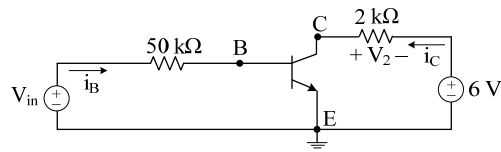


Problem 2 (20 points) Consider the common emitter circuit below.



$\beta = 100$
 $V_{BEON} = 0.7 \text{ V}$
 $V_{CESAT} = 0.2 \text{ V}$

(a) [3 pts.] Using KVL, give an expression for V_2 as a function of V_{CE} .

$$V_2 = \boxed{}$$

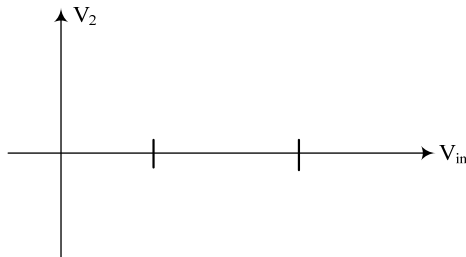
(b) [3 pts.] Using Ohm's law, give an expression for V_2 as a function of i_C .

$$V_2 = \boxed{}$$

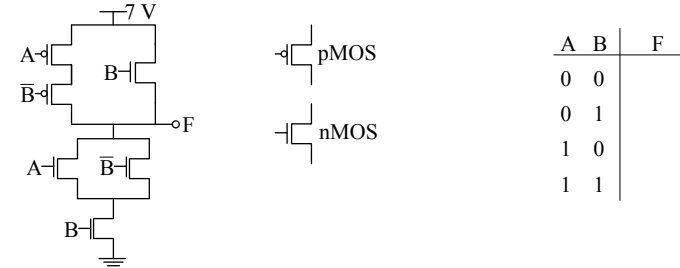
(c) [8 pts.] For all possible states of the transistor, give an expression for V_2 as a function of V_{in} . Explain and clearly justify all three parts.

BJT state	Off	Active	Saturated
$V_2 =$			

(d) [6 pts.] Draw V_2 versus V_{in} for $V_{in} \geq 0$; use results in (c). Clearly label all relevant values.



Problem 3 (10 points) Consider the CMOS circuit below.

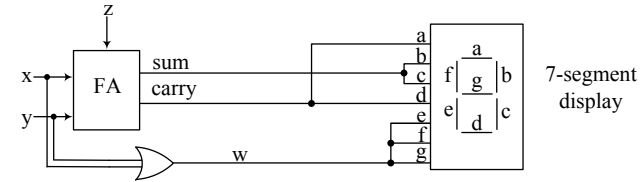


A	B	F
0	0	
0	1	
1	0	
1	1	

(a) [8 pts.] Fill in the truth table for F. Show your work.

(b) [2 pts.] What gate does the circuit implement?

Problem 4 (15 points)



For $z = 0$, fill out the table below

x	y	sum	carry	w	displayed
0	0				
0	1				
1	0				
1	1				

Problem 6 (10 points)

Check the one correct answer for all questions below (no need to show work). Assume the positive number system seen in class.

a) For $x = (101101)_2$

$x < 64$

$63 < x < 128$

$x > 127$

b) If $x = (AD1)_{16}$ and $y = (AC3)_{16}$

$x < y$

$x = y$

$x > y$

c) For $x = (10110)_2$ and $y = (011)_2$

$x + y < 24$

$x + y = 24$

$x + y > 24$

d) If $x = (2ACF)_{16}$

x is even

x is odd

cannot tell

e) If $x = (3214)_5$

$x < 5^3$

$5^3 - 1 < x < 5^4$

$x > 5^4 - 1$