Question 1: (60 points, 3 points each). Select the correct answer

1	2	3	4	5	6	7	8	9	10
a	D	C	D	C	E	D	B	C	C

11	12	13	14	15	16	17	18	19	20
E	B	D	A	A	A	B	C	A	D

1. Convert the following BCD number to decimal $(100000000011)_{BCD}$

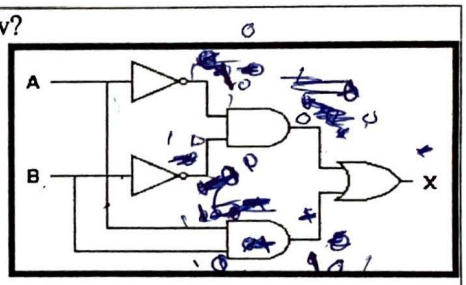
A. 803
B. 103
C. 8003
D. 1003
E. None of the above

8 0 3

2. What type of logic circuit is represented by the figure shown below?

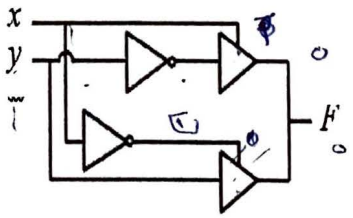
A. NAND
B. XOR
C. NOR
D. XNOR
E. None of the above

A	B	
0	0	1
0	1	0
1	0	0
1	1	1



3. For the shown circuit the function F is

A. F = X AND Y
B. F = X OR Y
C. F = X XOR Y
D. F = X XNOR Y
E. None



x	y	
0	0	0
0	1	1
1	0	1
1	1	0

4. Consider the number $(A95.2D3C)_{16}$. How many digits would you need to represent this number in signed octal?

A. 2 octal digits
B. 4 octal digits
C. 8 octal digits
D. 10 octal digits
E. None of the above

8 4 2 1

1010 1001 0101 . 0010 1101 0011 1100

A	10
B	11
C	12
D	13
E	14
F	15

5. Simplify the Boolean function F = X`Y`Z + X`YZ + XY`Z + XYZ

A. X`Z + XZ
B. YZ` + XZ
C. Z
D. 1
E. None of the above

$yz(x'+x) + y'z(x'+x)$

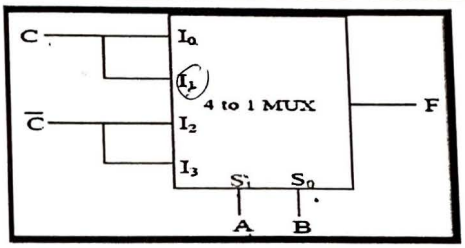
$yz + y'z$

$z(y+y')$

$z(1)$

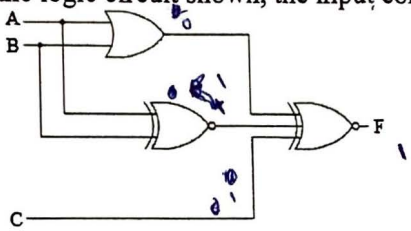
6. The logic realized by the circuit shown in figure is

A. F = B ⊕ C
B. F = (B ⊕ C)′
C. F = A ⊕ C
D. F = (B ⊕ C)′
E. None of the above



7. For the output F to be 1 in the logic circuit shown, the input combination should be

A. A=1, B=1, C=1
B. A=1, B=0, C=0
C. A=0, B=1, C=0
D. A=0, B=0, C=1
E. None



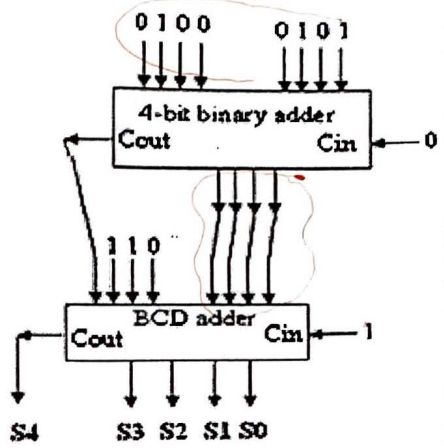
8. The binary value of S4 S3 S2 S1 S0 in the circuit beside is:

