EECS 16B Designing Information Devices and Systems II
Spring 2021 Discussion Worksheet Discussion 9A

This is a review session consisting of past 16B exam problems to help you review for the midterm exam tonight.

1. Transfer Function Analysis (Fa20 MT1, Q11)

This question was presented in the form of multiple-choice and True or False; it has been adapted to mimic a format closer to this year's exam.

You are given the following transfer function:

$$H(\omega) = \frac{1}{10} \frac{\left(1 + \frac{j\omega}{100}\right)(1 + j\omega \cdot 10)}{\left(1 + \frac{j\omega}{1000}\right)(1 + j\omega)} \tag{1}$$

(a) What is the magnitude of eq. (1), $|H(\omega)|$, as $\omega \to 0$?

(b) What is $|H(\omega)|$ as $\omega \to \infty$?

(c) Now, suppose we are working with the modified transfer function below.

$$H_M(\omega) = 10\frac{(1+j\omega\cdot 10)}{(1+j\omega)} \tag{2}$$

Construct the Phase Bode Plot of this transfer function. Be sure to convert the transfer function to its rational form for easy inspection of the poles and zeros. Use it to estimate the phase of the transfer function, $\measuredangle H(\omega)$, at $\omega_1 = 1$ and $\omega_2 = 100$.

(d) Now, compose the Bode Plot Approximation for the magnitude of the transfer function, $|H_M(\omega)|$. Use the rational form derived above.

2. CMOS Circuits (Sp20, MT1, Q1)

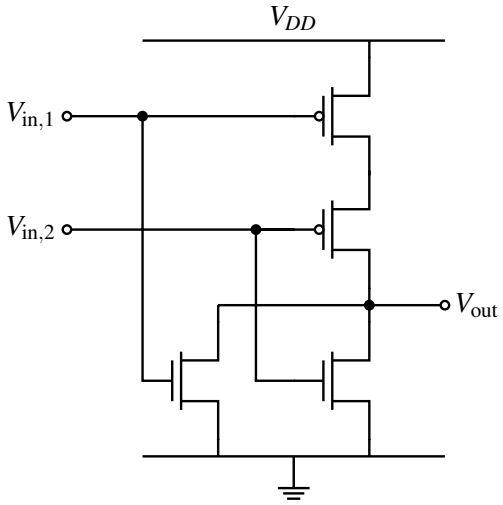

Figure 1: CMOS circuit

Consider the CMOS circuit of Figure 1. For each of the sets of $V_{\text{in},1}$ and $V_{\text{in},2}$ in the table below, fill in the corresponding voltage of the output V_{out}. You may assume that the threshold voltages for the transistors are $0 < V_{tn} < V_{DD}$ and $0 < |V_{tp}| < V_{DD}$.

$V_{\text{in},1}$	$V_{\text{in},2}$	V_o
0 V	0 V	
V_{DD}	0 V	
0 V	V_{DD}	
V_{DD}	V_{DD}	

3. Simple Differential Equation to Review!

(a) What is the solution $x(t)$ to the following scalar differential equation?

$$\frac{d}{dt}x(t) = 3jx(t) \qquad x(0) = 4$$

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