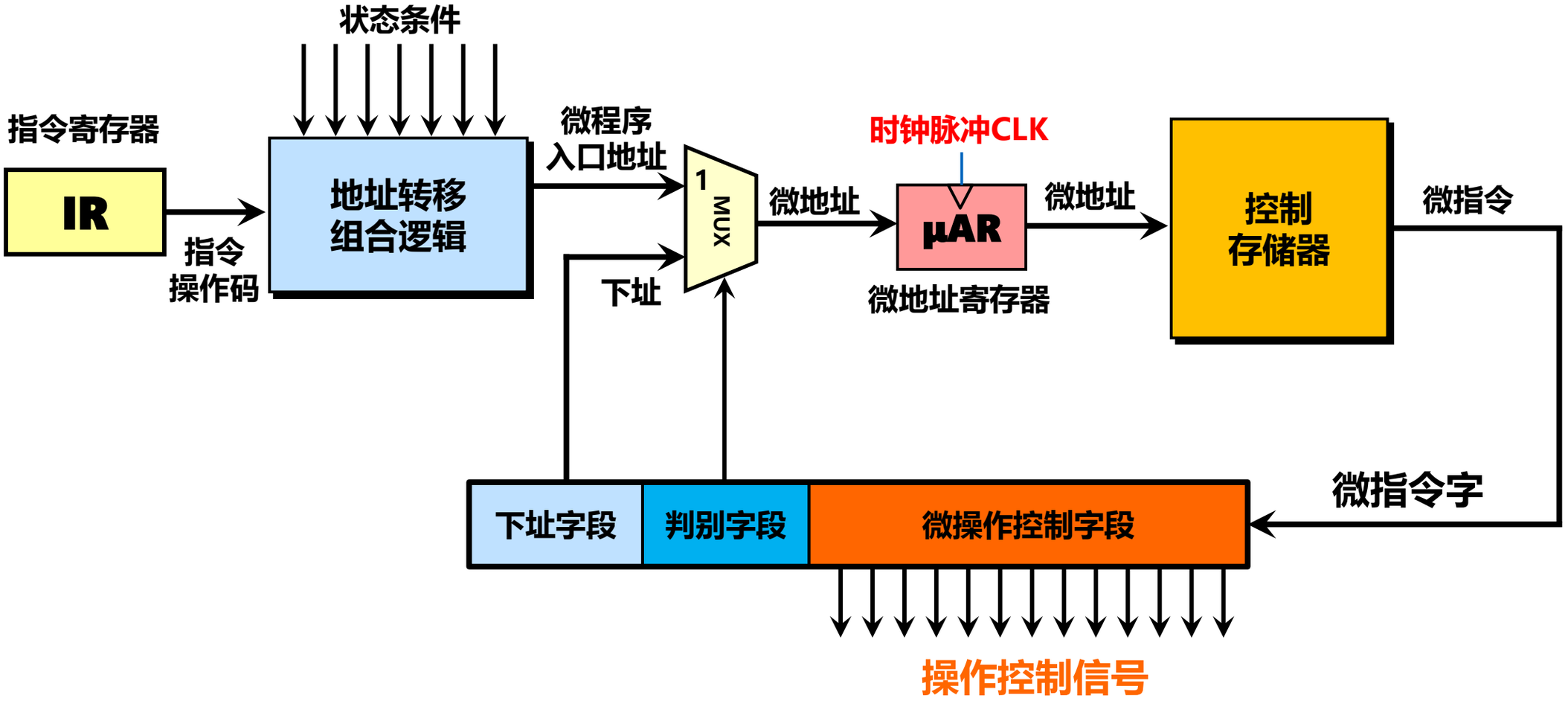
计算机组成原理

第六章 中央处理器

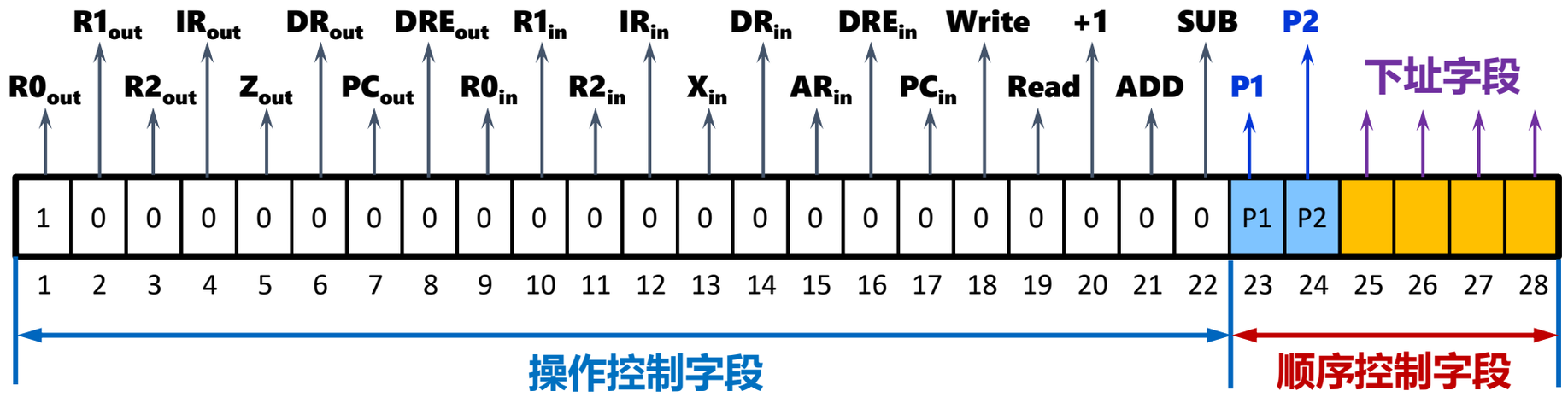
