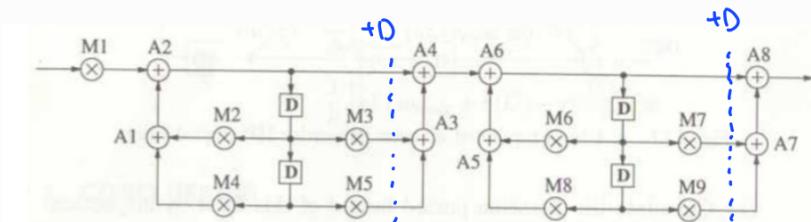


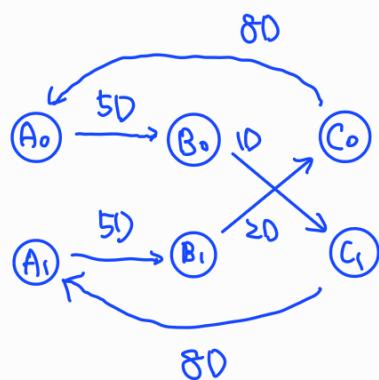
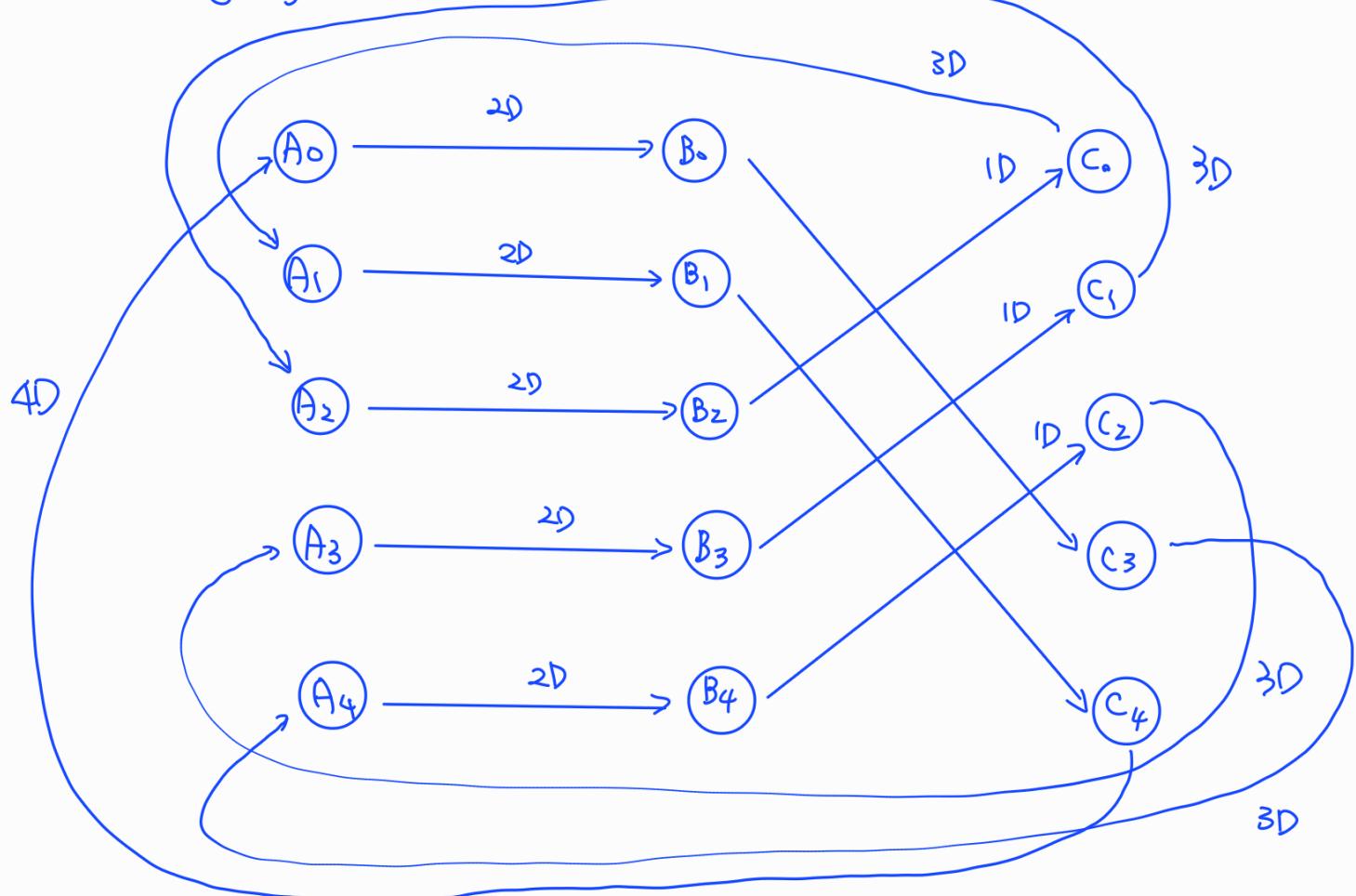
Q1

