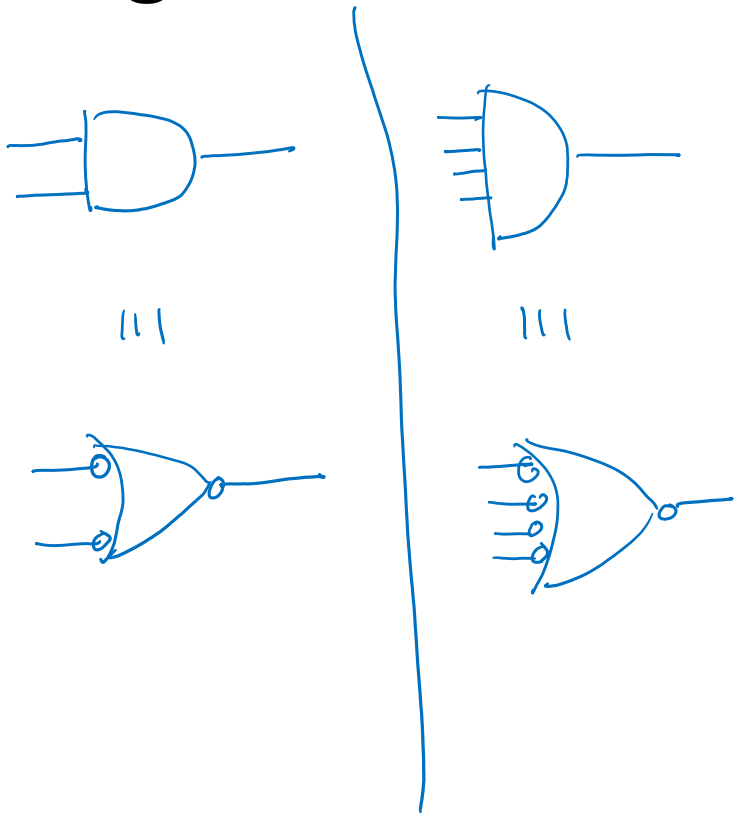
Its output is 0 when at least one of its input is 0. What gate is it?

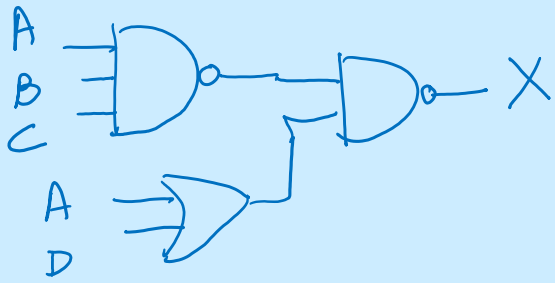
A. NOT

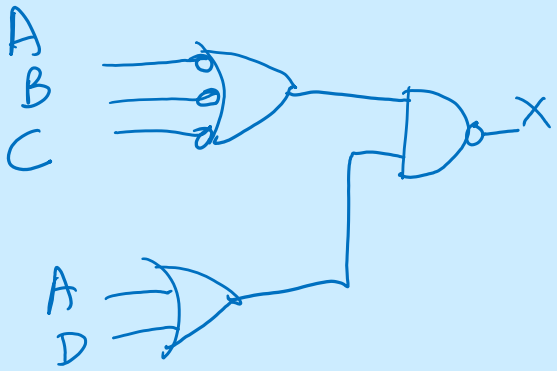
B. OR

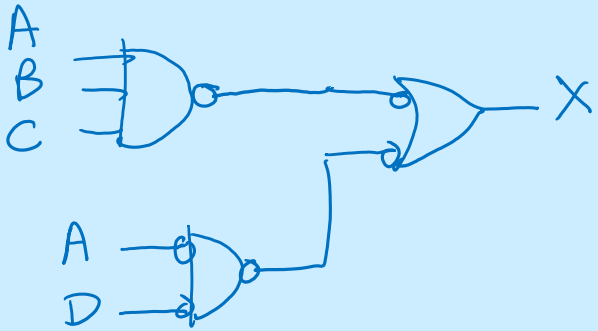
C. AND



a) X = [(ABC)’ (A+D)]’



