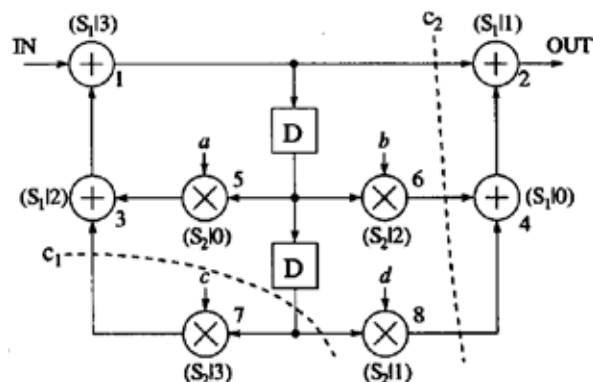**CSE4210 Architecture & Hardware for DSP**

Chapter 8

Activities

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Activity 1

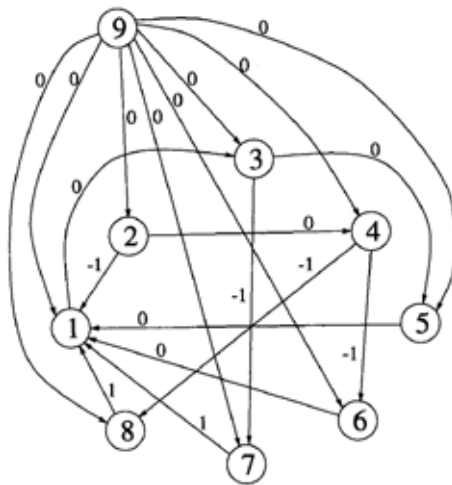Given the biquad filter below, (1) find folding equations, (2) can it be folded? If not, retiming it.

Activity 1 Solution

$$D_F(U \xrightarrow{\ e\ } V) = Nw(e) - P_u + v - u \qquad r(U) - r(V) \leq \left\lceil \frac{D_F(U \xrightarrow{\ e\ } V)}{N} \right\rceil$$

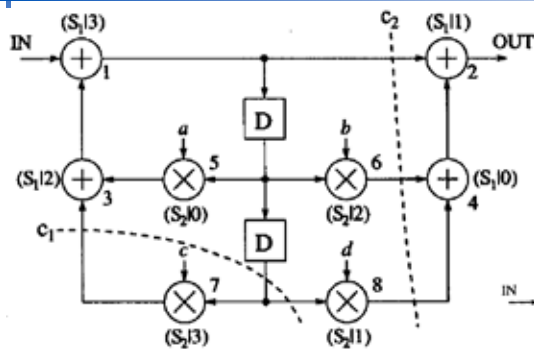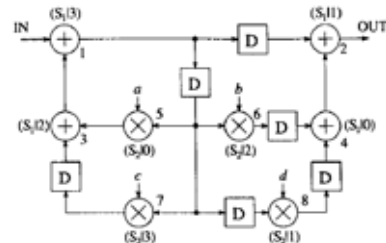| Edge	Folding Equation	Retiming for Folding Constraint
$1 \to 2$	$D_F(1 \to 2) = -3$	$r(1) - r(2) \leq -1$
$1 \to 5$	$D_F(1 \to 5) = 0$	$r(1) - r(5) \leq 0$
$1 \to 6$	$D_F(1 \to 6) = 2$	$r(1) - r(6) \leq 0$
$1 \to 7$	$D_F(1 \to 7) = 7$	$r(1) - r(7) \leq 1$
$1 \to 8$	$D_F(1 \to 8) = 5$	$r(1) - r(8) \leq 1$
$3 \to 1$	$D_F(3 \to 1) = 0$	$r(3) - r(1) \leq 0$
$4 \to 2$	$D_F(4 \to 2) = 0$	$r(4) - r(2) \leq 0$
$5 \to 3$	$D_F(5 \to 3) = 0$	$r(5) - r(3) \leq 0$
$6 \to 4$	$D_F(6 \to 4) = -4$	$r(6) - r(4) \leq -1$
$7 \to 3$	$D_F(7 \to 3) = -3$	$r(7) - r(3) \leq -1$
$8 \to 4$	$D_F(8 \to 4) = -3$	$r(8) - r(4) \leq -1$

Activity 1 Solution

Activity 1 Solution

- One solution is found from the constraint graph using Bellman-Ford Algorithm
- r(1)=-1 r(2)=0   r(3)=-1   r(4)=0
- r(5)=-1   r(6)=-1   r(7)=-2   r(8)=-2

Activity 1 Solution
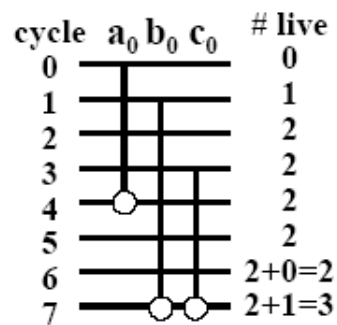

r(1)=-1 r(2)=0   r(3)=-1   r(4)=0
r(5)=-1   r(6)=-1   r(7)=-2   r(8)=-2

Retimed DFG

Activity 2

Given the linear lifetime chart below, (1) derive the data allocation using forward-backward register allocation; (2) synthesis the architecture.

Activity 2 Solution