- (a) critical path: $\left\{ \begin{array}{l} M_4 \rightarrow A_1 \rightarrow A_2 \rightarrow A_4 \rightarrow A_6 \rightarrow A_8 \\ M_2 \rightarrow A_1 \rightarrow A_2 \rightarrow A_4 \rightarrow A_6 \rightarrow A_8 \end{array} \right. \Rightarrow \text{critical path delay} = 7 \text{ u.t.}$
 $\text{iteration bound} = \text{Max} \left\{ \frac{4}{2}, \frac{4}{1}, \frac{4}{2}, \frac{4}{1} \right\} = 4 \text{ u.t.} \#$

(b)

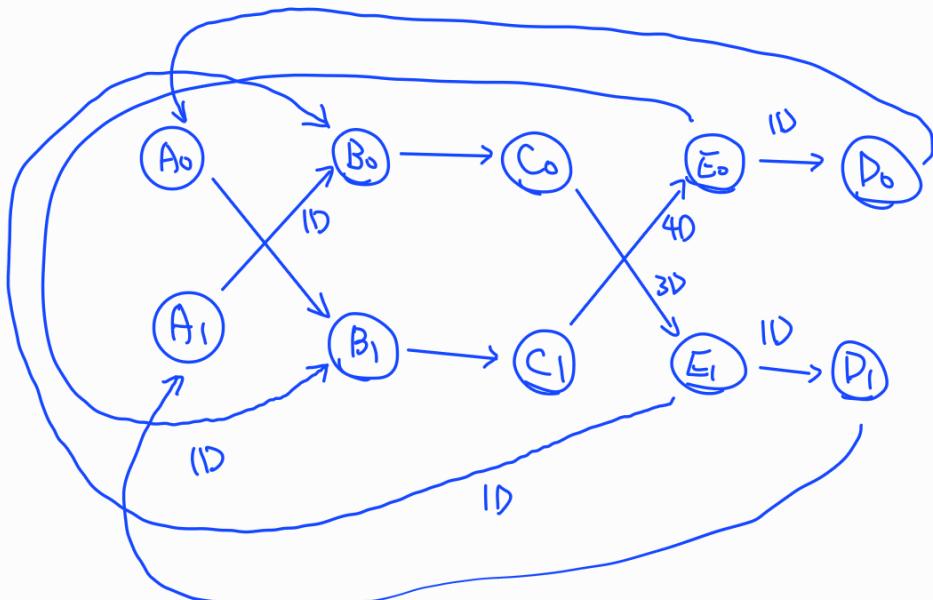


Q2

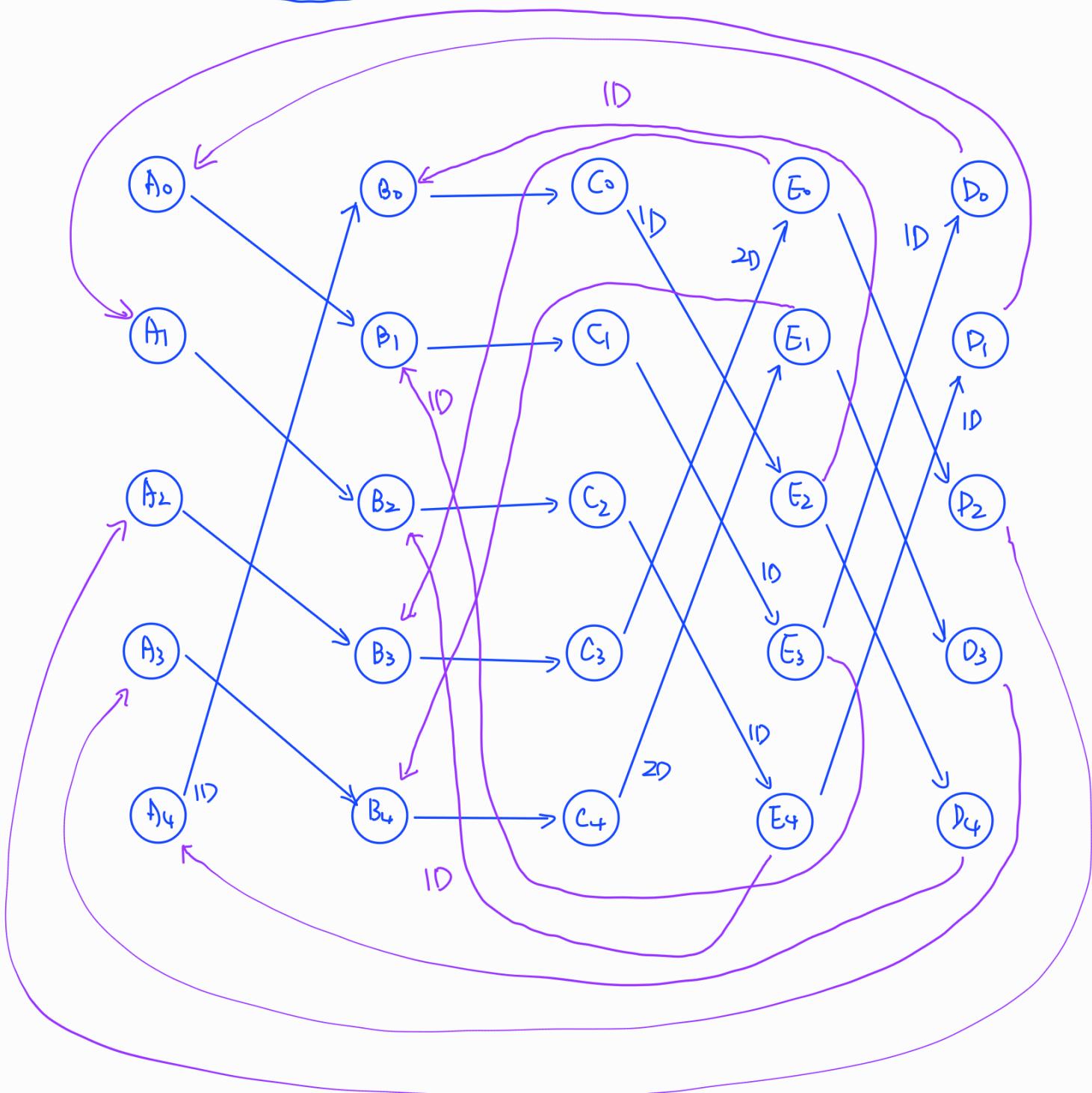
(a) $J=2$  $J=5$ 

(b)