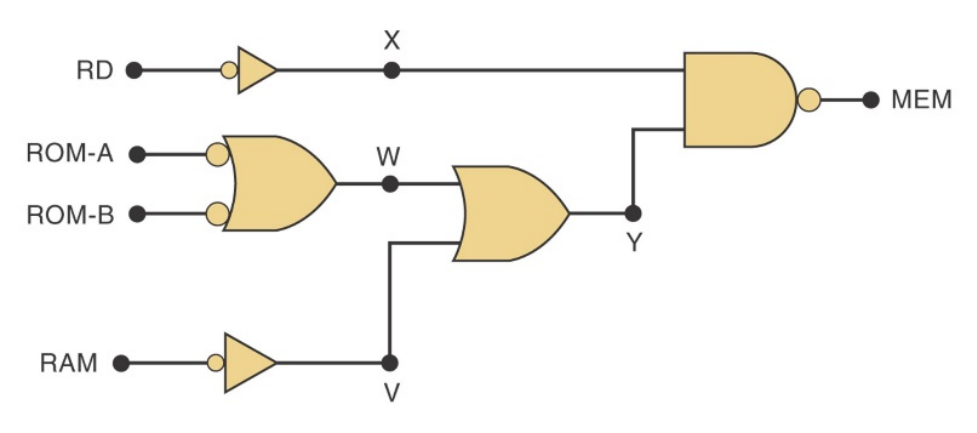


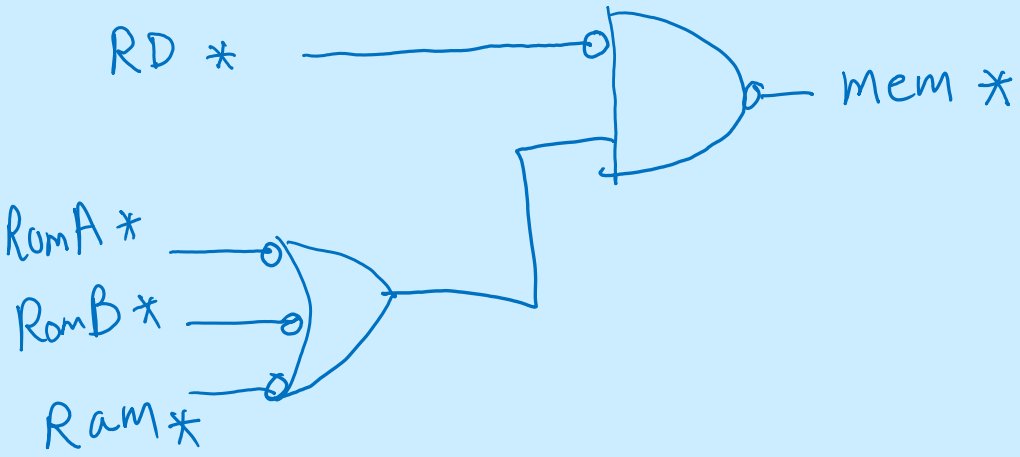


b) X=0 requires (either A=0, or B=0, or C=0) and (A=1 or D=1)

c) X=1 requires (A=B=C=1) or (A=D=0)

Possible to draw simpler diagram





$(A \oplus B)' = A \oplus B' = A' \oplus B$

True or false?

A. True

B. False

Construct the truth tables and compare:

A	B	(A ⊕ B)’	A ⊕ B’	A’ ⊕ B
0	0	1	1	1
0	1	0	0	0
1	0	0	0	0
1	1	1	1	1

Or use Boolean algebra:

(A ⊕ B)’ = A’B’ + AB

A ⊕ B’ = A(B’)’ + A’(B’) = AB + A’B’

A’ ⊕ B = (A’)B’ + (A’)’B = A’B’ + AB

Example: Construct the truth table for F:

F = W (X⊕Y⊕Z⊕W') + (X⊕Y⊕Z)

W	X	Y	Z	F
0	0	0	0	
0	0	0	1	1
0	0	1	0	1
0	0	1	1	
0	1	0	0	1
0	1	0	1	
0	1	1	0	
0	1	1	1	1
1	0	0	0	
1	0	0	1	
1	0	1	0	
1	0	1	1	
1	1	0	0	
1	1	0	1	
1	1	1	0	
1	1	1	1	

Continue:

F = W (X⊕Y⊕Z⊕W') + (X⊕Y⊕Z) = (X⊕Y⊕Z)

W	X	Y	Z	F
0	0	0	0	
0	0	0	1	1
0	0	1	0	1
0	0	1	1	
0	1	0	0	1
0	1	0	1	
0	1	1	0	
0	1	1	1	1
1	0	0	0	
1	0	0	1	1
1	0	1	0	1
1	0	1	1	
1	1	0	0	1
1	1	0	1	
1	1	1	0	
1	1	1	1	1

How many 2-input XOR gates are needed to generate the parity bit from an 8-bit data?

