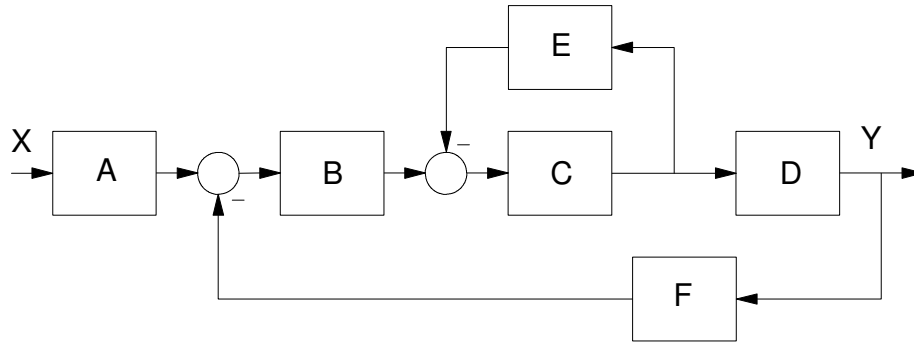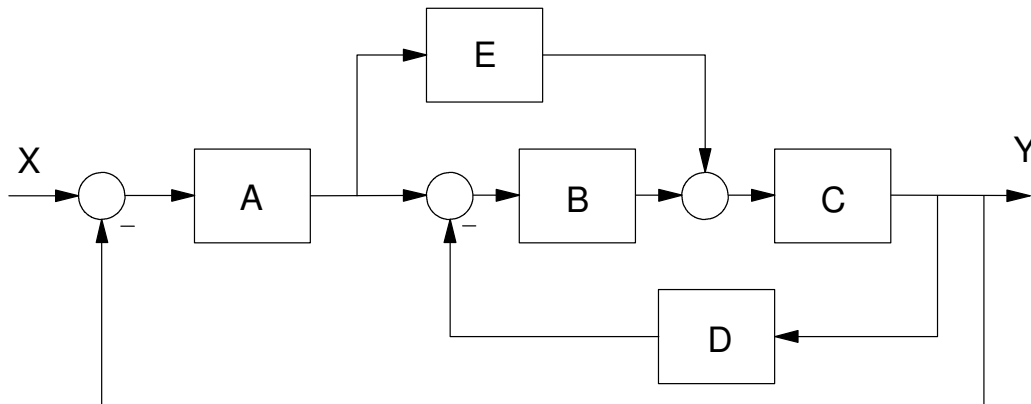# ECE 461/661 Handout #12

Block Diagrams

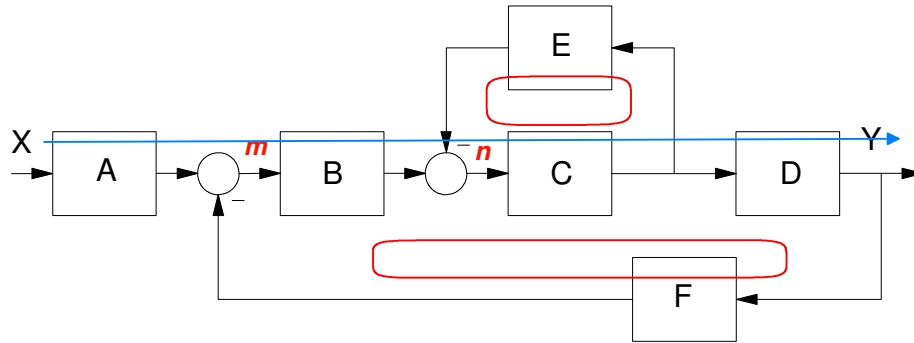1) Find the transfer function from X to Y

2) Find the transfer funciton from X to Y

Block Diagrams

Handout for Lecture #12, ECE 461/661

1) Find the transfer function from X to Y

Option #1: Shortcut

$$Y = \left(\frac{ABCD}{1+CE+BCDF} \right) X$$

Option #1: Algebra.

- Define the output of each summing junction
- Write the equations

$$m = AX - FY$$

$$Y = DCn$$

$$n = Bm - ECn$$

Solve

$$n = \left(\frac{B}{1+EC} \right) m$$

$$Y = \left(\frac{DCB}{1+EC} \right) m$$

$$\left(\frac{1+EC}{DCB} \right) Y = AX - FY$$
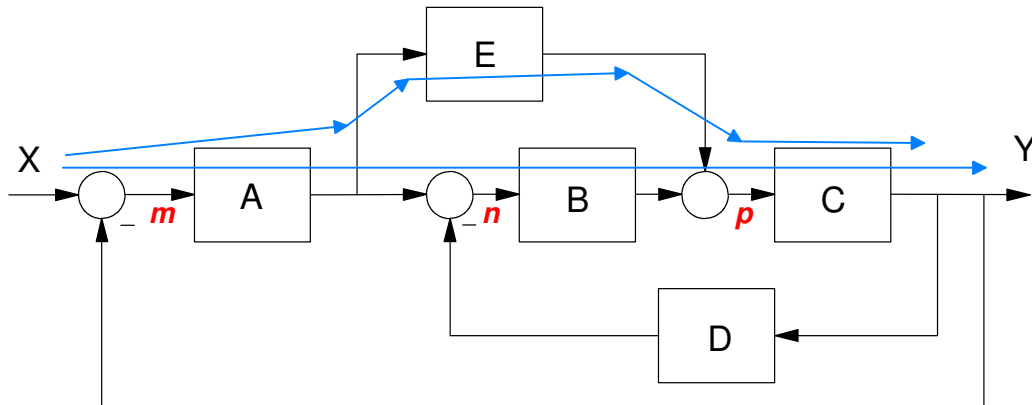
$$(1 + EC)Y = DCB(AX - FY)$$

$$(1 + EC + DCBF)Y = (DCBA)X$$

$$Y = \left(\frac{DCBA}{1+EC+DCBF} \right) X$$

Block Diagrams

2) Find the transfer funciton from X to Y

Shortcut:

$$Y = \left(\frac{ABC+AEC}{1+BCD+ABC+AEC} \right) X$$

Long solution (algebra)

$$m = X - Y$$

$$Y = Cp$$

$$p = EAm + Bn$$

$$n = Am - DCp$$

Solving

$$p = EAm + B(Am - DCp)$$

$$(1 + BDC)p = (EA + BA)m$$

$$p = \left(\frac{EA+BA}{1+BDC} \right) m = \left(\frac{EA+BA}{1+BDC} \right)(X - Y)$$

$$Y = Cp = C\left(\frac{EA+BA}{1+BDC} \right)(X - Y)$$

$$(1 + BDC)Y = C(EA + BA)(X - Y)$$

$$(1 + BDC + CBA + CEA)Y = (CEA + CBA)X$$

$$Y = \left(\frac{CEA+CBA}{1+BDC+CBA+CEA} \right) X$$