6.11 微程序设计

6.10 微程序控制器

1 微程序控制器组成原理框图



2 微指令格式



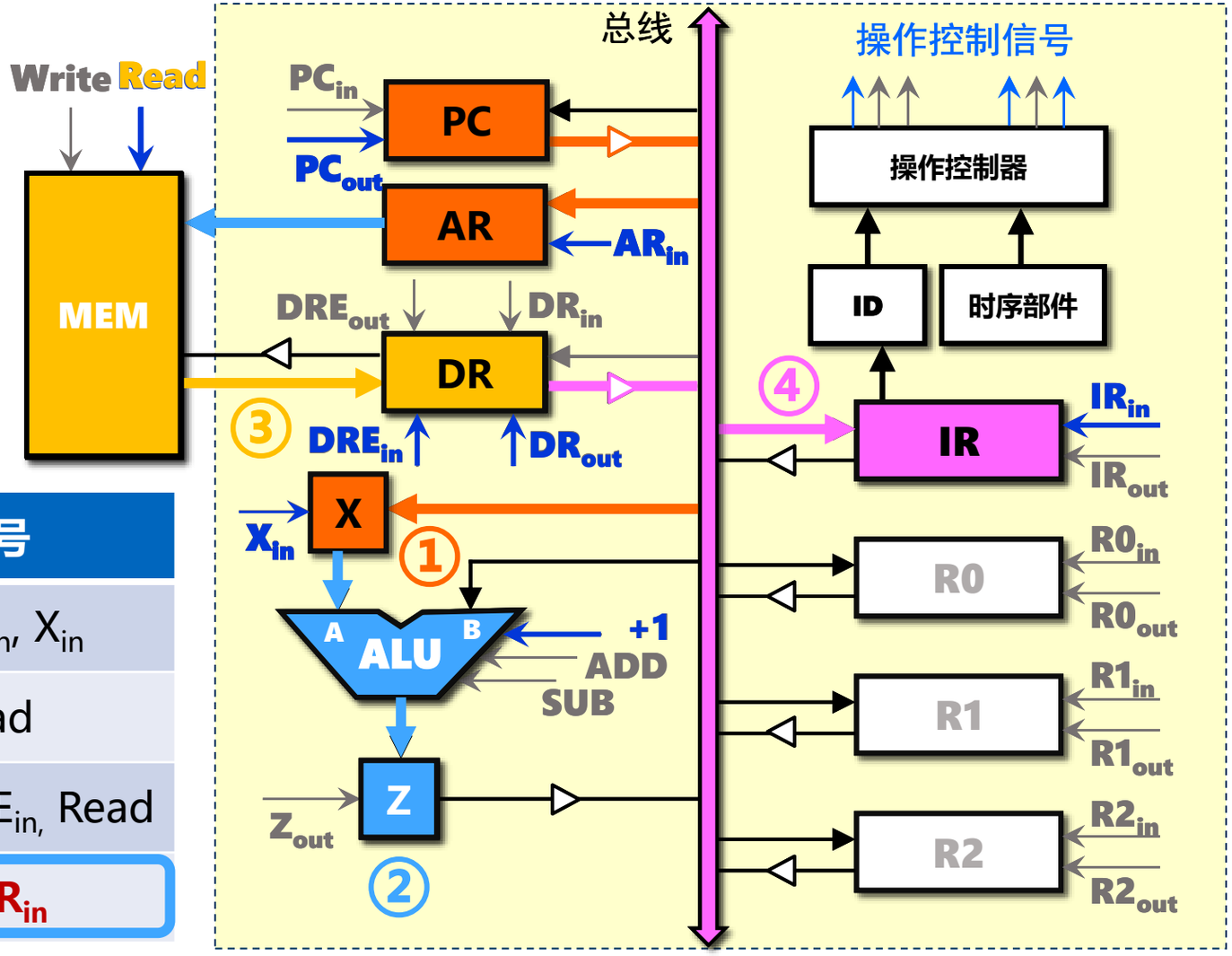
- 一条微指令对应一个时钟周期
- 微指令操作控制字段的信号在该时钟周期内有效
- 指令需要多少时钟周期就包括多少微指令

