关于测试单周期 CPU 的简单方法

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(特别说明:本表每个同学都需建立,检查实验时,必须提供!)

1、测试程序段

	汇编程序	指令		运行结果		
地址		op (6)	16 进制	Next_PC	ALU 运算 结果	DM 输出结 果 (LW)
0x00000000	addiu \$1,\$0,8	001001	24010008		8	
0x0000004	ori \$2,\$0,2	001101	34020002		2	
0x0000008	add \$3, <mark>\$2,</mark> \$1	000000	00411820		10	
0x000000C	sub \$5, <mark>\$3</mark> ,\$2	000000	00622822		8	
0x0000010	and \$4, <mark>\$5</mark> ,\$2	000000	00a22024		0	
0x0000014	or \$8, <mark>\$4</mark> ,\$2	000000	00824025		2	
0x0000018	sll \$8,\$8,1	000000	00084040		4/8	
0x000001C	bne \$8,\$1,-2 (≠,转 18)	000101	1501fffe	18/20	-4/0	
0x00000020	slti \$6,\$2,4	001010	28460004		1	
0x00000024	slti \$7, <mark>\$6,</mark> 0	001010	28c70000		0	
0x00000028	addiu \$7, <mark>\$7</mark> ,8	001001	24e70008		8/16	
0x0000002C	beq \$7,\$1,-2 (=,转 28)	000100	10e1fffe	28/30	0/8	
0x00000030	sw \$2,4(\$1)	101011	ac220004		12	
0x00000034	lw \$9,4(\$1)	100011	8c290004		12	2
0x00000038	addiu \$10,\$0,-2	001001	240afffe		-2	
0x0000003C	addiu \$10, \$10 ,1	001001	254a0001		-1/0	
0x00000040	bltz \$10,-2 (<0,转 3C)	000001	0540fffe	3c/44	-1/0	
0x00000044	andi \$11,\$2,2	001100	304b0002		2	
0x00000048	j 0x0000050	000010	08000014	50	xxxx	
0x0000004C	or \$8, <mark>\$4</mark> ,\$2	000000	00824025;			
0x0000050	halt	111111	FC000000			

- 1、将指令代码初始化到指令存储器中,直接写入。
- **2**、初始化 PC 的值,也就是以上程序段首地址 PC=**0**x**00000000**,以上程序段从 **0**x**000000000** 地址开始存放。
- 3、运行 Xilinx Vivado 进行仿真,看波形。

扩展指令测试程序段, 可根据自己实现的功能进行修改。

指令地址	汇编指令	十六进制	运行结果	
0x0000000	addiu \$1,\$0,0xf0	240100f0	0xf0	0
0x0000004	sb \$1,1(\$0)	a0010001		1
0x00000008	lb \$2,1(\$0)	80020001		2
0x000000C	addiu \$1,\$0,8	24010008	0x8	3
0x0000010	ori \$2,\$0,2	34020002	0x2	4
0x0000014	xori \$3, \$2 ,8	38430008	0xa	5