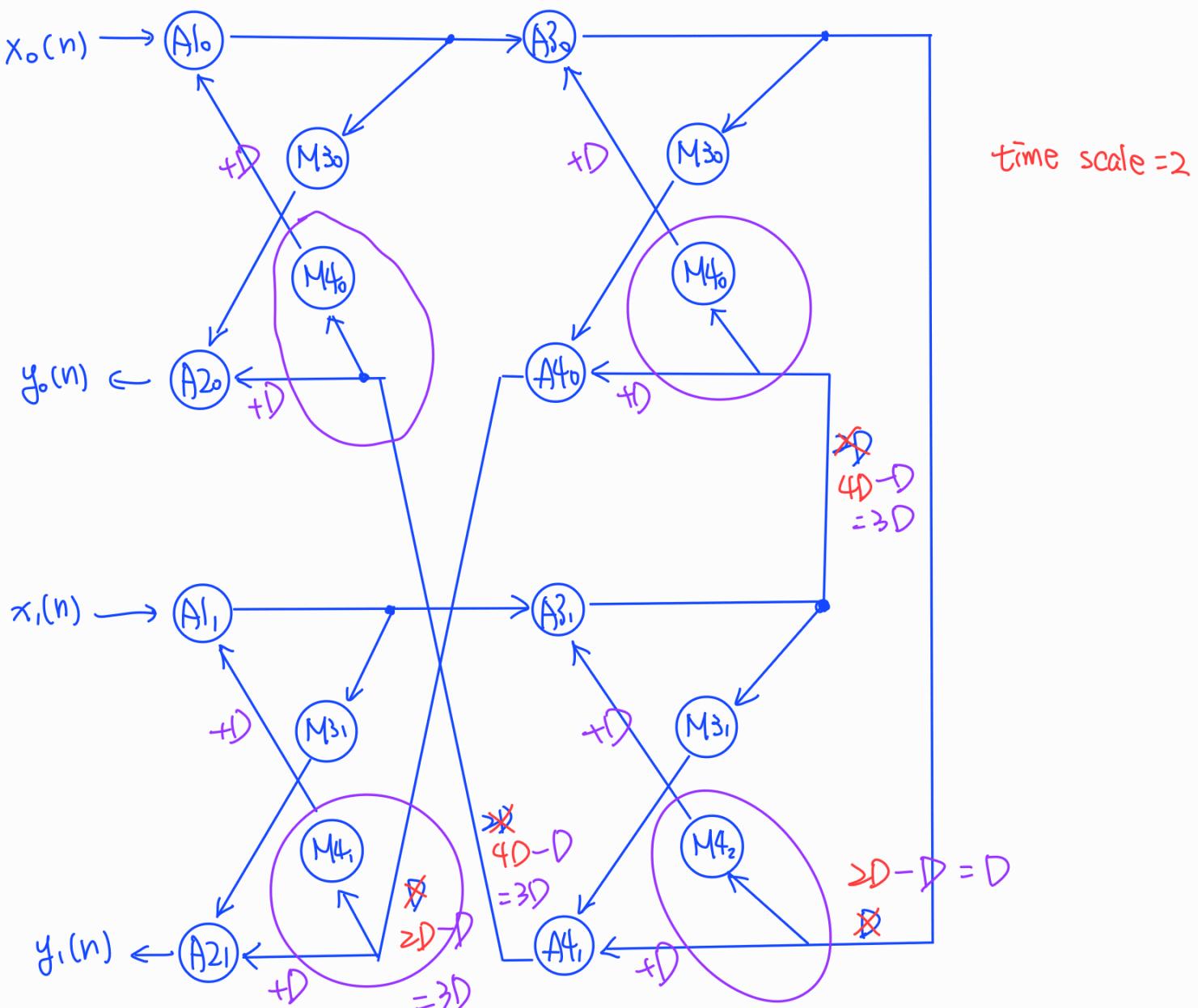
$$J=2$$



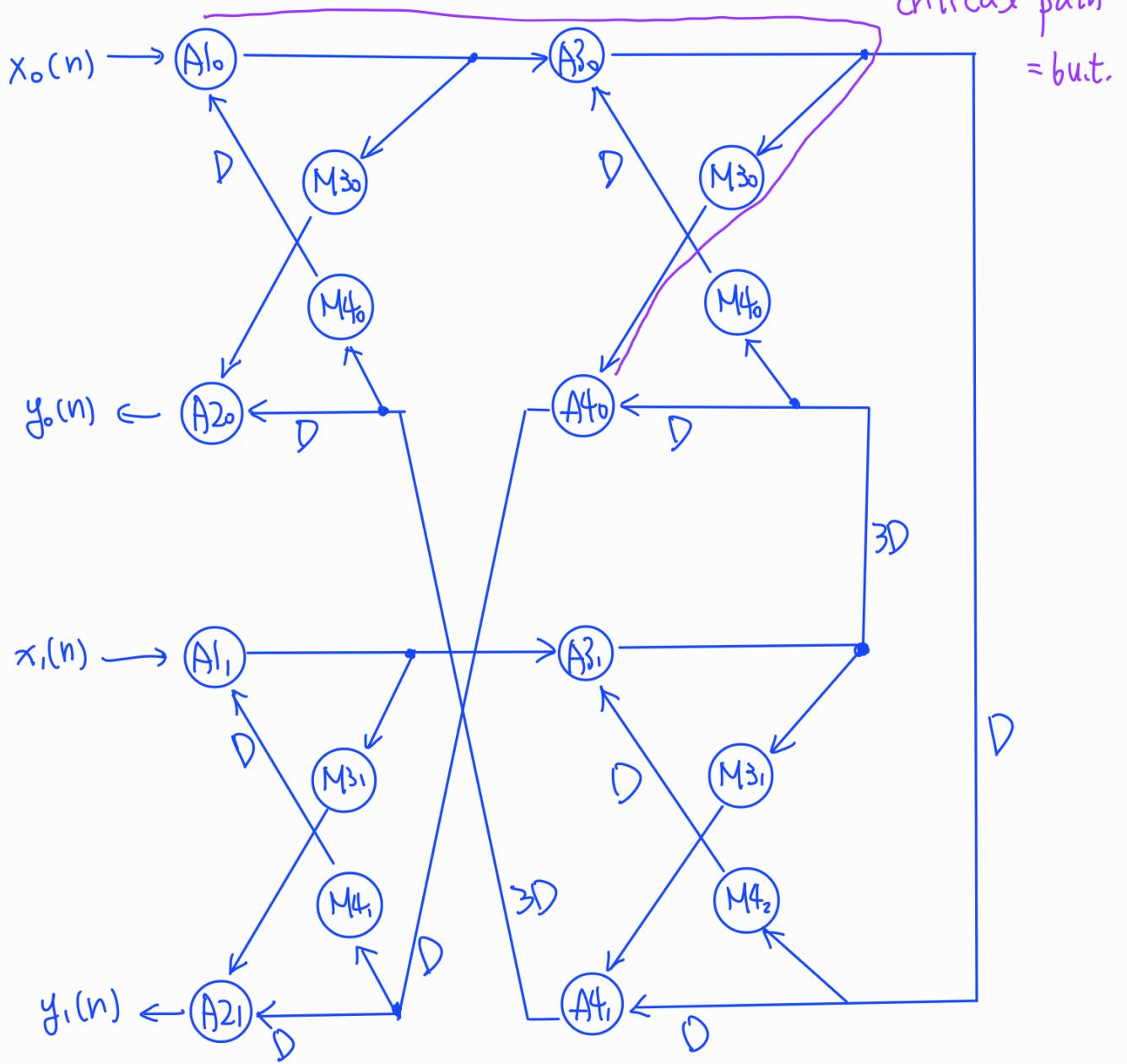
10



Q3



Ans:



Q4

(a)

$$D_F(U \rightarrow V) = N \cdot w(e) - P_U + V - u \quad \text{set } P_A = 1, P_M = 2$$

$$D_F(A_2 \rightarrow M_2) = 2(0) - 1 + 1 - 0 = 0$$

$$D_F(A_2 \rightarrow A_1) = 2(2) - 1 + 1 - 0 = 4$$

$$D_F(A_2 \rightarrow M_4) = 2(1) - 1 + 1 - 0 = 2$$

$$D_F(A_2 \rightarrow M_5) = 2(0) - 1 + 1 - 0 = 0$$

$$D_F(A_2 \rightarrow M_1) = 2(2) - 1 + 0 - 0 = 3$$

$$D_F(M_2 \rightarrow A_1) = 2(0) - 2 + 1 - 1 = -2$$

$$D_F(M_1 \rightarrow A_2) = 2(0) - 2 + 0 - 0 = -2$$

$$D_F(A_1 \rightarrow M_3) = 2(0) - 1 + 0 - 1 = -2$$

$$D_F(M_3 \rightarrow A_3) = 2(0) - 2 + 0 - 0 = -2$$

$$D_F(M_4 \rightarrow A_3) = 2(0) - 2 + 0 - 1 = -3$$

$$D_F(M_5 \rightarrow A_4) = 2(0) - 2 + 1 - 1 = -2$$

$$D_F(A_3 \rightarrow A_4) = 2(0) - 1 + 1 - 0 = 0$$

There are some values of D_F equation that are negative.

