Given the Boolean expression below (Y is the output), realize a single stage CMOS combinatorial logic circuit by creating complementary pull-down (PDN) and pull-up (PUP) networks.

\[ Y = A \cdot \overline{B} \cdot (\overline{C} + D \cdot E) \]
Find the input to output transfer function $H(s)$. Ignore all intrinsic capacitances.
For the linear oscillator circuit shown below, find the oscillation frequency and $g_m$ value required to ensure oscillation.
Given the Boolean expression below (Y is the output), realize a single stage CMOS combinatorial logic circuit by creating complementary pull-down (PDN) and pull-up (PUP) networks.

\[ Y = (A + B) \cdot (\overline{C} + D) \]
Find the small-signal Norton-equivalent $G_m$ and $R_{out}$ (without the influence of $C_1$). With $C_1$, find the small-signal input-to-output transfer function $H(s)$. 
Find the small-signal gain and the upper 3dB frequency $\omega_H$. 

![Circuit Diagram]

Vin
R1
Q1
R2
Q2
R3
Vout
Vdd
R4
For the linear oscillator circuit shown below, find the oscillation frequency and resistor value $R_2$ required to ensure oscillation.
For the Schmitt trigger (bistable circuit) shown below, sketch the $V_{in}$ versus $V_{out}$ transfer function. Be sure to note the important data points in the sketch. The opamp is ideal with $\pm 5$V limited output swing.