Ox00000018 sub \$4,\$3,\$1 00612022 0x2 6 Ox0000010 and \$5,\$4,\$2 00822824 0x2 7 Ox0000020 lui \$6,0xf000 3c06f000 0xf000 0000 8 Ox00000024 sra \$6,\$6,1 00063042 0x7c00 0000 a Ox00000025 srl \$6,\$6,1 00063042 0x7c00 0000 a Ox00000026 srl \$6,\$6,1 00063080 0xf000 0000 b Ox00000030 sra \$6,\$6,\$2 00463007 0xfc00 0000 c Ox0000034 lui \$7,2 3c070002 0x0002 0000 d Ox0000038 srl \$7,\$7,\$2 00473804 0x0008 0000 e Ox00000030 srlv \$7,\$7,\$1 00e13826 0x0002 0000 f Ox00000040 xor \$7,\$7,\$1 00e13826 0x0002 0000 f Ox00000044 srl \$5,\$5,2 00052880 0x8 11 Ox00000048 beq \$5,\$1,2(=,\$					
DX00000020	0x0000018	sub \$4, \$3 ,\$1	00612022	0x2	6
0x00000024 sra \$6,\$6,1 00063043 0xf800 0000 9 0x00000028 srl \$6,\$6,1 00063042 0x7c00 0000 a 0x0000002C sil \$6,\$6,2 00063080 0xf000 0000 b 0x00000030 srav \$6,\$6,\$2 00463007 0xfc00 0000 c 0x00000038 sliv \$7,\$7,\$2 00473804 0x0008 0000 e 0x0000003C sriv \$7,\$7,\$2 00473806 0x0002 0000 f 0x00000040 xor \$7,\$7,\$1 00e13826 0x0002 0008 10 0x00000044 sll \$5,\$5,2 00052880 0x8 11 0x00000044 sll \$5,\$5,2 00052880 0x20 11 0x00000048 beq \$5,\$1,-2(=,\$\$\frac{1}{8}\$ 14) 10a1ffe 0x0 12 0x00000040 sil \$5,\$5,2 00052880 0x20 11 0x00000048 beq \$5,\$1,-2(=,\$\$\frac{1}{4}\$ 14) 10a1ffe 0x0 12 0x00000040 sil \$5,\$5,2 00052880 0x20 11 0x00000040 sil \$5,\$5,1,-2(=,\$\frac{1}{4}\$ 1	0x000001C	and \$5, \$4 ,\$2	00822824	0x2	7
Dx00000028	0x00000020	lui \$6,0xf000	3c06f000	0xf000 0000	8
DXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	0x00000024	sra \$6,\$6,1	00063043	0xf800 0000	9
0x00000030 srav \$6,\$6,\$2 00463007 0xfc00 0000 c 0x00000034 lui \$7,2 3c070002 0x0002 0000 d 0x00000038 sllv \$7,\$7,\$2 00473804 0x0000 0000 e 0x00000040 xor \$7,\$7,\$1 00e13826 0x0002 0008 10 0x00000044 sll \$5,\$5,2 00052880 0x8 11 0x00000044 sll \$5,\$5,2 00052880 0x20 12 0x00000044 sll \$5,\$5,2 00052880 0x20 11 0x00000048 beq \$5,\$1,-2(=,接 14) 10a1fffe 0x18 12 0x00000040 jal 0x0000080 0c000020 13 0x00000080 sw \$2,4(\$1) ac220004 0xc 20 0x00000081 lw \$13,4(\$1) 8c2d0004 0xc 21 0x00000082 jr \$31 03e00008 22 0x00000054 addiu \$14,\$0,-2 240efffe -2 15 0x00000055 slt \$8,\$13,\$1 01a1402a 1 17 0x00000066	0x00000028	srl \$6,\$6,1	00063042	0x7c00 0000	а
Dx00000034	0x0000002C	sll \$6,\$6,2	00063080	0xf000 0000	b
DX00000038 sllv \$7,\$7,\$2 D0473804 DX0008 0000 e DX0000003C srlv \$7,\$7,\$2 D0473806 DX0002 0000 f DX00000040 Xor \$7,\$7,\$1 D0e13826 DX0002 0008 10 DX00000044 sll \$5,\$5,2 D0052880 DX8 DX8 DX9 DX9	0x00000030	srav \$6,\$6,\$2	00463007	0xfc00 0000	С
0x0000003C	0x00000034	lui \$7,2	3c070002	0x0002 0000	d
