

系统结构第三次作业

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3.8

$\sum_{i=1}^4 (A_i \times B_i)$: 4次乘法 + 3次加法 \Rightarrow

$$M_1 = A_1 \times B_1$$

$$M_2 = A_2 \times B_2$$

$$M_3 = A_3 \times B_3$$

$$M_4 = A_4 \times B_4$$

$$A_1' = M_1 + M_2$$

$$A_2' = A_1' + M_3$$

$$A_3' = A_2' + M_4$$

绘制时空图

S_1 S_2 S_3 S_4 S_5

1 M_1

2 M_1

3 M_2 M_1

4 M_2

5 M_2

6 M_3 M_2

7 M_3

8 M_4 M_3

9 A_1' M_4

10 M_4 A_1'

11 A_1'

12 A_2' A_1'

13 A_2'

14 A_2'

15 A_3' A_2'

16 A_3'

17 A_3'

18 A_3'

$$\therefore TP = \frac{7}{18t_0}$$

$$S = \frac{(4 \times 4 + 3 \times 4) \times t_0}{18t_0} = \frac{28}{18} = 1.56$$

$$E = \frac{4 \times 4 + 3 \times 4}{5 \times 18} = 0.31$$

3.9 (1) 由表可知 $F = \{8, 4, 3, 1\}$

$$C_0 = 10001101$$

$$\textcircled{1} C_1 = \text{SHR}^{(2)}(C_0) \vee C_0 = 10101111$$

$$C_2 = \text{SHR}^{(3)}(C_0) \vee C_0 = 10001101 = C_0$$

$$C_3 = \text{SHR}^{(6)}(C_0) \vee C_0 = 10001111$$

$$C_4 = \text{SHR}^{(7)}(C_0) \vee C_0 = 10001101 = C_0$$

$$\textcircled{2} C_5 = \text{SHR}^{(5)}(C_1) \vee C_0 = C_0$$

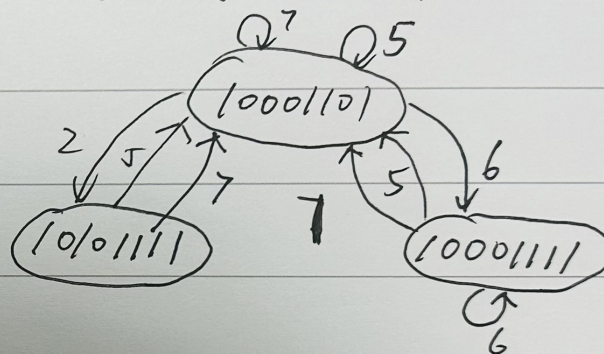
$$C_6 = \text{SHR}^{(7)}(C_1) \vee C_0 = C_0$$

$$\textcircled{3} C_7 = \text{SHR}^{(5)}(C_3) \vee C_0 = C_0$$

$$C_8 = \text{SHR}^{(6)}(C_3) \vee C_0 = C_3$$

$$C_9 = \text{SHR}^{(7)}(C_3) \vee C_0 = C_0$$

故可绘制状态转移图:



(2) 最优调度策略: (2, 5) 平均延迟时间为 3.5ac

$$\therefore \text{流水线最大吞吐率} = \frac{1}{3.5ac}$$

$$\textcircled{3} TP = \frac{6}{(2+5+2+5+2+9)ac} = \frac{6}{25ac}$$

3.11

(98*17)+18=1684

指令	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
LW	IF	ID	EX	M	WB																	
DADDIU		IF	S	S	ID	EX	M	WB														
SW					IF	S	S	ID	EX	M	WB											
DADDIU								IF	ID	EX	M	WB										
DSUB									IF	S	S	ID	EX	M	WB							
BNEZ												IF	S	S	ID	EX	M	WB				
LW															IF	S	S	IF	ID	EX	M	WB

(98*10)+11=991

指令	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
LW	IF	ID	EX	M	WB											
DADDIU		IF	ID	S	EX	M	WB									
SW			IF	S	ID	EX	M	WB								
DADDIU					IF	ID	EX	M	WB							
DSUB						IF	ID	EX	M	WB						
BNEZ							IF	ID	EX	M	WB					
LW								IF	miss	miss	IF	ID	EX	M	WB	

$$(98 \times 6) + 10 = 598$$

指令	1	2	3	4	5	6	7	8	9	10	11
LW	IF	ID	EX	M	WB						
DADDIU		IF	ID	EX	M	WB					
DADDIU			IF	ID	EX	M	WB				
DSUB				IF	ID	EX	M	WB			
BNEZ					IF	ID	EX	M	WB		
SW						IF	ID	EX	M	WB	
LW							IF	ID	EX	M	WB