

List of commonly missed points has been updated today

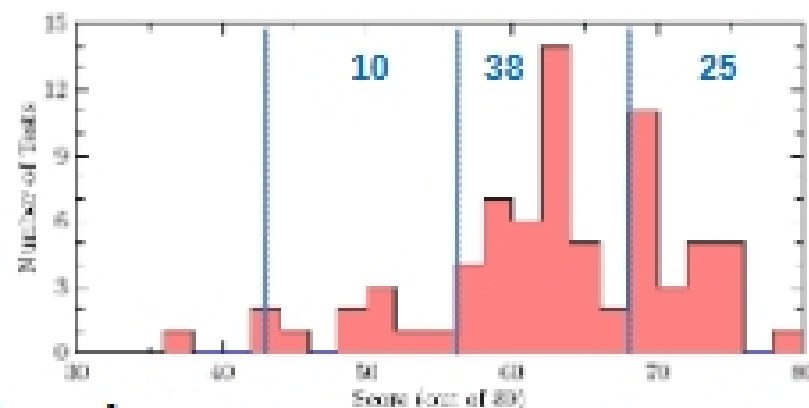
HW#8 will be posted tonight.

# Lecture 14

Grading guidelines are posted

## ANNOUNCEMENTS

- Midterm #1 results (undergrad. scores only):
  - N=74; mean=62.8; median=63; std.dev.=8.42
- You may pick up your exam during any TA office hour.
  - Regrade requests must be made *before* you leave with your exam.
- The list of misunderstood/forgotten points has been updated.