A. 10001

B. 10110

C. 10000

D. 01001



9. Implementation of a full adder with an active low decoder and two

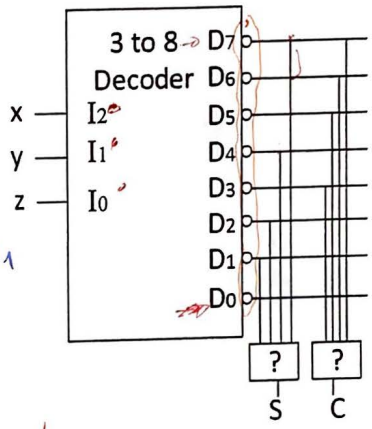
A. OR gates

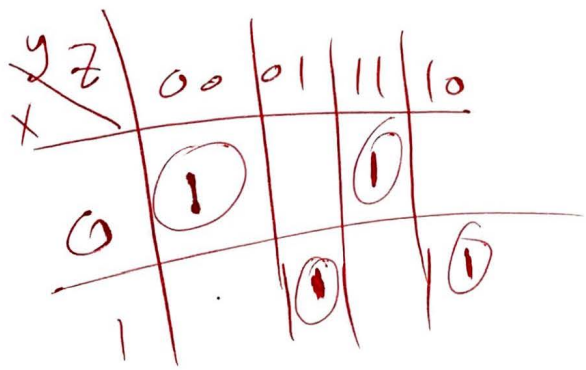
B. AND gates

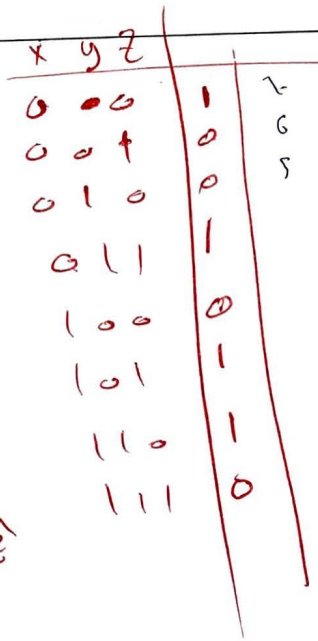
C. NOR gates

D. NAND gates

E. None







$\dot{x}\dot{y}\dot{z} + x\dot{y}z + xyz + xy\dot{z}$

$x(\dot{y}z + y\dot{z})$

$x \oplus y \oplus z$

$x(y \oplus z)$

10. Which function F is implemented by using this 4X1 Multiplexer

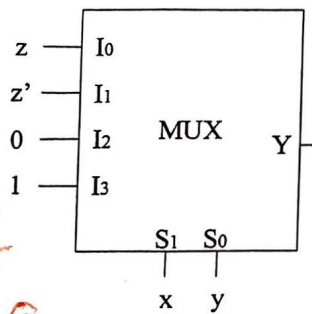
A. F(x, y, z) = ∑(0, 3, 4, 5)

B. F(x, y, z) = ∑(1, 3, 6, 7)

C. $F(x, y, z) = \sum(1, 2, 6, 7)$

D. F(x, y, z) = ∑(1, 2, 5, 7)

E. None



11. The Boolean function $F = A \oplus B \oplus C \oplus D = 1$ means:

A. all inputs are zeros ($A = 0, B = 0, C = 0, D = 0$).

B. all inputs are ones ($A = 1, B = 1, C = 1, D = 1$).

C. half of the inputs are zeros (for example: $A = 0, B = 0, C = 1, D = 1$).

D. one or two or three of the inputs are ones.

E. one or three of the inputs are ones.

12. Consider the $F(A, B, C, D) = \sum(0,1,2,3,7,8,9,10,12)$ with don't care terms $d(A, B, C, D) = \sum(11,13,15)$. List all of the essential prime implicants

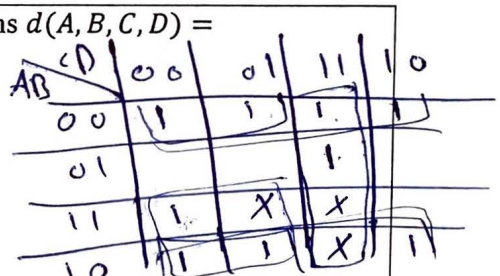
A. B', AD, AC', CD

B. B', AC', CD

C. AD, AC', CD

D. B', AD, CD

E. *None*



13. Given F(x, y, z) = ∏(0, 3, 4, 7), and G is the complement of F, then:

A. G(x, y, z) = ∑(0, 1, 2, 3, 5, 7)

B. G(x, y, z) = ∏(0, 3, 4, 7)

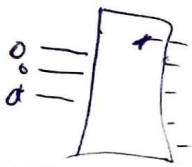
C. G(x, y, z) = ∑(1, 2, 5, 6)

