

Binary coded DFCU (n=2)

Valve 1 flow rate is 1Q, Valve 2 flow rate is 2Q

Delay needed for the smallest valve **ONLY**, which is **Valve 1** in this scenario.

In Descending Order								
From Q	To QT	D(S)	From Q	To QT	D(S)	From Q	To QT	D(S)
3	2	NO	2	1	DELAY	1	0	NO
	1	NO		0	NO			
	0	NO						
Total is 1								

In Ascending Order								
From Q	To QT	D(S)	From Q	To QT	D(S)	From Q	To QT	D(S)
0	1	NO	1	2	NO	2	3	NO
	2	NO		3				
	3	NO						
Total is 0								

D(S): Decision whether the Smallest valve ONLY needs a Delay or not when the flow demand shifts from one state to another. QT: Total flow rate at the specified state

Valves	DFCU (n=2)			
V1	0	1	0	1
V2	0	0	1	1
Net Flow	0	1	2	3

Binary coded DFCU (n=3)

Valve 1 flow rate is 1Q, Valve 2 flow rate is 2Q, Valve 3 flow rate is 4Q

Delay needed for the smallest valve **ONLY**, which is **Valve 1** in this scenario.

In Descending Order											
From QT	To QT	D(S)	From QT	To QT	D(S)	From QT	To QT	D(S)	From QT	To QT	D(S)
7	6	NO	6	5	DELAY	5	4	NO	4	3	DELAY
	5	NO		4	NO		3	NO			
	4	NO		3	DELAY		2	NO			
	3	NO		2	NO		1	DELAY			
	2	NO		1	DELAY		0	NO			
	1	NO		0	NO						
	0	NO									
3	2	NO	2	1	DELAY	1	0	NO			
	1	NO		0	NO						
	0	NO									
Total is 6											

In Ascending order											
From QT	To QT	D(S)	From QT	To QT	D(S)	From QT	To QT	D(S)	From QT	To QT	D(S)
0	1	NO	1	2	NO	2	3	NO	3	4	NO
	2	NO		3	NO		4	NO			
	3	NO		4	NO		5	DELAY			
	4	NO		5	NO		6	NO			
	5	NO		6	NO		7	NO			
	6	NO		7	NO						
	7	NO									
4	5	NO	5	6	NO	6	7	NO			
	6	NO		7	NO						
	7	NO									
Total is 1											

D(S): Decision whether the Smallest valve ONLY needs a Delay or not when the flow demand shifts from one state to another.
 QT: Total flow rate at the specified state

Valves	DFCU (n=3)							
V1	0	1	0	1	0	1	0	1
V2	0	0	1	1	0	0	1	1
V3	0	0	0	0	1	1	1	1
Net Flow	0	1	2	3	4	5	6	7

Binary coded DFCU (n=4)

Valve 1 flow rate is 1Q, Valve 2 flow rate is 2Q, Valve 3 flow rate is 4Q, Valve 4 flow rate is 8Q

Delay needed for the smallest valve ONLY, which is Valve 1 in this scenario.