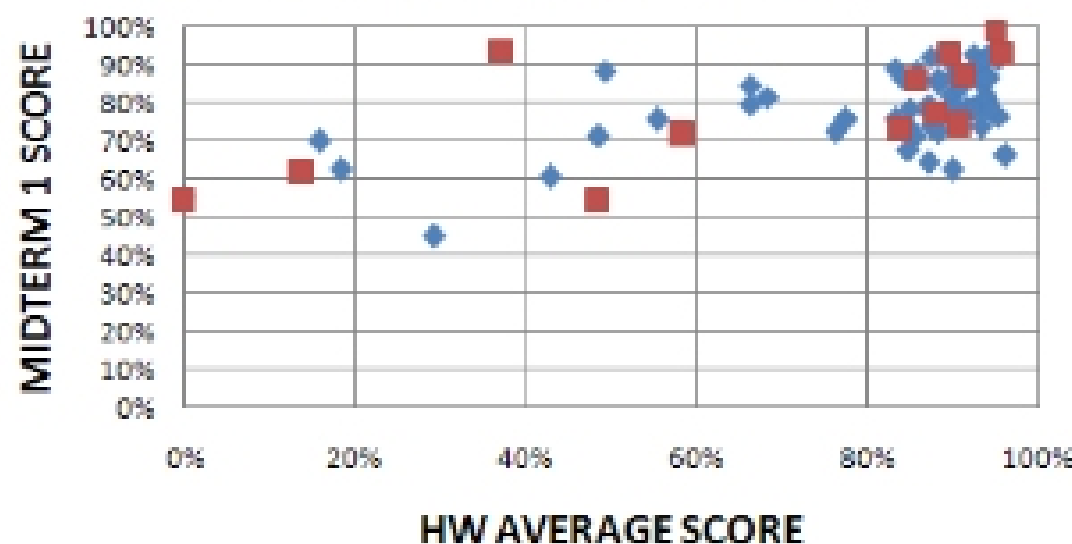


## OUTLINE

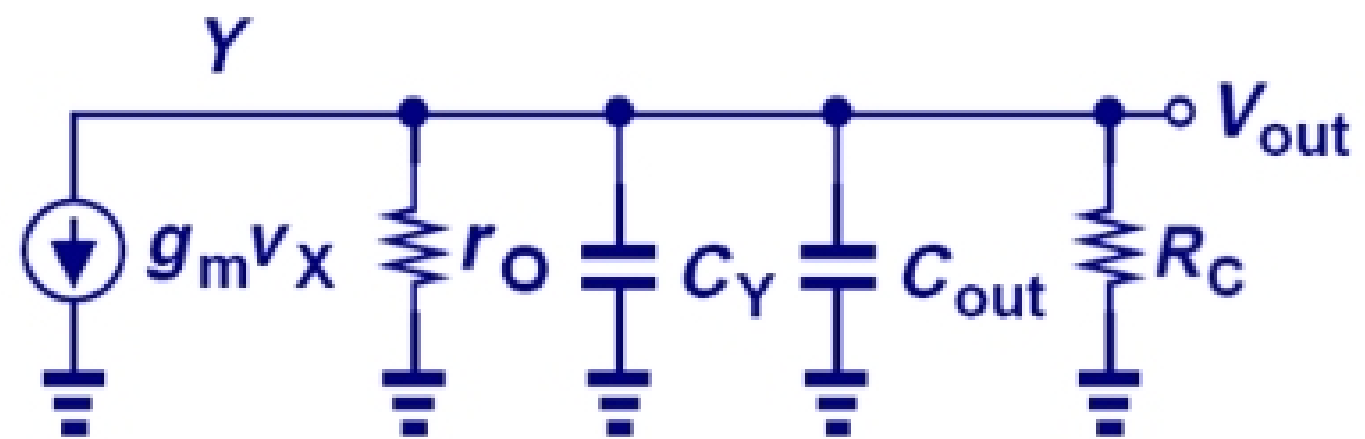
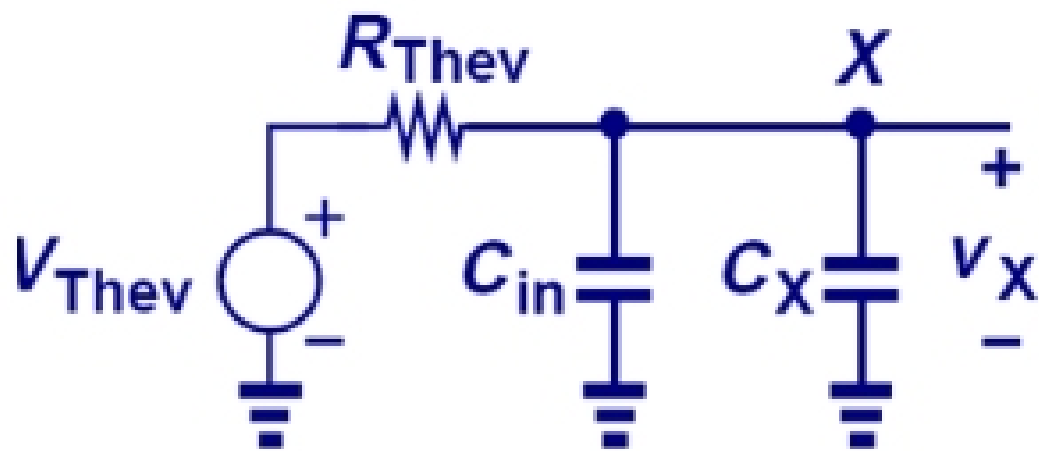
- Frequency Response (cont'd)
  - CE stage (final comments)
  - CB stage
  - Emitter follower
  - Cascode stage

Reading: Chapter 11.4-11.6

CORRELATION BETWEEN MT & HW SCORES



# CE Stage Pole Frequencies, for $V_A < \infty$



$$V_{\text{Thev}} = V_{\text{in}} \frac{r_{\pi}}{r_{\pi} + R_S}$$

$$R_{\text{Thev}} = R_S \parallel r_{\pi}$$

$$C_X = C_{\mu} (1 + g_m (R_C \parallel r_o))$$

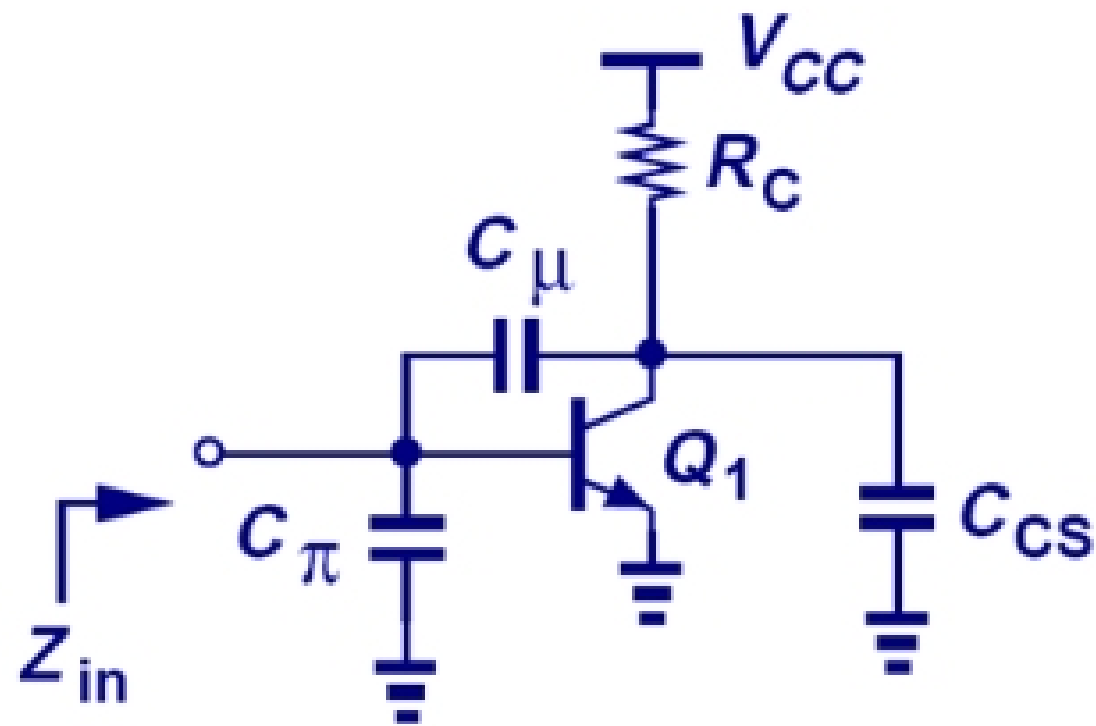
$$C_Y = C_{\mu} \left( 1 + \frac{1}{g_m (R_C \parallel r_o)} \right)$$