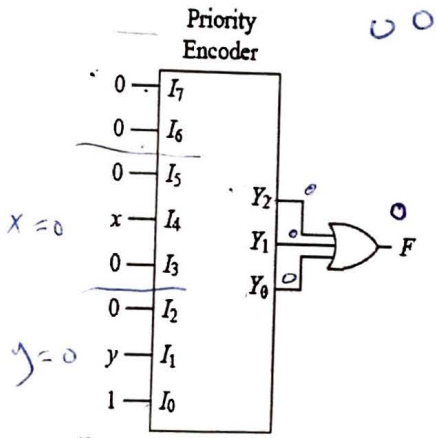
D. G(x, y, z) = ∑(0, 3, 4, 7)

E. None of the above

14. The shown priority encoder gives highest priority to *I7*. The output *F*:

A. is = 0 when $x = 0$ and $y = 0$.
B. is = 0 when $x < y$, i.e. $x = 0$ and $y = 1$.
C. is = 0 when $x = y = 1$, i.e. $x = 1$ and $y = 1$.
D. is = 0 when $x > y$, i.e. $x = 1$ and $y = 0$.
E. is always = 1.



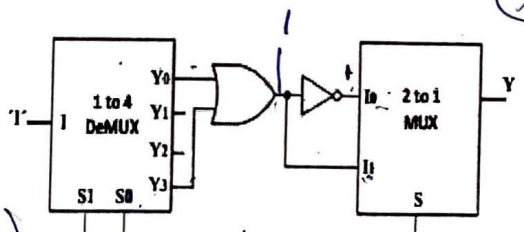


15. The number $(55)_8$ is equivalent to:

A. $(2D)_{16}$
B. $(D2)_{16}$
C. $(B1)_{16}$
D. $(1B)_{16}$
E. $(55)_{16}$

16. The output Y of the circuit is

A. $Y(A,B,C) = \sum(1,2,4,7)$
B. $Y(A,B,C) = \sum(0,3,5,6,7)$
C. $Y(A,B,C) = \prod(1,2,4,7)$
D. $Y(A,B,C) = \prod(0,3,5,6,7)$
E. None

