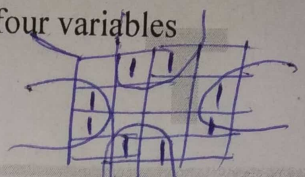
Q.71 Consider the following Boolean function with four variables **[GATE : 2007]**

$F(w, x, y, z) = \Sigma(1, 3, 4, 6, 9, 11, 12, 14)$.

The function is :



(A) Independent of one variables

(B) Independent of two variables

(C) Independent of three variables

(D) Dependent on all variables

Q.72 In the Karnaugh map shown below, X denotes a don't care term. What is the minimal form of the function represented by the Karnaugh map? **[GATE : 2008]**

cd \ *ab*	00	01	11	10
00	1	1		1
01	X=0			
11	X=0			
10	1	1		X=1

(A) $\bar{b}.\bar{d}+\bar{a}.\bar{d}$

(B) $\bar{a}.\bar{b}+\bar{b}.\bar{d}+\bar{a}.b.\bar{d}$

(C) $\bar{b}.\bar{d}+\bar{a}.b.\bar{d}$

(D) $\bar{a}.\bar{b}+\bar{b}.\bar{d}+\bar{a}.\bar{d}$

Q.73 Consider the following minterm expression of

$F(P, Q, R, S) = \Sigma m(0, 2, 5, 7, 8, 10, 13, 15)$

The minterms 2, 7, 8 and 13 are 'don't care' terms. The minimal sum-of-products form for F is _____.

[GATE : 2014]

(A) $Q\overline{S} + \overline{Q}S$ (B) $\overline{Q}\overline{S} + QS$

(C) $\overline{Q}\overline{R}\overline{S} + \overline{Q}R\overline{S} + Q\overline{R}S + QRS$ (D) $\overline{P}\overline{Q}\overline{S} + \overline{P}Q\overline{S} + PQS + P\overline{Q}\overline{S}$

Q.74 Consider the following Boolean expression for F: (P, Q, R, S) = PQ + $\overline{P}$QR+$\overline{P}$Q$\overline{R}$S.

The minimal sum-of-products form of F is _____.

[GATE : 2014]

(A) PQ + QR + QS (B) P + Q + R + S (C) $\overline{P}+\overline{Q}+\overline{R}+\overline{S}$ (D) $\overline{P}R + \overline{P}\overline{R}S + P$

Q.75 Consider the Karnaugh map given below, where X represents "don't care" and blank represents 0

ba \ dc	00	01	11	10
00		x	x	
01	1			x
11	1			1
10		x	x	

Assume for all inputs (a, b, c, d), the respective complements $(\overline{a}, \overline{b}, \overline{c}, \overline{d})$ are also available. The above logic is implemented using 2-input NOR gates only. The minimum number of gates required is _____.

[GATE : 2017]

Q.76 What is the equivalent Boolean expression in product-of-Sums form for the Karnasugh map given in fig?

[GATE : 1996]

AB \ CD	00	01	11	10
00		1	1	
01	1			1
11	1			1
10		1	1	

(A) $B\overline{D} + \overline{B}D$ (B) $(B+\overline{C}+D)(\overline{B}+C+\overline{D})$

(C) $(B+D)(\overline{B}+\overline{D})$ (D) $(B+\overline{D})(\overline{B}+D)$

Q.77 Which function does NOT implement the Karnaugh map given below?

[GATE : 2000]

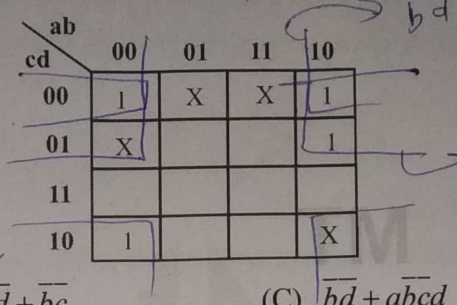
wz → / xy ↓	00	01	11	10
00	0	x	0	0
01	0	x	1	1
11	1	1	1	1
10	0	x	0	0

(A) (w + x)y (B) x y + y w

(C) $(w+x)(\overline{w}+y)(\overline{x}+y)$ (D) None of the above

Q.78 What is the minimal form of the Karnaugh map shown below? Assume that X denotes a don't care term.

[GATE : 2012]



(A) $\overline{bd}$ (B) $\overline{bd}+\overline{bc}$ (C) $\overline{bd}+a\overline{bcd}$ (D) $\overline{bd}+\overline{bc}+\overline{cd}$

Q.79 The total number of prime implicants of the function f (w, x, y, z) = Σ (0, 2, 4, 5, 6, 10) is _____.