3 取指令数据通路

Mem[PC++] → IR

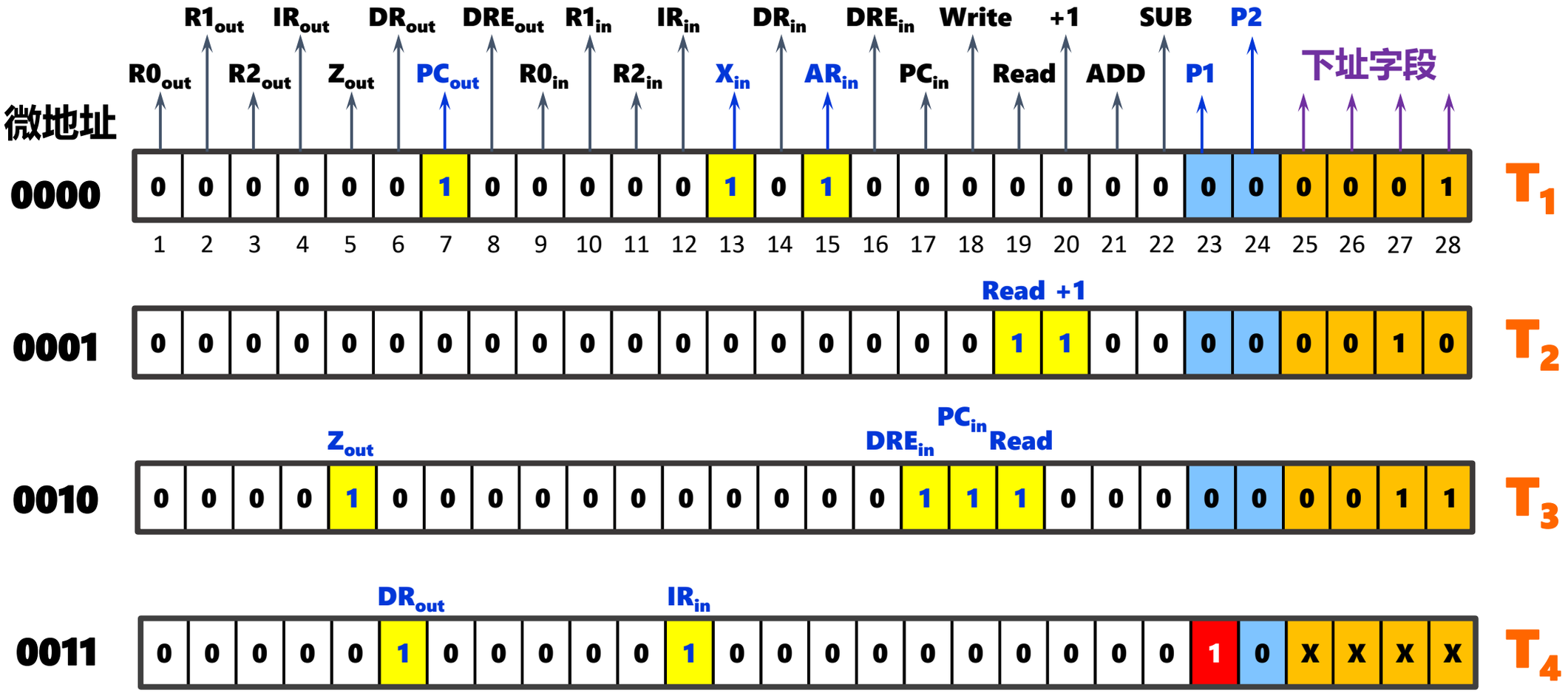
- **4个时钟周期**
- **四条微指令**

节拍	数据通路	控制信号
T1	(PC)→AR, (PC)→X	PC_{out}, AR_{in}, X_{in}
T2	(X)+1→Z	+1, Read
T3	(Z)→PC, Mem[AR]→DR	Z_{out}, PC_{in}, DRE_{in}, Read
T4	**(DR)→IR**	**DR_{out}, IR_{in}**



节拍	取指令数据通路	控制信号
T1	(PC)→AR，(PC)→X	PC_{out}, AR_{in}, X_{in}
T2	(X)+1→Z	+1, Read
T3	(Z)→PC，Mem[AR]→DR	Z_{out}, PC_{in}, DRE_{in}, Read
T4	(DR)→IR	DR_{out}, IR_{in}