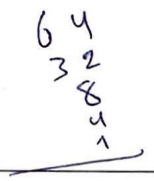


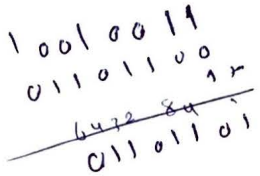
17. A full adder can be made out of

A. Two half adders
B. Two half adders and OR gate
C. Two half adders and NOT gate
D. Two half adders and AND gate

18. What is the number represented of the binary words 10010011, assuming the representation is in Two's complement

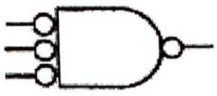
A. -19
B. 109
C. –109
D. -108
E. None



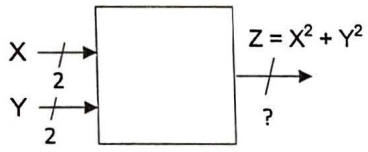


19. The shown symbol is an equivalent representation of the

A. NOT gate
B. AND gate
C. OR gate
D. NOR gate
E. None

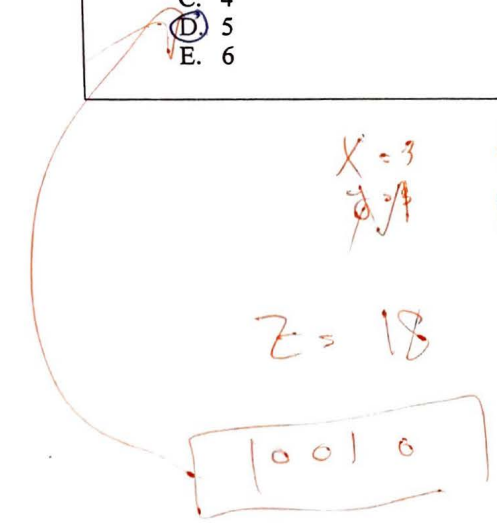


20. A logic circuit has two inputs X & Y each is a 2-bit unsigned umber. It has an output number *Z* such that



the minimum number of bits required for the output number *Z* is

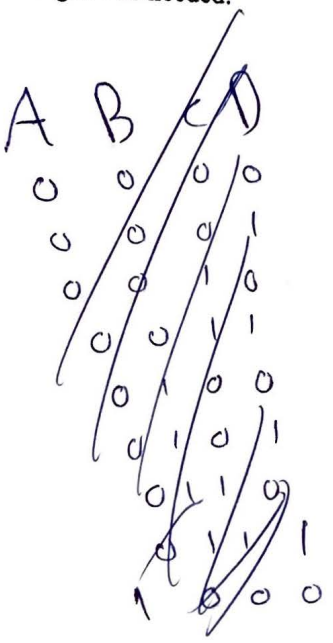
A. 2
B. 3
C. 4
D. 5
E. 6

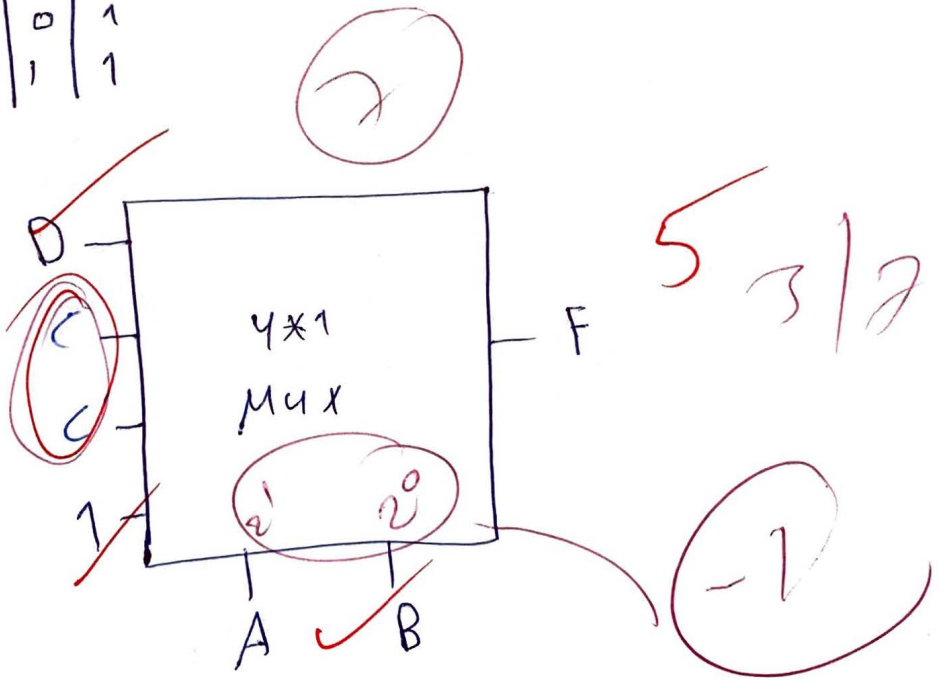


Question#2: 10 points

The following function is given in sum of minterms form $F(A,B,C,D) = \sum(1,3,4,11,12,13,14,15)$. Implement this function using one mux 4*1 with minimum number of external gates as needed.

A	B	C	D	F
0	0	0	0	0
0	0	0	1	1
0	0	1	0	0
0	0	1	1	1
0	1	0	0	1
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1





Question#3: 10 points

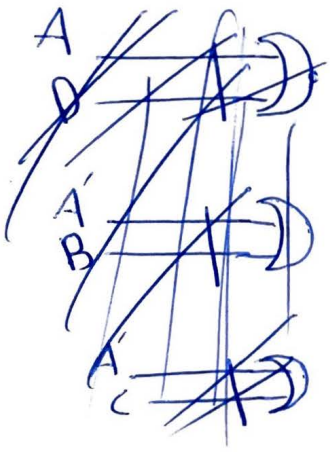
Implement the following function using NOR-NOR two level implementations