[GATE : 2015]

Q.80 Given, $f(w, x, y, z) = \Sigma_m (0, 1, 2, 3, 7, 8, 10) + \Sigma_d (5, 6, 11, 15)$

where represents the don't – care condition in Karnaugh maps. Which of the following is a minimum product – of – sums (POS) form of f(w, x, y, z)?

[GATE : 2017]

(A) $f = (\overline{w}+\overline{z})(\overline{x}+z)$ (B) $f = (\overline{w}+z)(x+z)$

(C) $f = (w+z)(\overline{x}+z)$ (D) $f = (w+\overline{z})(\overline{x}+z)$

Q.81 Consider the minterm list form of a Boolean function F given below.

F(P, Q, R, S) = Σm(0, 2, 5, 7, 9, 11) + d(3, 8, 10, 12, 14)

Here, m denotes a minterm and d denotes a don't care term. The number of essential prime implicants of the function F is _____.

[GATE : 2018]

Q.82 What is the minimum number of 2-input NOR gates required to implement 4-variable function expressed in sum-of-minterms from as f = Σ(0, 2, 5, 7, 8, 10, 13, 15)? Assume that all the inputs and their complements are available. Answer _____.

[GATE : 2019]

Chapter - 4 : Combinational Circuit

Q.83 A multiplexer with a 4 bit data select input is a

[GATE : 1998]

(A) 4 : 1 Multiplexer (B) 2 : 1 Multiplexer

(C) 16 : 1 Multiplexer (D) 8 : 1 Multiplexer

Q.84 The number of full and half – adders required to add 16 – bit numbers is:

[GATE : 1999]

(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

Q.85 A circuit outputs a digit in the form of 4 bits. 0 is represented by 0000, 1 by 0001, ……, 9 by 1001. A combinational circuit is to be designed which takes these 4 bits as input and output 1 if the digit ≥ 5, and 0 otherwise. If only AND, OR and NOT gates may be used what is the minimum number of gates required?

[GATE : 2004]

(A) 2 (B) 3 (C) 4 (D) 5

Q.86 We consider the addition of two 2's complement numbers $b_{n-1}b_{n-2}.....b_0$ and $a_{n-1}a_{n-2}.....a_0$. A binary adder for adding unsigned binary numbers is used to add the two numbers. The sum is denoted by $c_{n-1}c_{n-2}.....c_0$ and the carry-out by c_{out}. Which one of the following options correctly identifies the overflow condition?

[GATE : 2006]

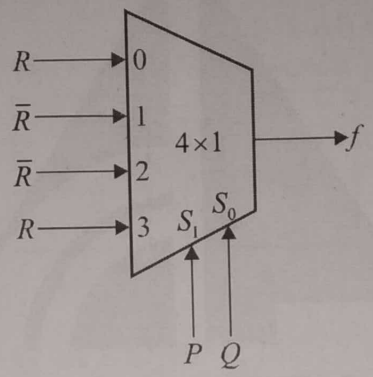
(A) $c_{out}\left(\overline{a_{n-1} \oplus b_{n-1}}\right)$

(B) $a_{n-1}b_{n-1}\overline{c_{n-1}} + \overline{a_{n-1}b_{n-1}}c_{n-1}$

(C) $c_{out} \oplus c_{n-1}$

(D) $a_{n-1} \oplus b_{n-1} \oplus c_{n-1}$

Q.87 The Boolean expression for the output f of the multiplexer shown below is **[GATE : 2010]**



$= R\bar{P}\bar{Q} + \bar{R}\bar{P}Q + \bar{R}PQ + RPQ$

$= R(\overline{P \oplus Q}) + \bar{R}(P \oplus Q)$

$P \oplus Q \oplus R$

(A) $\overline{P \oplus Q \oplus R}$

(B) $P \oplus Q \oplus R$

(C) $P+Q+R$

(D) $\overline{P+Q+R}$

Q.88 When two 8-bit numbers $A_7.....A_0$ and $B_7.....B_0$ in 2's complement representation (with A_0 and B_0 as the least significant bits) are added using a ripple-carry adder, the sum bits obtained are $S_7.....S_0$ and the carry bits are $C_7.....C_0$. An overflow is said to have occurred if

[GATE : 2017]