\Rightarrow invalid folding design

(b)

```
clear
close all
clc

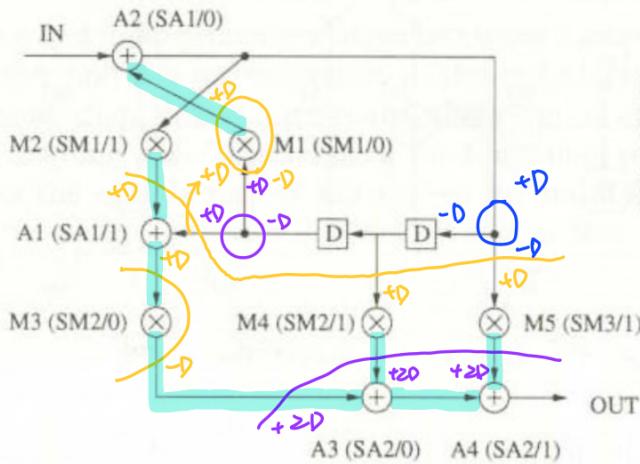
floating_order = [0 1; 1 0];
vaild = 0;
min_Df = 0;

for sa1 = 1 : 2
    SA1 = floating_order(sa1, :);
    for sa2 = 1 : 2
        SA2 = floating_order(sa2, :);
        for sm1 = 1 : 2
            SM1 = floating_order(sm1, :);
            for sm2 = 1 : 2
                SM2 = floating_order(sm2, :);
                for sm3 = 1 : 2
                    SM3 = floating_order(sm3, :);
                    Df = zeros(12, 1);
                    Df(1) = 2*2 - 1 + SA1(2) - SA1(1);
                    Df(2) = 2*2 - 1 + SM1(1) - SA1(1);
                    Df(3) = 2*0 - 1 + SM1(2) - SA1(1);
                    Df(4) = 2*1 - 1 + SM2(2) - SA1(1);
                    Df(5) = 2*0 - 1 + SM3(2) - SA1(1);
                    Df(6) = 2*0 - 1 + SM2(2) - SA1(2);
                    Df(7) = 2*0 - 1 + SA2(1) - SA2(1);
                    Df(8) = 2*0 - 2 + SA1(1) - SM1(1);
                    Df(9) = 2*0 - 2 + SA1(2) - SM1(2);
                    Df(10)= 2*0 - 2 + SA2(2) - SM2(1);
                    Df(11)= 2*0 - 2 + SA2(1) - SM1(2);
                    Df(12)= 2*0 - 2 + SA2(2) - SM3(2);
                    min_Df = min(Df);
                    if min_Df >= 0
                        vaild = 1;
                        fprintf('There are valid floating design\n');
                        break;
                    end
                end
            end
        end
    end
end

if vaild == 0
    fprintf('There are no valid floating design\n');
end
```

There are no valid floating design
fx >>

(C)



$$\begin{aligned} SA1 &= \{ A2, A1 \} \\ SA2 &= \{ A3, A4 \} \\ SM1 &= \{ M1, M2 \} \\ SM2 &= \{ M3, M4 \} \\ SM3 &= \{ \phi, M5 \} \end{aligned}$$

set $P_A = 1, P_M = 2$

$$DF(U \rightarrow V) = N \cdot w(e) - P_U + V - u$$

$$DF(A_2 \rightarrow M_2) = 2(0) - 1 + 1 - 0 = 0$$

$$DF(A_2 \rightarrow A_1) = 2(3) - 1 + 1 - 0 = 6$$

$$DF(A_2 \rightarrow M_4) = 2(2) - 1 + 1 - 0 = 4$$

$$DF(A_2 \rightarrow M_5) = 2(1) - 1 + 1 - 0 = 2$$

$$DF(A_2 \rightarrow M_1) = 2(1) - 1 + 0 - 0 = 1$$

$$DF(A_1 \rightarrow M_3) = 2(1) - 1 + 0 - 1 = 0$$

$$DF(M_2 \rightarrow A_1) = 2(1) - 2 + 1 - 1 = 0$$

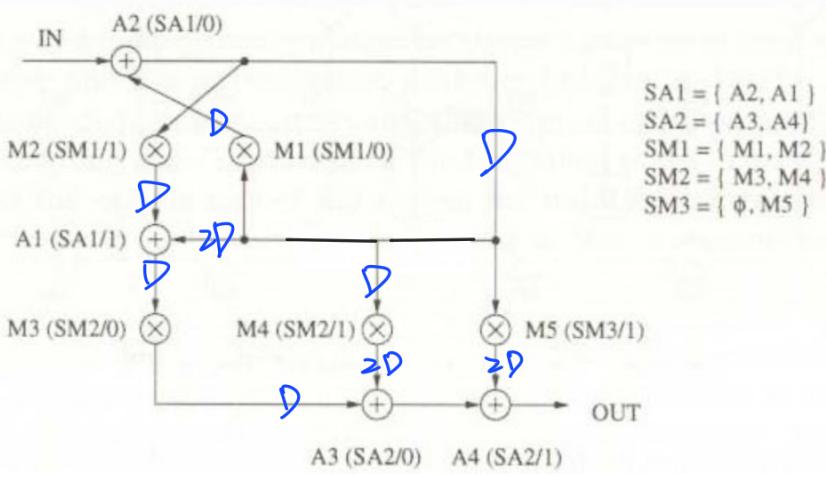
$$DF(M_1 \rightarrow A_2) = 2(1) - 2 + 0 - 0 = 0$$

