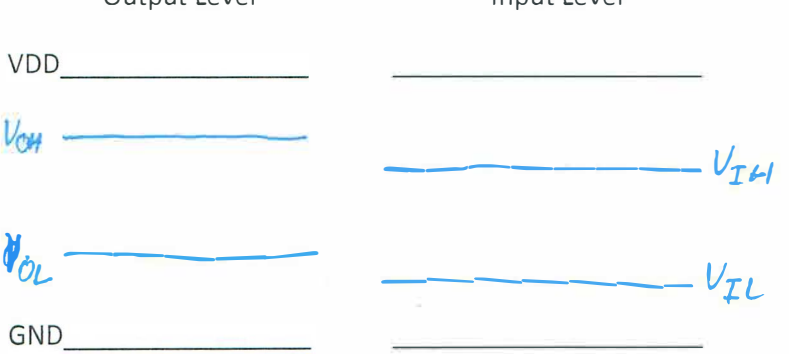
Name Answers

CE-1901-11 – Dr. Durant – Quiz 3
Winter 2016-'17, Week 3

1. (2 points) On the diagram below, **illustrate** values of V_{OH}, V_{IH}, V_{OL}, and V_{IL} that would allow logic 1 to be transmitted ***correctly*** but where logic 0 might ***not be transmitted correctly*** even when there is no noise.



$V_{IH} < V_{OH}$ has (positive) noise margin → can tolerate some noise in logic!

$V_{IL} < V_{OL}$ is a problem. transmitted V_{OL} (w/o noise) is received in unknown/forbidden region, $V_{IL} < x < V_{IH}$

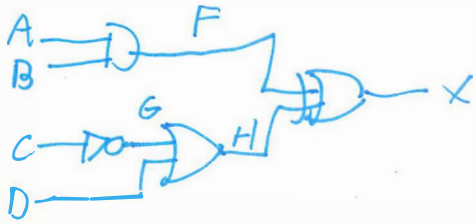
2. (2 points) ***State and explain why either*** a (relatively) positive or negative charge must be present at the gate of an PMOS transistor (specifically, a p-channel enhancement mode MOSFET [metal-oxide-semiconductor field-effect transistor]) in order for current to be ***allowed to flow*** between the drain and the source.

negative charge repels electrons from channel region

so, channel has electron vacancies in silicon lattice. These vacancies ("holes") are the specified (p = positive) charge carrier for a PMOS transistor, so current can flow between D & S.

3. (3 points) Draw the **gate diagram** for X = (AB) ⊕ (C' + D).

(-3/4) NOR vs. XOR



4. (3 points) **Complete** the truth table for the above function, including **all** intermediate terms. Be sure to clearly label all terms (some columns are labeled to get you started; you might not need all columns).

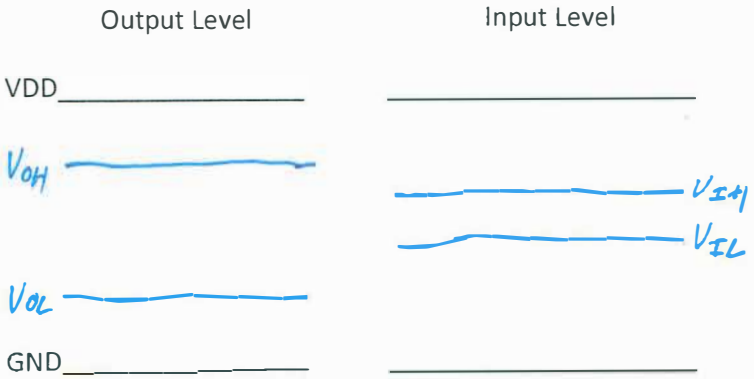
ABCD	F = AB	G = $\overline{C}$	H = GD	H = G+D		X = F⊕H
0000	0	1	0	1		1
0001	0	1	1	1		1
0010	0	0	0	0		0
0011	0	0	0	1		1
0100	0	1	0	1		1
0101	0	1	1	1		1
0110	0	0	0	0		0
0111	0	0	0	1		1
1000	0	1	0	1		1
1001	0	1	1	1		1
1010	0	0	0	0		0
1011	0	0	0	1		1
1100	1	1	0	1		0
1101	1	1	1	1		0
1110	1	0	0	0		1
1111	1	0	0	1		0

(-1/2) forgot this column, only

Name Answers

CE-1901-12 – Dr. Durant – Quiz 3
Winter 2016-'17, Week 3

1. (2 points) On the diagram below, **illustrate** values of V_{OH}, V_{IH}, V_{OL}, and V_{IL} that would enable proper operation.

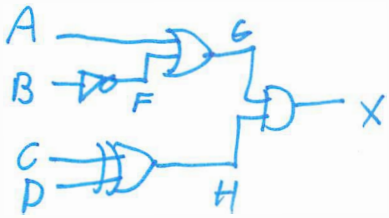


Must have: $V_{IH} < V_{OH}$
$V_{IL} > V_{OL}$
to have (positive) noise margin

2. (2 points) ***State and explain why either*** a (relatively) positive or negative charge must be present at the gate of an NMOS transistor (specifically, an n-channel enhancement mode MOSFET [metal-oxide-semiconductor field-effect transistor]) in order for current to be ***blocked*** ("cutoff") between the drain and the source.

– charge @ gate repels electrons (e^-) from channel region
so, not enough carriers in channel to conduct current

3. (3 points) Draw the **gate diagram** for X = (A + B') (C ⊕ D).



4. (3 points) **Complete** the truth table for the above function, including **all** intermediate terms. Be sure to clearly label all terms (some columns are labeled to get you started; you might not need all columns) .

ABCD	B' = F	G = A+F	H = C⊕D			X = G·H
0000	1	1	0			0
0001	1	1	1			1
0010	1	1	1			1
0011	1	1	0			0
0100	0	0	0			0
0101	0	0	1			0
0110	0	0	1			0
0111	0	0	0			0
1000	1	1	0			0
1001	1	1	1			1
1010	1	1	1			1
1011	1	1	0			0
1100	0	1	0			0
1101	0	1	1			1
1110	0	1	1			1
1111	0	1	0			0