(A) The carry bit C_7 is 1

(B) All the carry bits ($C_7.....C_0$) are 1

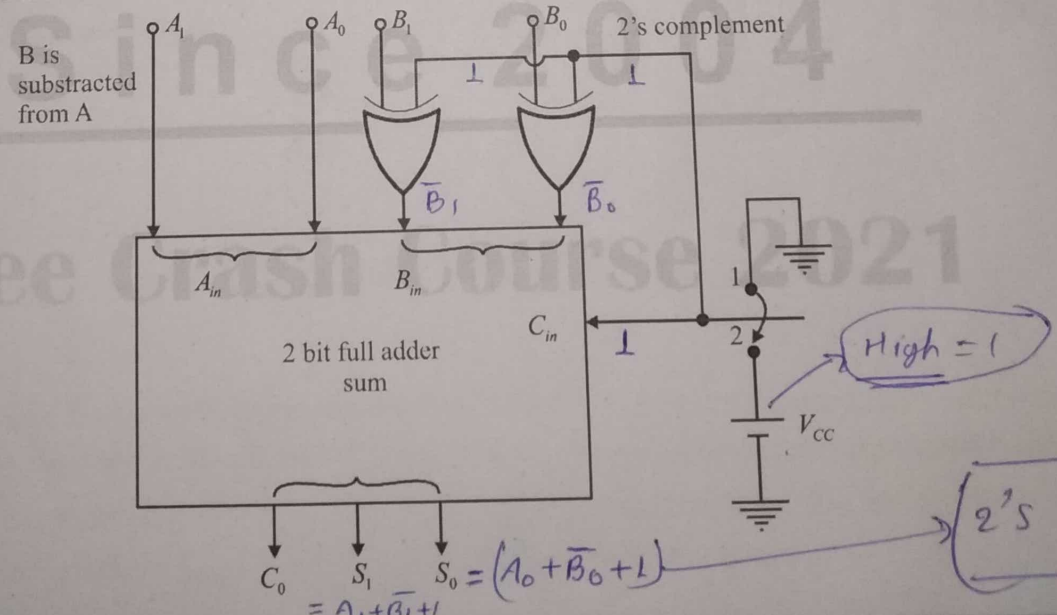
(C) $\left(A_7.B_7.\overline{S}_7 + \overline{A}_7.\overline{B}_7.S_7\right)$ is 1

(D) $\left(A_0.B_0.\overline{S}_0 + \overline{A}_0.\overline{B}_0.S_0\right)$ is 1

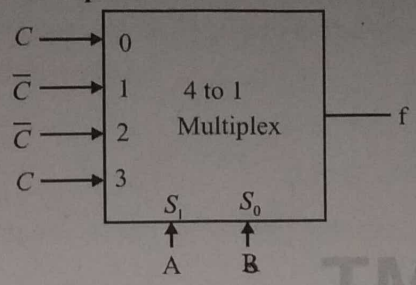
Q.89 Fill in the blanks:

In the two bit full-adder/subtractor unit shown in fig., when the switch is in position 2, subtraction using 2's complement arithmetic.

[GATE : 1990]



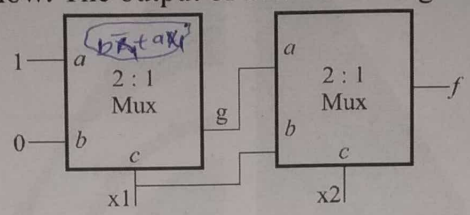
Q.90 Consider the circuit in fig shown. It implements **[GATE : 1996]**



(A) $\overline{A}\overline{B}C + \overline{A}B\overline{C} + ABC$ (B) A + B + C

(C) $A \oplus B \oplus C$ (C) AB + BC + CA

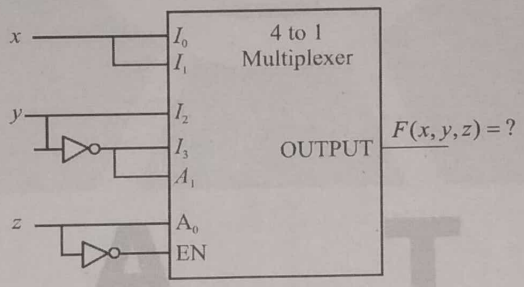
Q.91 Consider the circuit shown below. The output of a 2: 1 Mux is given by the function (ac' + bc).