A. 4

B. 6

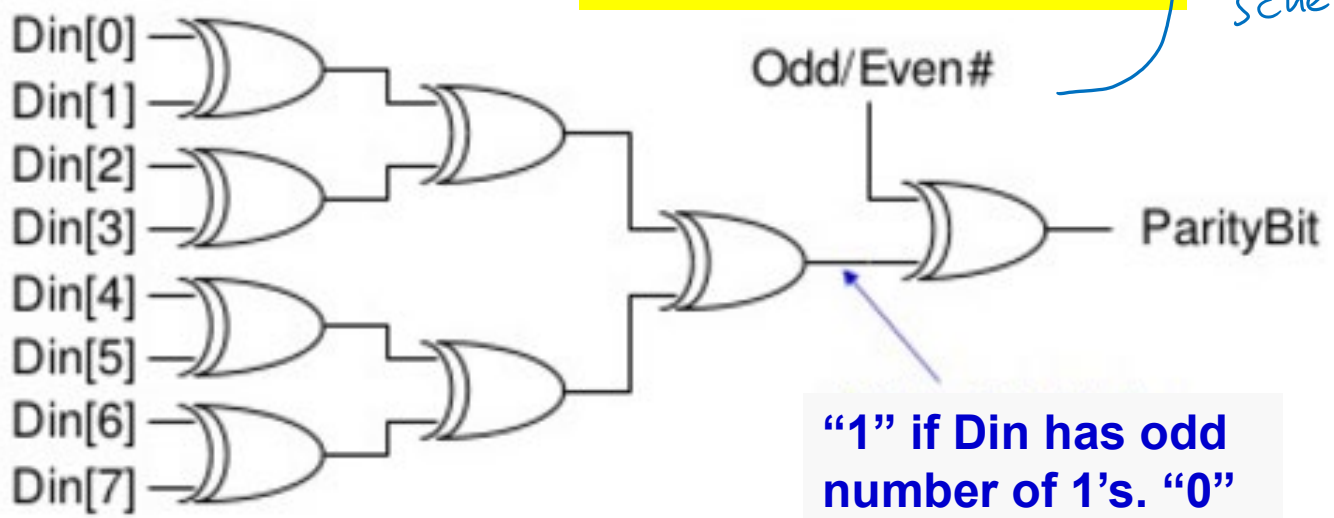
C. 8

D. 10

An 8-Bit Parity Generator

select parity scheme

1: Odd / 0: Even



"1" if Din has odd number of 1's. "0" otherwise.

For 7-bit parity, tie Din[7] to a '0'

Re-write the following in hexadecimal:

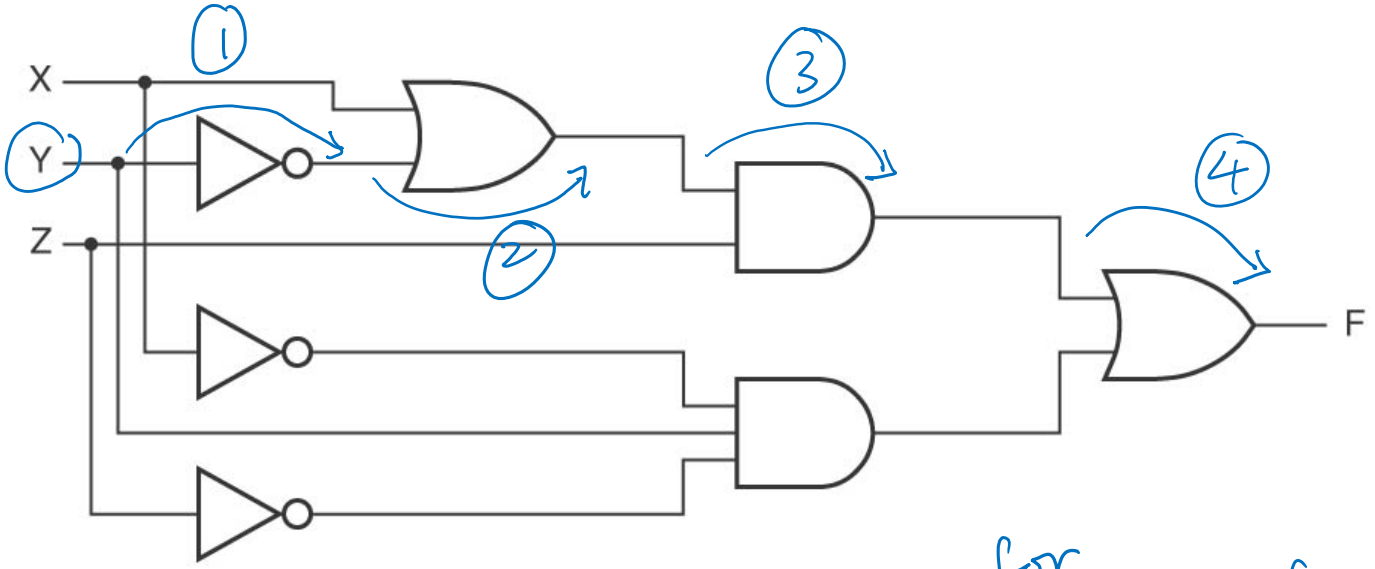
9(dec) + 7(dec) = 16(dec)

9h + 7h = 10h

21(dec) + 7(dec) = 28(dec)

15h + 7h = 1Ch

How many units of gate delay in total?