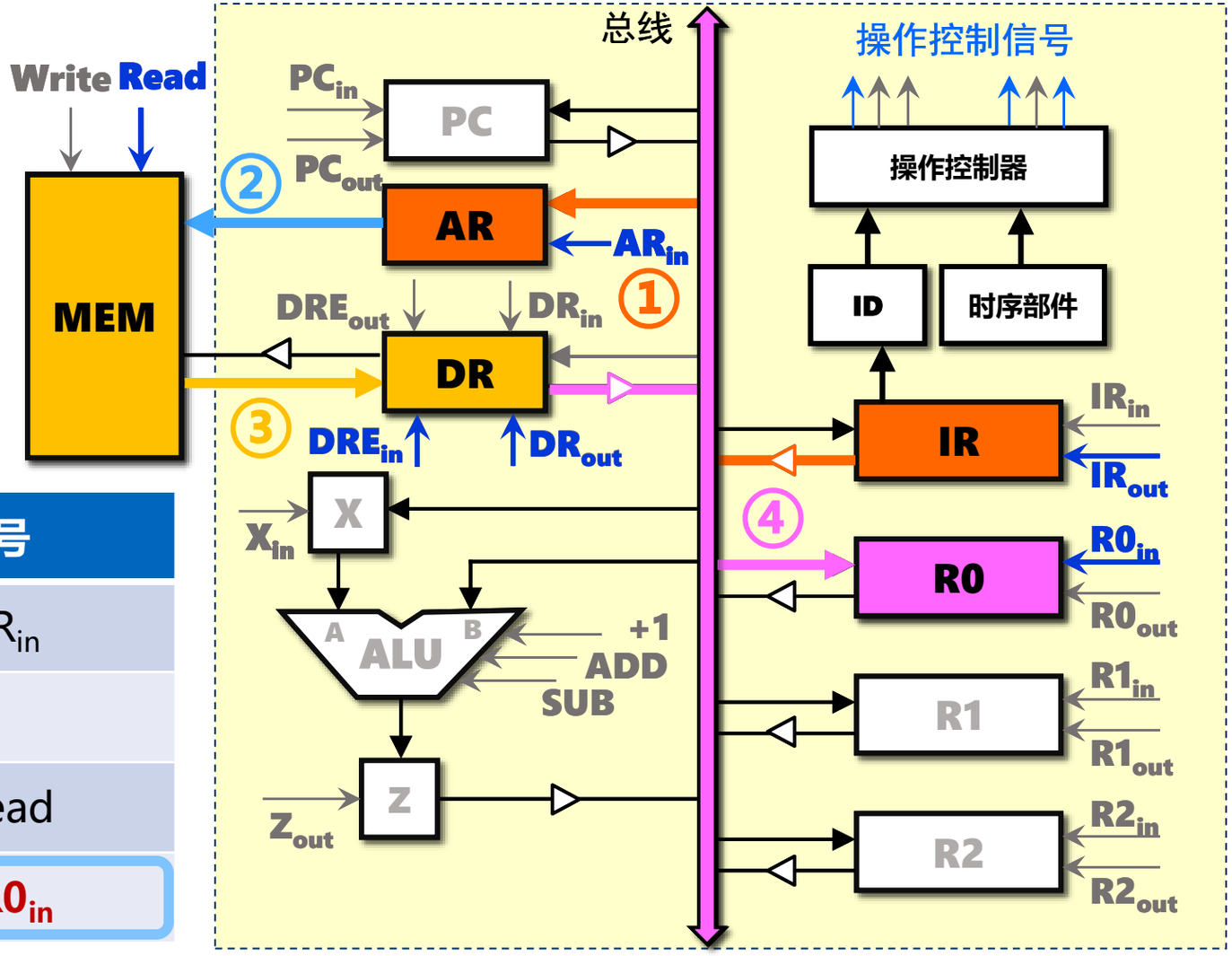
4 取指令微程序



5 LOAD指令执行数据通路

LOAD R0,6#

Mem[IR_A] → Reg

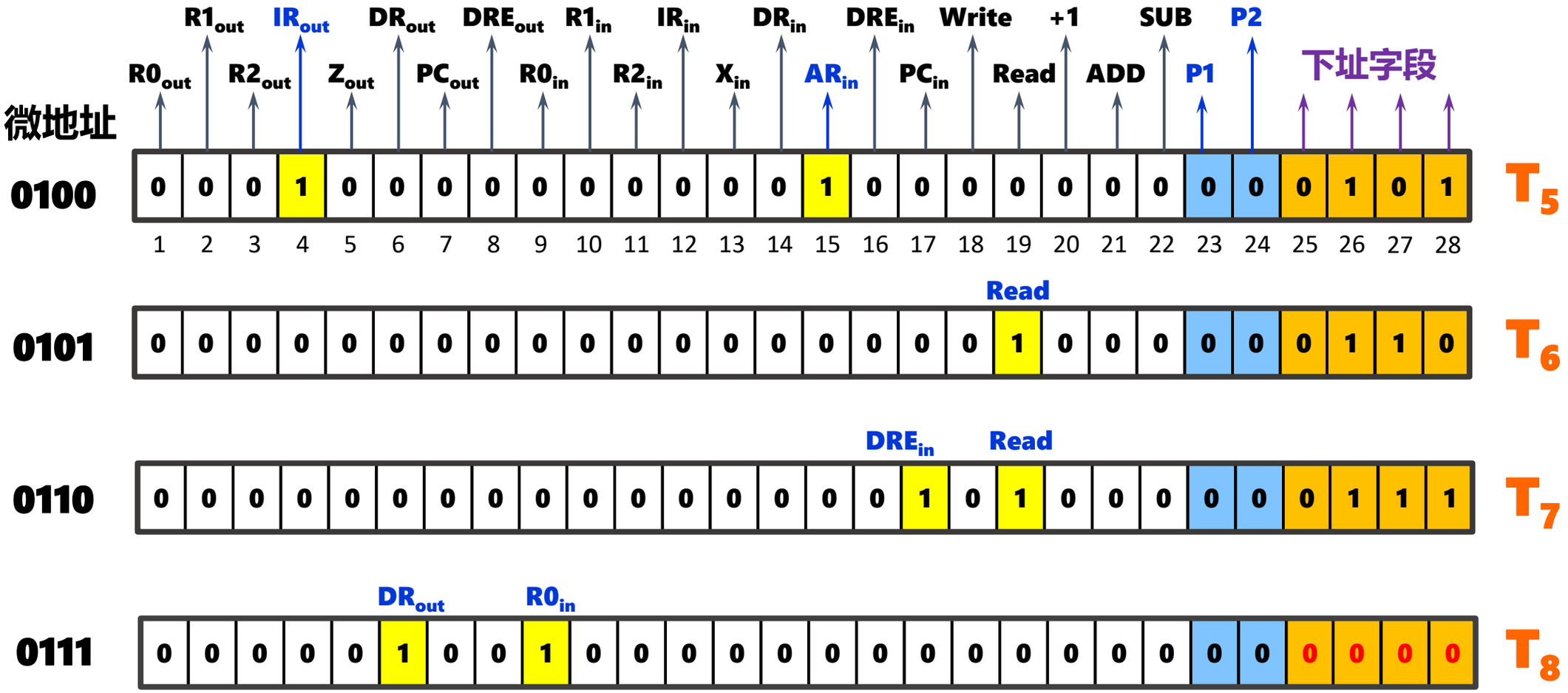


节拍	数据通路	控制信号
T1	(IR_A)→AR, (PC)→X	IR_{out}, AR_{in}
T2		Read
T3	Mem[AR]→DR	DRE_{in},Read