Dx00000040	0x00000038	sllv \$7,\$7,\$2	00473804	0x0008 0000	е
Dx00000044	0x000003C	srlv \$7,\$7,\$2	00473806	0x0002 0000	f
Dx00000048 beq \$5,\$1,-2(=,转 14) 10a1fffe	0x00000040	xor \$7,\$7,\$1	00e13826	0x0002 0008	10
0x00000044 sll \$5,\$5,2 00052880 0x20 11 0x00000048 beq \$5,\$1,-2(=,转 14) 10a1fffe 0x18 12 0x0000004c jal 0x0000080 0c000020 13 0x00000080 sw \$2,4(\$1) ac220004 0xc 20 0x00000084 lw \$13,4(\$1) 8c2d0004 0xc 21 0x00000088 jr \$31 03e00008 22 0x00000050 slt \$8,\$13,\$1 01a1402a 1 14 0x00000054 addiu \$14,\$0,-2 240efffe -2 15 0x00000058 slt \$9,\$8,\$14 010e482a 1 16 0x0000005c slti \$10,\$9,2 292a0002 1 17 0x00000060 slti \$11,\$10,0 294b0000 0 18 0x00000064 add \$11,\$11,\$10 016a5820 1 19 0x00000068 bne \$11,\$2,-2(\$#,\$60) 1562fffe -1 1a 0x00000066 addiu \$12,\$0,-2 240efffe -2 15 0x00000066 ddiu \$12,\$0,-2 240efffe -1 1a 0x00000066 ddiu \$12,\$12,1 258c0001 -1 1c 0x00000070 addiu \$12,\$12,1 258c0001 0 1c 0x00000074 bltz \$12,-2(<0,\$# 40) 0580fffe 1d 0x00000076 andi \$12,\$2,2 304c0002 2 1e 0x00000076 j 0x000008c 08000023 1f	0x00000044	sll \$5, \$5 ,2	00052880	0x8	11
0x00000048 beq \$5,\$1,-2(=,转 14) 10a1fffe	0x00000048	beq \$5,\$1,-2(=,转 14)	10a1fffe	0x0	12
0x0000004c	0x00000044	sll \$5, \$5 ,2	00052880	0x20	11
0x00000080 sw \$2,4(\$1) ac220004 0xc 20 0x00000084 lw \$13,4(\$1) 8c2d0004 0xc 21 0x00000088 jr \$31 03e00008 22 0x00000050 slt \$8,\$13,\$1 01a1402a 1 14 0x00000054 addiu \$14,\$0,-2 240efffe -2 15 0x00000058 slt \$9,\$8,\$14 010e482a 1 16 0x0000005c slti \$10,\$9,2 292a0002 1 17 0x00000060 slti \$11,\$10,0 294b0000 0 18 0x00000064 add \$11,\$11,\$10 016a5820 1 19 0x00000064 add \$11,\$11,\$10 016a5820 2 19 0x00000068 bne \$11,\$2,-2 (≠,转 60) 1562fffe 0 1a 0x00000066 addiu \$12,\$0,-2 240cfffe -2 1b 0x00000060 addiu \$12,\$12,1 258c0001 -1 1c 0x00000070 addiu \$12,\$12,1 258c0001 0 1c 0x00000070	0x00000048	beq \$5,\$1,-2(=,转 14)	10a1fffe	0x18	12
0x00000084 lw \$13,4(\$1) 8c2d0004 0xc 21 0x00000088 jr \$31 03e00008 22 0x00000050 slt \$8,\$13,\$1 01a1402a 1 14 0x00000054 addiu \$14,\$0,-2 240efffe -2 15 0x00000058 slt \$9,\$8,\$14 010e482a 1 16 0x0000005c slti \$10,\$9,2 292a0002 1 17 0x00000060 slti \$11,\$10,0 294b0000 0 18 0x00000064 add \$11,\$10,0 294b0000 0 18 0x00000068 bne \$11,\$2,-2 (≠,转 60) 1562fffe -1 1a 0x00000064 add \$11,\$11,\$10 016a5820 2 19 0x00000068 bne \$11,\$2,-2 (≠,转 60) 1562fffe 0 1a 0x0000006c addiu \$12,\$0,-2 240cfffe -2 1b 0x00000070 addiu \$12,\$12,1 258c0001 -1 1c 0x00000070 addiu \$12,\$12,1 258c0001 0 1c 0x00000070<	0x0000004c	jal 0x0000080	0c000020		13
