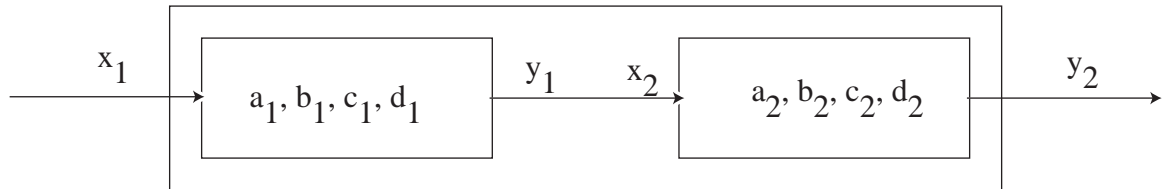


## EECS20n, Quiz 4, 03/19/04

Last Name \_\_\_\_\_ First \_\_\_\_\_ Lab time \_\_\_\_\_

1. **10 points** Two linear systems are combined in a cascade composition as shown below:

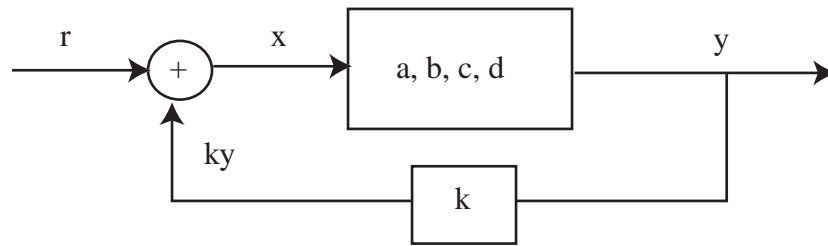


The two systems, indexed  $i = 1, 2$ , are 1-dimensional with scalar input  $x_i$ , scalar output  $y_i$ , initial state  $s_i(0)$  and update equations:

$$\begin{aligned} s_i(n+1) &= a_i s_i(n) + b_i x_i(n) \\ y_i(n) &= c_i s_i(n) + d_i x_i(n) \end{aligned}$$

The cascade composition means that  $x_2 = y_1$ . Write down the state, initial state, and update equations for the composite system.

2. **10 points** A 1-dimensional system with scalar input  $x$ , scalar output  $y$ , state  $s$ , is put in feedback composition with input  $r$  and output  $y$  as shown below:



What are the state and the update equations for the feedback composition?