Which of the following is true? **[GATE : 2001]**

(A) f = x1' + x2 (B) f = x1' x2 + x1x2' (C) f = x1 x2 + x1'x2' (D) f = x1 + x2'

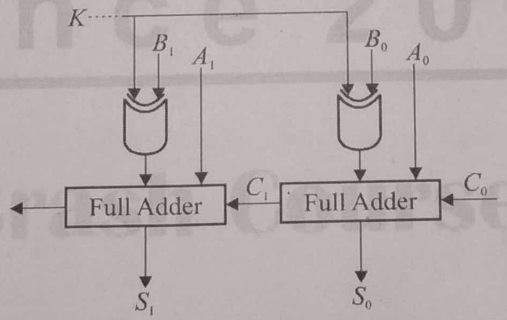
Q.92 Consider the following multiplexer where I_0, I_1, I_2, I_3, are four data input lines selected by two address line combinations A_1 $A_0 = 00, 01, 10, 11$ respectively and f is the output of the multiplex (or). EN is the Enable input. **[GATE : 2002]**



The function f (x,y,z) implemented by the above circuit is

(A) $xy\overline{z}$ (B) $xy + z$ (C) $x + y$ (D) None of the above

Q.93 Consider the ALU shown below **[GATE : 2003]**



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, A – B and A + 1

Q.94 Consider a multiplexer with X and Y as data inputs and Z as control input. If z = 0 selects input x, and z = 1 selects input Y. What are the connections required to realize the 2- variable Boolean function f = T + R without using any additional Hardware? **[GATE : 2004]**

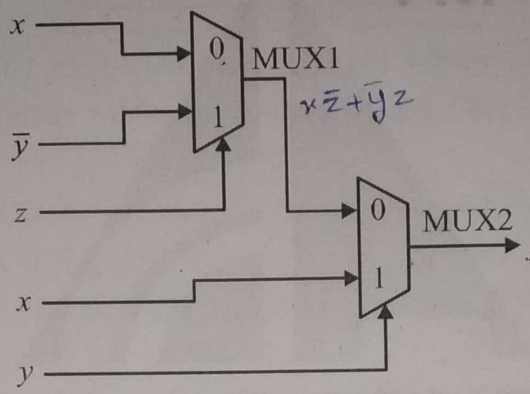
(A) R to X, 1 to Y, T to Z

(B) T to X, R to Y, T to Z

(C) T to X, R to Y, O to Z

(D) R to X, O to Y, T to Z

Q.95 Consider the circuit given. Which one of the following options correctly represents $f(x, y, z)$? **[GATE : 2006]**



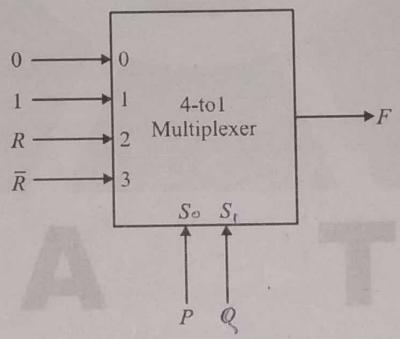
(A) $x\bar{z}+xy+\bar{y}z$

(B) $x\bar{z}+xy+\overline{yz}$

(C) $xz+xy+\overline{yz}$

(D) $xz+x\bar{y}+\bar{y}z$

Q.96 Consider the 4-to-1 multiplexer with two select lines S_1 and S_0 given below. **[GATE : 2014]**



The minimal sum-of-products form of the Boolean expression for the output F of the multiplexer is

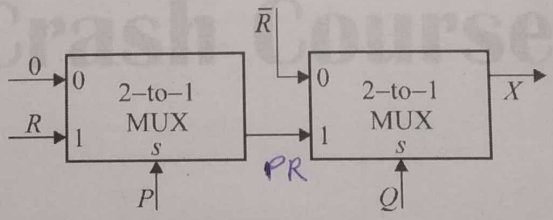
(A) $\bar{P}Q+Q\bar{R}+P\bar{Q}R$

(B) $\bar{P}Q+\bar{P}Q\bar{R}+PQ\bar{R}+P\bar{Q}R$

(C) $\bar{P}QR+\bar{P}Q\bar{R}+Q\bar{R}+P\bar{Q}R$

(D) $PQ\bar{R}$

Q.97 Consider the two cascaded 2-to-1 multiplexers as shown in the figure. **[GATE : 2016]**



The minimal sum of products form of the output X is

(A) $\overline{P\bar{Q}}+PQR$

(B) $\bar{P}Q+QR$

(C) $PQ+\overline{P\bar{Q}}R$

(D) $\overline{Q\bar{R}}+PQR$