

系统结构第三次作业

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3.8

$$M_1 = A_1 \times B_1$$

$$\sum_{i=1}^4 (A_i \times B_i) : 4 \text{ 次乘法} + 3 \text{ 次加法} \Rightarrow M_2 = A_2 \times B_2$$

$$M_3 = A_3 \times B_3$$

$$M_4 = A_4 \times B_4$$

$$A'_1 = M_1 + M_2$$

$$A'_2 = A'_1 + M_3$$

$$A'_3 = A'_2 + M_4$$

绘制时空图

S₁ S₂ S₃ S₄ S₅

1 M₁

2 M₁

3 M₂ M₁

4 M₂

5 M₂

6 M₃ M₂

7 M₃

8 M₄ M₃

9 A'₁ M₄

10 M₄ A'₁

11 A'₁

12 A'₂

13 A'₂

14 A'₂

15 A'₃

16 A'₃

17 A'₃

18 A'₃

$$\Delta T_P = \frac{7}{18t_0}$$

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

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

A'

A'

A'

A'

A'

A'

A'

A'

3.9 (1) 由表可知 $F = \{8, 4, 3, 1\}$

$$\therefore C_0 = 10001101$$

① $C_1 = SHR^{(2)}(C_0)VC_0 = 10101111$

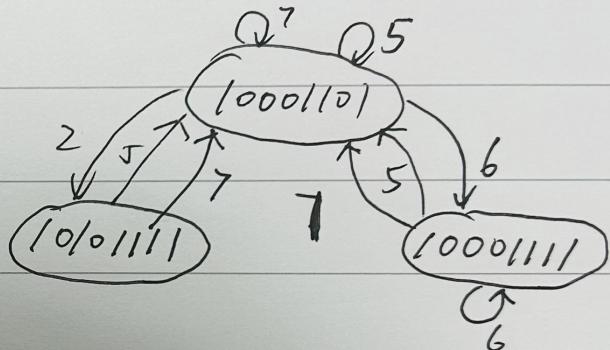
$$C_2 = SHR^{(3)}(C_0)VC_0 = 10001101 = C_0$$

$$C_3 = SHR^{(6)}(C_0)VC_0 = 10001111$$

$$C_4 = SHR^{(7)}(C_0)VC_0 = 10001101 = C_0$$

② $C_5 = SHR^{(5)}(C_1)VC_0 = C_0$

故可绘制状态转移图:



③ $C_7 = SHR^{(5)}(C_3)VC_0 = C_0$

$$C_8 = SHR^{(6)}(C_3)VC_0 = C_3$$

$$C_9 = SHR^{(7)}(C_3)VC_0 = C_0$$

(2) 最优调度策略: (2, 5) 平均延迟时间为 3.5at

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

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

3.11

$$(98 \times 17) + 18 = 1684$$

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	

$$(98 \times 10) + 11 = 991$$

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		