In Descending Order											
From QT	To QT	D(S)	From QT	To QT	D(S)	From QT	To QT	D(S)	From QT	To QT	D(S)
15	14	NO	14	13	DELAY	13	12	NO	12	11	DELAY
	13	NO		12	NO		11	NO		10	NO
	12	NO		11	DELAY		10	NO		9	DELAY
	11	NO		10	NO		9	NO		8	NO
	10	NO		9	DELAY		8	NO		7	DELAY
	9	NO		8	NO		7	NO		6	NO
	8	NO		7	DELAY		6	NO		5	DELAY
	7	NO		6	NO		5	NO		4	NO
	6	NO		5	DELAY		4	NO		3	DELAY
	5	NO		4	NO		3	NO		2	NO
	4	NO		3	DELAY		2	NO		1	DELAY
	3	NO		2	NO		1	NO		0	NO
	2	NO		1	DELAY		0	NO			
	1	NO		0	NO						
	0	NO									
	0	NO									
From QT	To QT	D(S)	From QT	To QT	D(S)	From QT	To QT	D(S)	From QT	To QT	D(S)
11	10	NO	10	9	DELAY	9	8	NO	8	7	DELAY
	9	NO		8	NO		7	NO		6	NO
	8	NO		7	DELAY		6	NO		5	DELAY
	7	NO		6	NO		5	NO		4	NO
	6	NO		5	DELAY		4	NO		3	DELAY
	5	NO		4	NO		3	NO		2	NO
	4	NO		3	DELAY		2	NO		1	DELAY
	3	NO		2	NO		1	NO		0	NO
	2	NO		1	DELAY		0	NO			
	1	NO		0	NO						
	0	NO									
From QT	To QT	D(S)	From QT	To QT	D(S)	From QT	To QT	D(S)	From QT	To QT	D(S)
7	6	NO	6	5	DELAY	5	4	NO	4	3	DELAY
	5	NO		4	NO		3	NO		2	NO
	4	NO		3	DELAY		2	NO		1	DELAY
	3	NO		2	NO		1	NO		0	NO
	2	NO		1	DELAY		0	NO			
	1	NO		0	NO						
	0	NO									
From QT	To QT	D(S)	From QT	To QT	D(S)	From QT	To QT	D(S)	From QT	To QT	D(S)
3	2	NO	2	1	DELAY	1	0	NO			
	1	NO		0	NO						
	0	NO									
Total is	28										

In Ascending Order											
From QT	To QT	D(S)	From QT	To QT	D(S)	From QT	To QT	D(S)	From QT	To QT	D(S)
0	1	NO	1	2	NO	2	3	NO	3	4	NO
	2	NO		3	NO		4	NO		5	NO
	3	NO		4	NO		5	NO		6	NO
	4	NO		5	NO		6	NO		7	NO
	5	NO		6	NO		7	NO		8	NO
	6	NO		7	NO		8	NO		9	NO
	7	NO		8	NO		9	NO		10	NO
	8	NO		9	NO		10	NO		11	NO
	9	NO		10	NO		11	NO		12	NO
	10	NO		11	NO		12	NO		13	NO
	11	NO		12	NO		13	NO		14	NO
	12	NO		13	NO		14	NO		15	NO
	13	NO		14	NO		15	NO			
	14	NO		15	NO						
	15	NO									
From QT	To QT	D(S)	From QT	To QT	D(S)	From QT	To QT	D(S)	From QT	To QT	D(S)
4	5	NO	5	6	NO	6	7	NO	7	8	NO
	6	NO		7	NO		8	NO		9	NO
	7	NO		8	NO		9	NO		10	NO
	8	NO		9	NO		10	NO		11	NO
	9	DELAY		10	NO		11	NO		12	NO
	10	NO		11	NO		12	NO		13	NO
	11	DELAY		12	NO		13	NO		14	NO
	12	NO		13	NO		14	NO		15	NO
	13	NO		14	NO		15	NO			
	14	NO		15	NO						
	15	NO									
From QT	To QT	D(S)	From QT	To QT	D(S)	From QT	To QT	D(S)	From QT	To QT	D(S)
8	9	NO	9	10	NO	10	11	NO	11	12	NO
	10	NO		11	NO		12	NO		13	NO
	11	NO		12	NO		13	NO		14	NO
	12	NO		13	NO		14	NO		15	NO
	13	NO		14	NO		15	NO			
	14	NO		15	NO						
	15	NO									
From QT	To QT	D(S)	From QT	To QT	D(S)	From QT	To QT	D(S)	From QT	To QT	D(S)
12	13	NO	13	14	NO	14	15	NO			
	14	NO		15	NO						
	15	NO									
Total is	9										

D(S): Decision whether the Smallest valve ONLY needs a Delay or not when the flow demand shifts from one state to another.
 QT: Total flow rate at the specified state

Valves	DFCU (n=4) Combinations															
V1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
V2	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
V3	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
V4	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
Net Flow	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

