Quiz #2

(to be included as Appendix Q2 in Final Write-up)

In class using materials from both the text (HO#23) and the Gray and Meyer text (HO#24) we have considered noise and circuit-level impact on MDS and NF. In particular, in class it was shown that by adding the feedback resistor to the simple circuit shown in Figure 11.18 (HO#24) that the following equation is modified as shown below: (11.38)

$$\frac{v_o^{\ 2}}{\Delta f} = g_m^2 R_L^2 \frac{r_p^2}{\left(r_p + R_S + r_b\right)^2}\left[\frac{1}{1=\left(\frac{f}{f_1}\right)^2}\right]\left[4kT\left(R_S + r_b\right)\left(1+\frac{R_s + r_b}{R_f}\right)+\left(R_S + r_b\right)^2 2qI_B\right]$$

$$+R_L^2\left(4kT\frac{1}{R_f \parallel R_L}+2qI_C\right)$$

Basically, there are two terms that have been changed. In class (HO#28) the SPICE results for the basic LNA topology used in Lab #1 were also discussed, along with suggestions about improvements to the design in order to achieve stability (per the "K" factor discussed in HO#27).

With this background, and as you work to improve your LNA (whether you use the topology from Lab #1 or any others you find appropriate), in the final lab write-up the following information (and discussion) is to be included in an Appendix Q2:

- SPICE results for your final LNA design including:
  - Gain-bandwidth
  - Noise data (both $v_o^{\ 2}$ and NF)
- Hand calculations (using eqn. 11.38) showing which components of noise are dominant for your design values
- Critical discussion of how much the LNA versus other blocks contributes to your MDS. (Hint: HO#22 and the discussion regarding Razavi Figure 6.35 is a very detailed analysis. You might start with a two-stage consideration based on the NF values for the next-stage multiplier that is after the LNA)