How to come up with an appropriate pMOS circuit?

• Design a suitable analog or digital circuit with less than 30 transistors
  – Combine some basic digital and/or analog circuits into a more complex circuit with a useful function.

• Alternatively, find an appropriate circuit in a circuits book or digital logic book.
  – Stay away from dynamic circuits or complex analog circuits.
  – Convert it to a pMOS circuit with enhancement loads
Conversion to pMOS circuits

• Bipolar circuits
  – Replace all npn with nMOSFET, all pnp with pMOSFET. Then follow CMOS instructions

• CMOS circuits
  – Replace all pMOSFETs with n-type enhancement loads. Some additional changes might be necessary

• nMOS circuits
  – Replace all load devices (depletion load or other) with n-type enhancement loads.

This procedure results in an nMOS circuit. Replace now all nMOS devices with pMOS devices.
Basic Logic Gates

**Inverter**

Enhancement load

**2-input NOR gate**

**2-input NAND gate**
Other Logic Gates

3-input NOR gate

4-input NOR gate

3-input NAND gate

4-input NAND gate
Basic Memory Circuits

- flip-flop
- 6-transistor SRAM cell
- RS flip-flop

6-transistor SRAM cell
Analog Circuits: An Example

Operational Amplifier

Current mirror  Differential amplifier  Source follower  Inverter  Output stage