T4	**(DR)→R0**	**DR_{out}, $R0_{in}$**

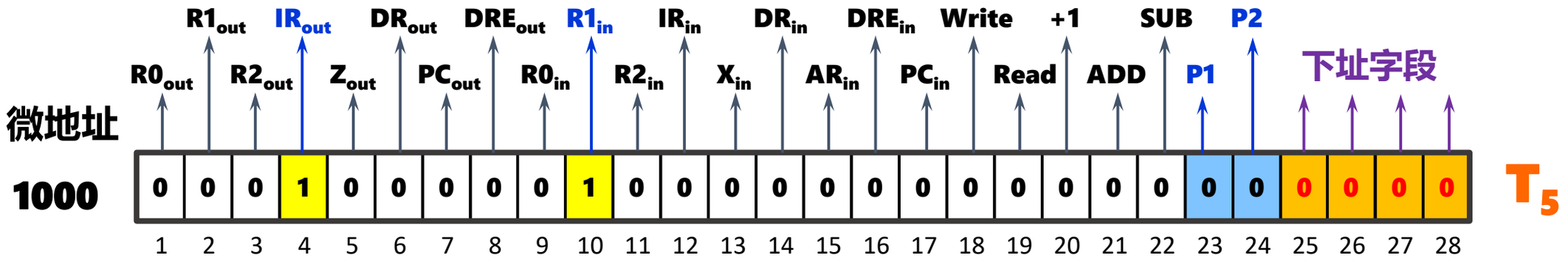
6.11 微程序设计

节拍	取指令数据通路	控制信号
T1	$(IR_A)\rightarrow AR$, $(PC)\rightarrow X$	IR_{out}, AR_{in}
T2		Read
T3	Mem[AR]→DR	DRE_{in},Read
T4	(DR)→R0	DR_{out}, $R0_{in}$