$$DF(M_3 \rightarrow A_3) = 2(1) - 2 + 0 - 0 = 0$$

$$DF(M_4 \rightarrow A_3) = 2(2) - 2 + 0 - 1 = 1$$

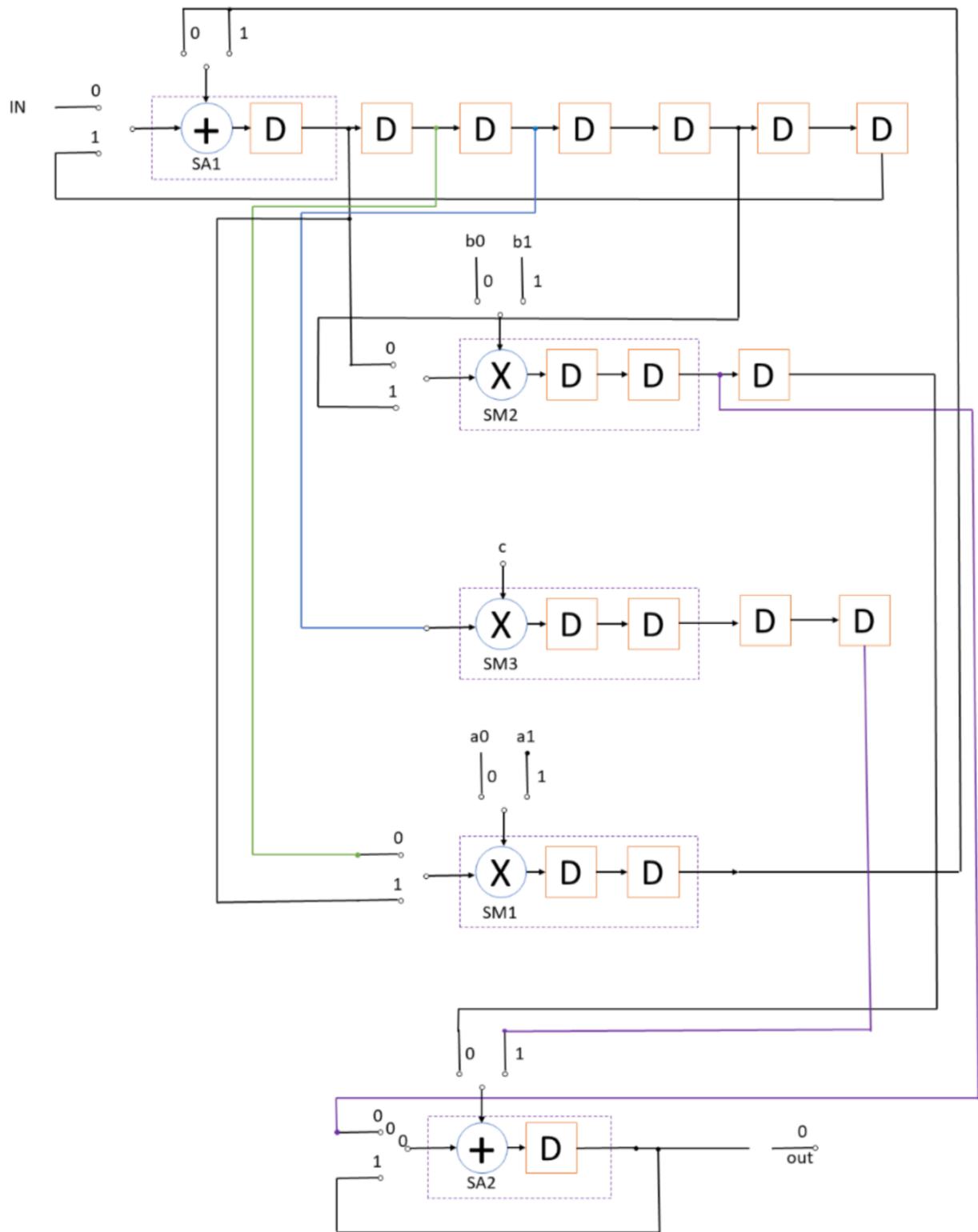
$$DF(M_5 \rightarrow A_4) = 2(2) - 2 + 1 - 1 = 2$$

$$DF(A_3 \rightarrow A_4) = 2(0) - 1 + 1 - 0 = 0$$



$$\begin{aligned} SA1 &= \{ A2, A1 \} \\ SA2 &= \{ A3, A4 \} \\ SM1 &= \{ M1, M2 \} \\ SM2 &= \{ M3, M4 \} \\ SM3 &= \{ \phi, M5 \} \end{aligned}$$