$$\omega_{p,\text{in}} \approx \frac{1}{R_{\text{Thev}} \left( C_{\text{in}} + (1 + g_m (R_C \parallel r_o)) C_{\mu} \right)}$$

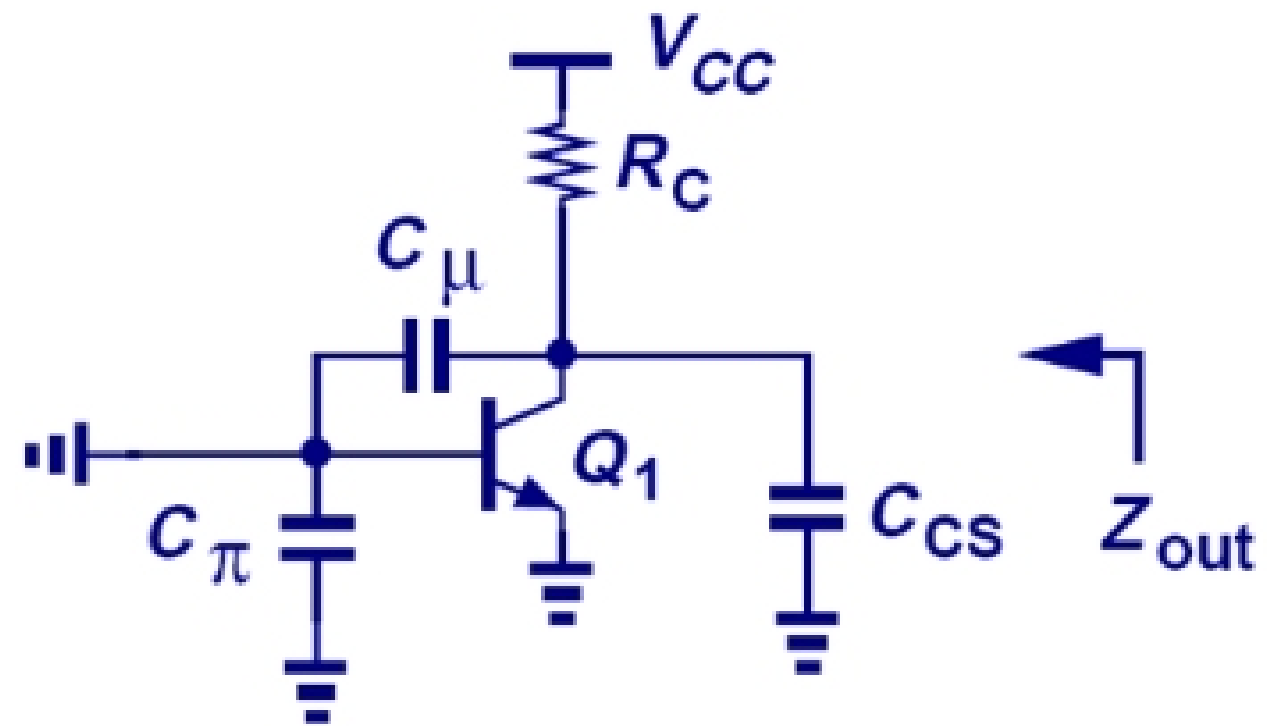
$$\omega_{p,\text{out}} \approx \frac{1}{\left( R_C \parallel r_o \right) \parallel C_{\text{out}} + \left[ 1 + \frac{1}{g_m (R_C \parallel r_o)} \right] \parallel C_{\mu}}$$

Note that  $\omega_{p,\text{out}} > \omega_{p,\text{in}}$

# I/O Impedances of CE Stage



$$Z_{in} \approx \frac{1}{j\omega \left[ C_{\pi} + (1 + g_m (R_C \parallel r_o)) C_{\mu} \right]} \parallel r_{\pi}$$



$$Z_{out} = \frac{1}{j\omega [C_{\mu} + C_{CS}]} \parallel R_C \parallel r_o$$