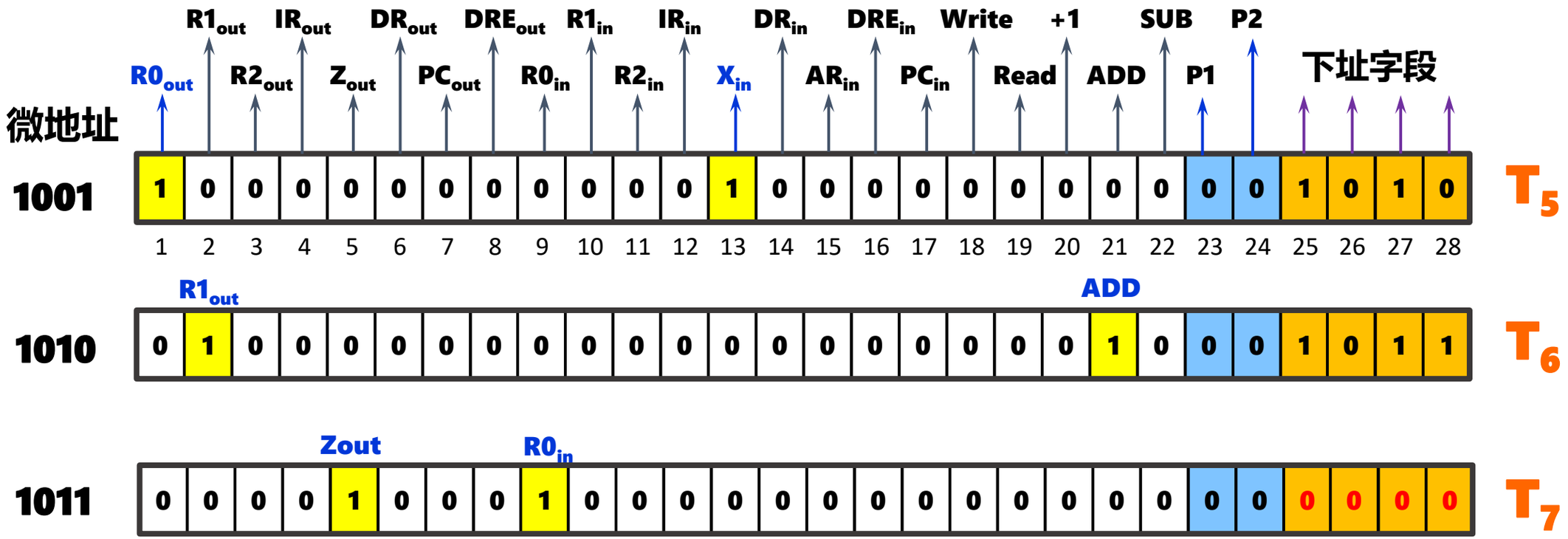
6 LOAD指令微程序



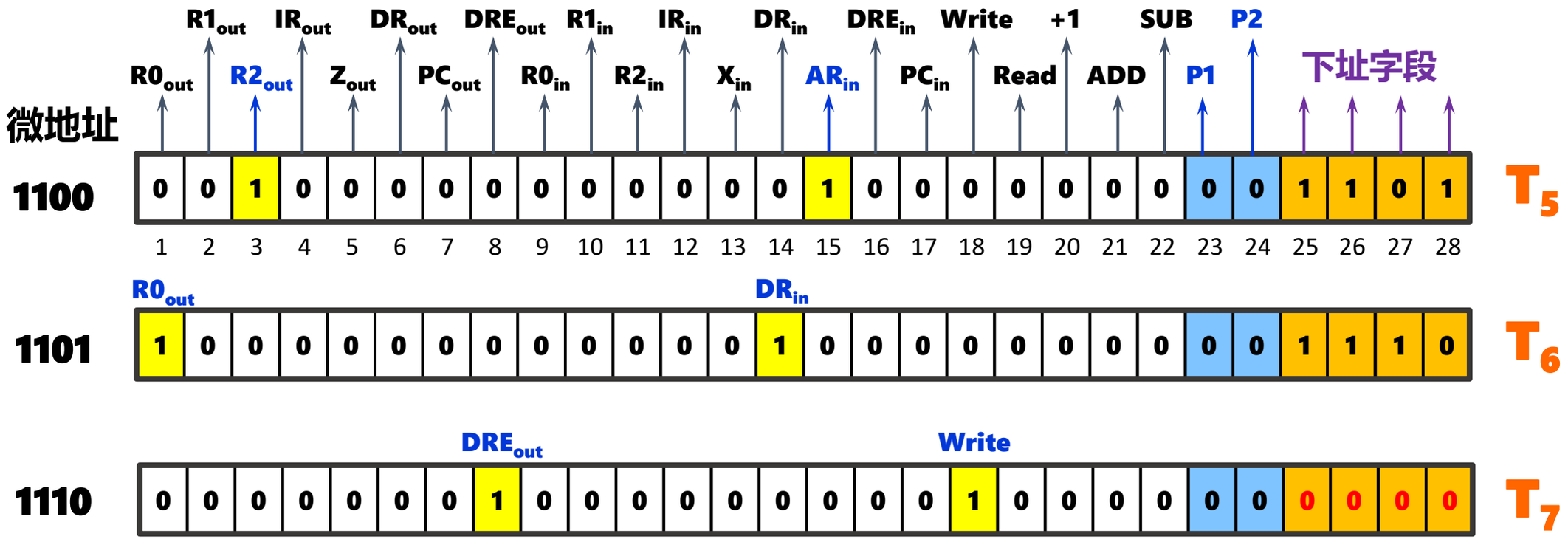
7 MOVE指令微程序


R1out
IRout
DRout
DREout
R1in
IRin
DRin
DREin
Write
+1
SUB
P2
R0out
R2out
Zout
PCout
R0in
R2in
Xin
ARin
PCin
Read
ADD
P1
下址字段
微地址
1000
0 0 0 1 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
T5

8 ADD指令微程序

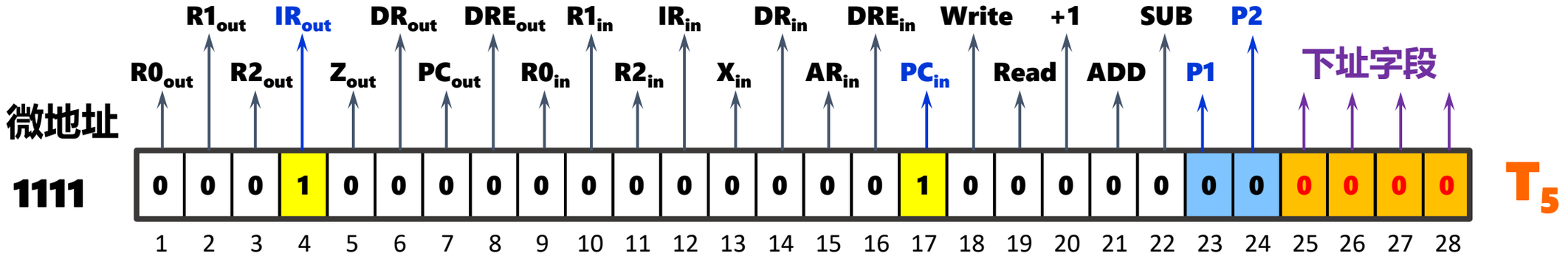

R1out IRout DRout DREout R1in IRin DRin DREin Write +1 SUB P2
R0out R2out Zout PCout R0in R2in Xin ARin PCin Read ADD P1
下址字段
微地址
1001
1 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0
T5
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
R1out
ADD
1010
0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 1 1
T6
Zout
R0in
1011
0 0 0 0 1 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
T7

9 STORE指令微程序



6.11 微程序设计

A JMP指令微程序



B 单总线CPU微程序

状态	微地址	操作控制字段																				顺序控制字段						
S0	0000	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	取指令微程序
S1	0001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	
S2	0010	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1	
S3	0011	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	X	X	X	X	
S4	0100	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	LOAD微程序
S5	0101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	
S6	0110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	1	1	
S7	0111	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
S8	1000	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	MOVE微程序
S9	1001	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	ADD 微程序
S10	1010	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	1	
S11	1011	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
S12	1100	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	STORE微程序
S13	1101	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	
S14	1110	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	
S15	1111	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	JMP 微程序

谢谢!