(d)

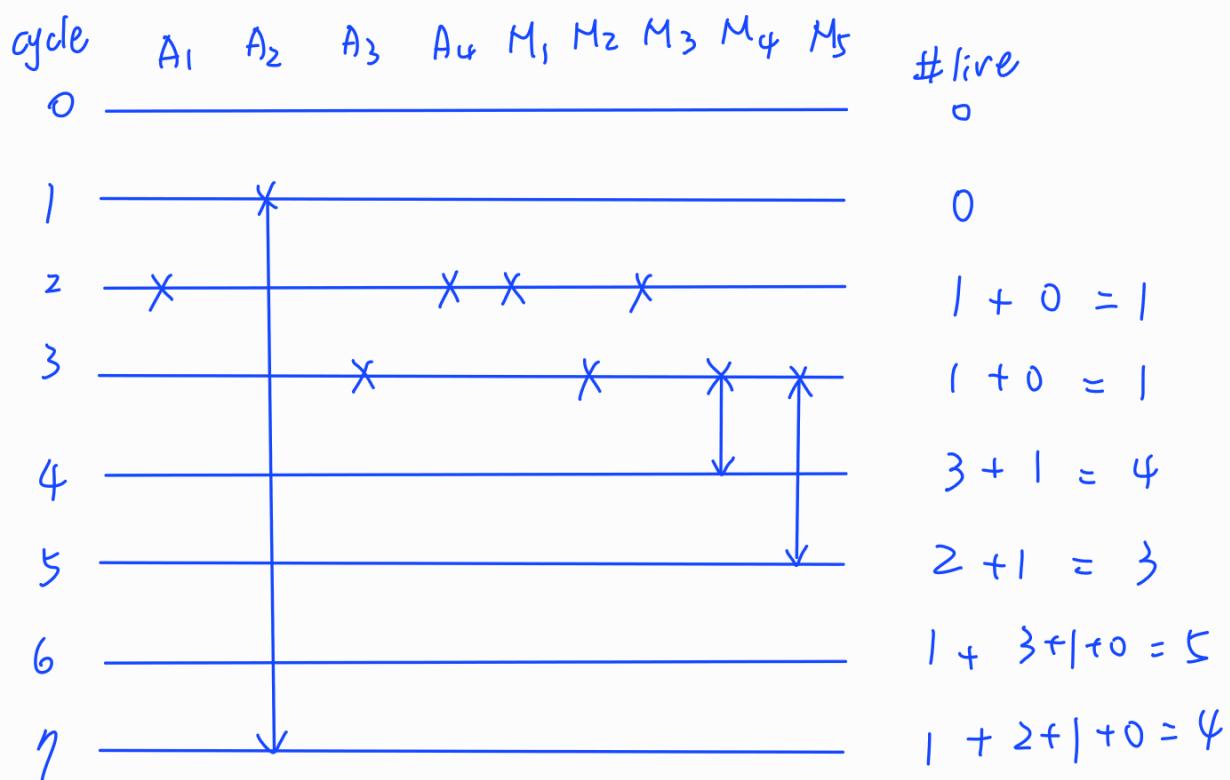


(2)

	$T_{in} = U + P_U$	$T_{out} = U + P_U + \max_v \{D_F(U \rightarrow V)\} = T_{in} + \max_v \{D_F(U \rightarrow V)\}$	life time
A ₁	1+1=2	2+0=2	0
A ₂	0+1=1	1+6=7	6
A ₃	0+1=1	1+0=1	0
A ₄	1+1=2	—	
M ₁	0+2=2	2+6=8	0
M ₂	1+2=3	3+0=3	0
M ₃	0+2=2	2+0=2	0
M ₄	1+2=3	3+1=4	1
M ₅	1+2=3	3+2=5	2

△ life time table

folding factor = 2 Max. life time = 6 $\Rightarrow 6/2 = 3 \Rightarrow$ 3個 iteration



△ life time chart

Cycle	In	R1	R2	R3	R4	R5	Output
0							
1		A2					
2			A2				
3	M4、M5		A2				
4		M5	A2		M4		M4
5			M5	A2		M5	M5
6				A2			A2
7					A2		A2

△ register allocation