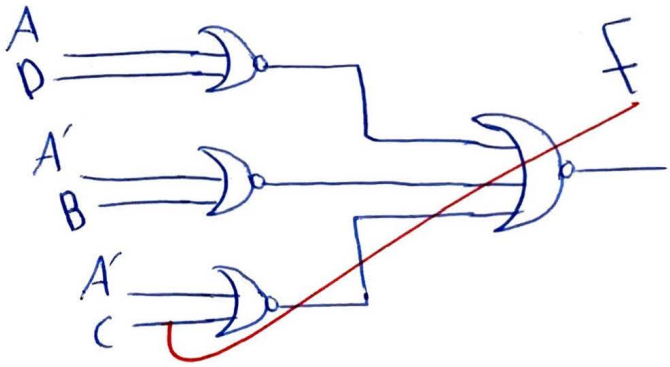
$F(A,B,C,D) = \sum (1,3;5,7,14,15)$

$F(A,B,C,D) = \Pi (0,2,4,6,8,9,10,11,12,13)$

CD / AB	00	01	11	10
00	0			0
01	0			0
11	0	0		
10	0	0	0	0

$F(A,B,C,D) = (A+D).(A'+B).(A'+C)$



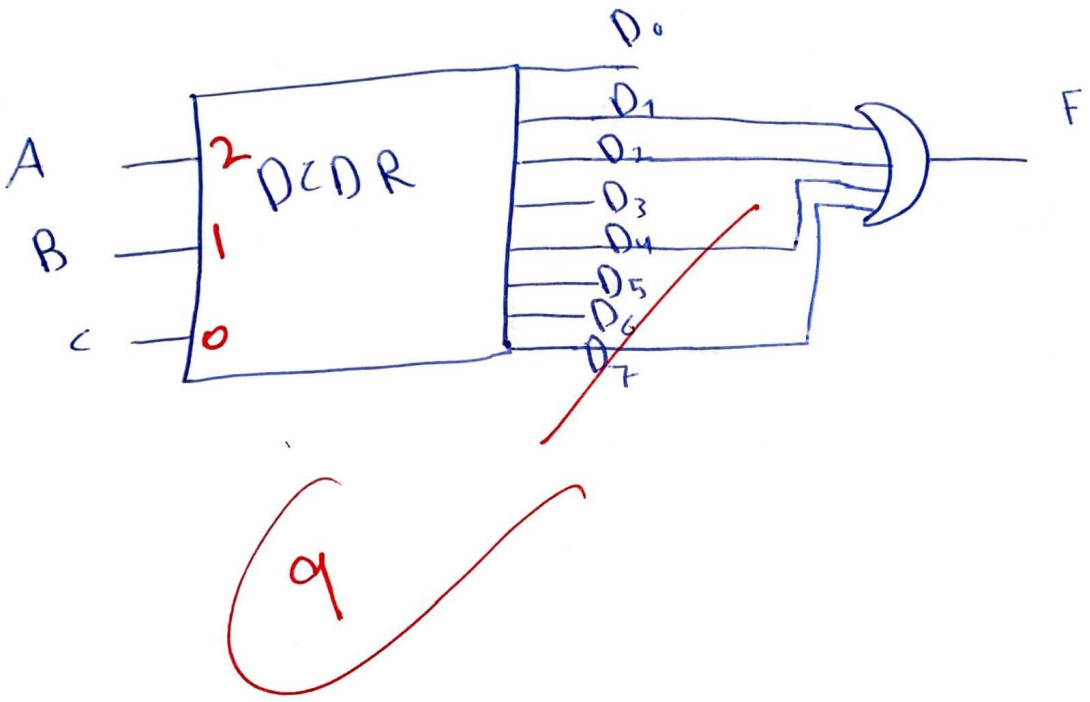


Question#4: 10 points

Use a suitable size of decoder and an external logic gate to implement the even parity generator for a circuit with three inputs A, B, C

$(A,B,C) = \Sigma(1,2,4,7)$

A	B	C	P
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1



9

Question#5: 10 points

Derive the truth table only for a four bit combinational circuit 2`s complementer (The output generates the 2`s complement of the input binary number)

A	B	C	D	Y_0	Y_1	Y_2	Y_3	Y_4
0	0	0	0	0	0	0	0	0
0	0	0	1	0	1	1	1	1
0	0	1	0	0	1	1	1	0
0	0	1	1	0	1	1	0	1
0	1	0	0	0	1	1	0	0
0	1	0	1	0	1	0	1	1
0	1	1	0	0	1	0	1	0
0	1	1	1	0	1	0	0	1
1	0	0	0	0	1	0	0	0
1	0	0	1	0	0	1	1	1
1	0	1	0	0	0	1	1	0
1	0	1	1	0	0	1	0	1
1	1	0	0	0	0	1	0	0
1	1	0	1	0	0	0	1	1
1	1	1	0	0	0	0	1	0
1	1	1	1	0	0	0	0	1