look for longest path from input to output

A. 4

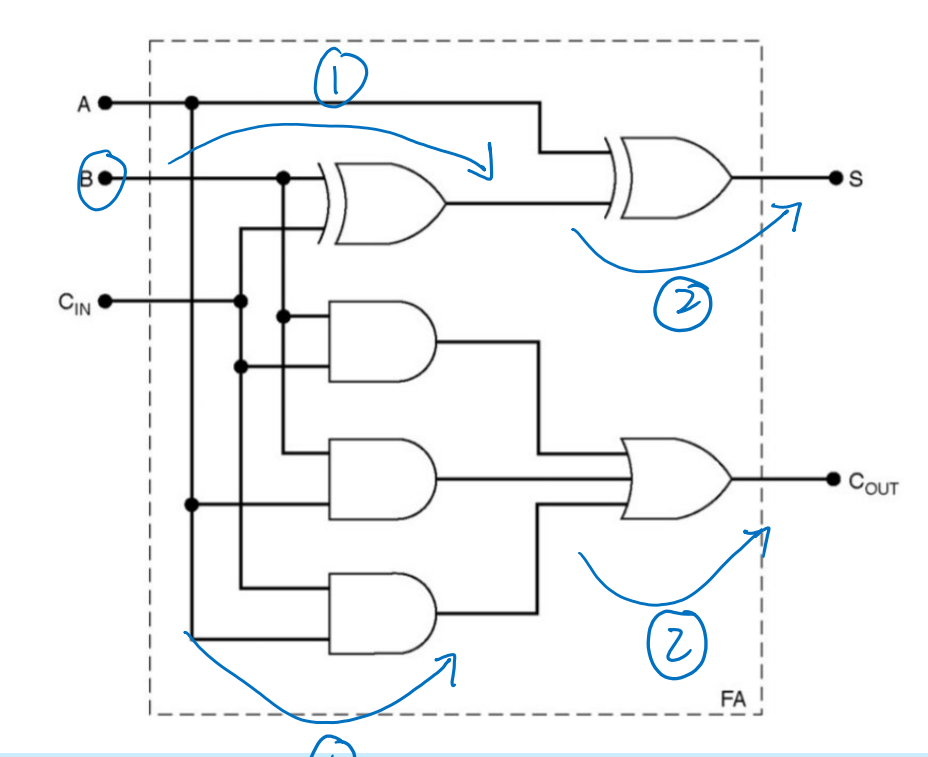
B. 5

C. 6

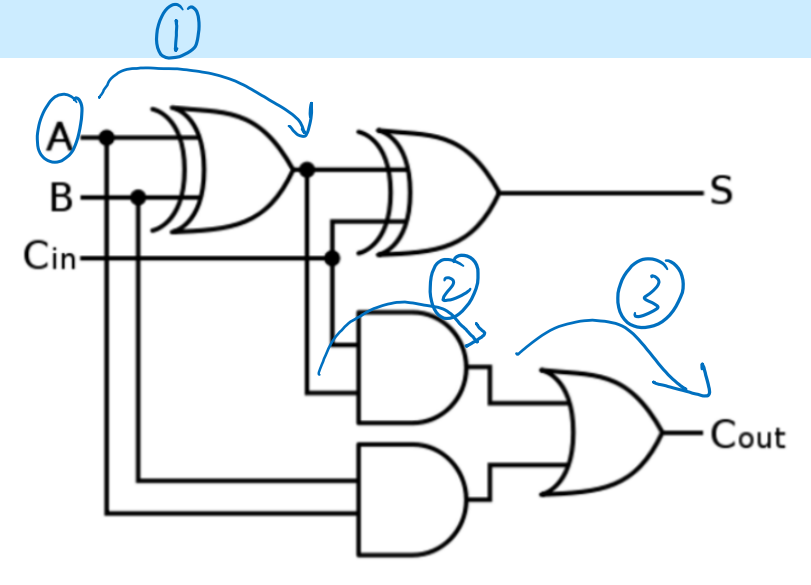
D. 7

Both are full adders

t_{pd} = 2 units



t_{pd} = 3 units



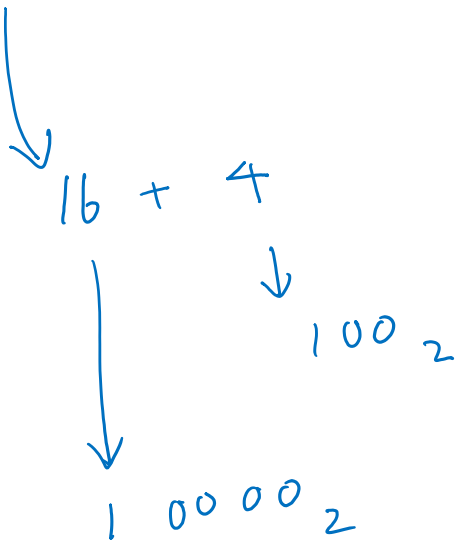
Give the sign-magnitude/2's complement representation of +20 (dec):

A. 1 0 1 0 0

B. 0 1 1 0 0

C. 0 1 0 1 0 0 ✓

D. 1 0 1 1 0 0



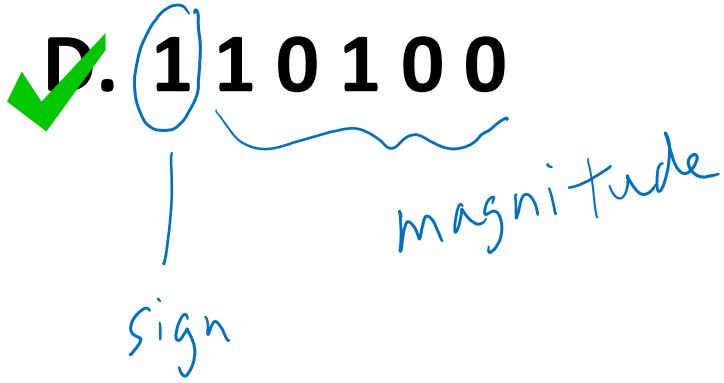
Give the sign-magnitude representation of -20 (dec):

A. 1 0 1 0 0

B. 0 1 1 0 0

C. 1 0 1 1 0 0

D. 1 1 0 1 0 0



Give the 2's complement representation of -20 (dec):

A. 1 0 1 0 0

B. 0 1 1 0 0

C. 1 0 1 1 0 0

D. 1 1 0 1 0 0

10100

↓ 2's comp

1 01100

↑ sign bit has value of $-(2)^5 = -32_{10}$

$1100_2 = 12_{10}$

$-32_{10} + 12_{10} = -20_{10}$