A. $AB + B\bar{C} + \bar{C}A + \bar{B}\bar{C}$

B. $A \oplus B \oplus C$

C. $A \oplus B$

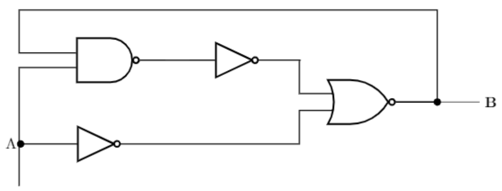
D. $\bar{A}\bar{B}C + \bar{A}B\bar{C} + A\bar{B}\bar{C}$

gate1987 digital-logic combinational-circuit multiplexer circuit-output

Answer key

6.7.2 Circuit Output: GATE CSE 1989 | Question: 4-ix

Explain the behaviour of the following logic circuit with level input A and output B.



gate1989 descriptive digital-logic circuit-output

Answer key