0x00000088 jr \$31 03e00008 22 0x00000050 slt \$8,\$13,\$1 01a1402a 1 14 0x00000054 addiu \$14,\$0,-2 240efffe -2 15 0x00000058 slt \$9,\$8,\$14 010e482a 1 16 0x0000005c slti \$10,\$9,2 292a0002 1 17 0x00000060 slti \$11,\$10,0 294b0000 0 18 0x00000064 add \$11,\$11,\$10 016a5820 1 19 0x00000068 bne \$11,\$2,-2 (≠,转 60) 1562fffe -1 1a 0x0000006a bne \$11,\$2,-2 (≠,转 60) 1562fffe 0 1a 0x0000006c addiu \$12,\$0,-2 240cfffe -2 1b 0x00000070 addiu \$12,\$12,1 258c0001 -1 1c 0x00000074 bltz \$12,-2 (<0,转 40)	0x00000080	sw \$2,4(\$1)	ac220004	0xc	20
0x00000050 slt \$8,\$13,\$1 01a1402a 1 14 0x00000054 addiu \$14,\$0,-2 240efffe -2 15 0x00000058 slt \$9,\$8,\$14 010e482a 1 16 0x0000005c slti \$10,\$9,2 292a0002 1 17 0x00000060 slti \$11,\$10,0 294b0000 0 18 0x00000064 add \$11,\$11,\$10 016a5820 1 19 0x00000068 bne \$11,\$2,-2 (≠,转 60) 1562fffe -1 1a 0x0000006a bne \$11,\$2,-2 (≠,转 60) 1562fffe 0 1a 0x0000006c addiu \$12,\$0,-2 240cfffe -2 1b 0x00000070 addiu \$12,\$12,1 258c0001 -1 1c 0x00000070 addiu \$12,\$12,1 258c0001 0 1c 0x00000070 addiu \$12,\$12,1 258c0001 0 1c 0x00000074 bltz \$12,-2 (<0,* 40)	0x00000084	lw \$13,4(\$1)	8c2d0004	0xc	21
0x00000054 addiu \$14,\$0,-2 240efffe -2 15 0x00000058 slt \$9,\$8,\$14 010e482a 1 16 0x0000005c slti \$10,\$9,2 292a0002 1 17 0x00000060 slti \$11,\$10,0 294b0000 0 18 0x00000064 add \$11,\$11,\$10 016a5820 1 19 0x00000068 bne \$11,\$2,-2 (≠,转 60) 1562fffe -1 1a 0x00000068 bne \$11,\$2,-2 (≠,转 60) 1562fffe 0 1a 0x0000006c addiu \$12,\$0,-2 240cfffe -2 1b 0x00000070 addiu \$12,\$12,1 258c0001 -1 1c 0x00000074 bltz \$12,-2 (<0,转 40)	0x00000088	jr \$31	03e00008		22
0x00000058 slt \$9,\$8,\$14 010e482a 1 16 0x0000005c slti \$10,\$9,2 292a0002 1 17 0x00000060 slti \$11,\$10,0 294b0000 0 18 0x00000064 add \$11,\$11,\$10 016a5820 1 19 0x00000068 bne \$11,\$2,-2 (≠,按 60) 1562fffe -1 1a 0x00000068 bne \$11,\$2,-2 (≠,按 60) 1562fffe 0 1a 0x0000006c addiu \$12,\$0,-2 240cfffe -2 1b 0x00000070 addiu \$12,\$12,1 258c0001 -1 1c 0x00000074 bltz \$12,-2 (<0,按 40)	0x00000050	slt \$8, \$13 ,\$1	01a1402a	1	14
0x0000005c slti \$10,\$9,2 292a0002 1 17 0x00000060 slti \$11,\$10,0 294b0000 0 18 0x00000064 add \$11,\$11,\$10 016a5820 1 19 0x00000068 bne \$11,\$2,-2 (≠,转 60) 1562fffe -1 1a 0x00000068 bne \$11,\$2,-2 (≠,转 60) 1562fffe 0 1a 0x0000006c addiu \$12,\$0,-2 240cfffe -2 1b 0x00000070 addiu \$12,\$12,1 258c0001 -1 1c 0x00000074 bltz \$12,-2 (<0,转 40)	0x00000054	addiu \$14,\$0,-2	240efffe	-2	15
0x00000060 slti \$11,\$10,0 294b0000 0 18 0x00000064 add \$11,\$11,\$10 016a5820 1 19 0x00000068 bne \$11,\$2,-2 (≠,转 60) 1562fffe -1 1a 0x00000064 add \$11,\$11,\$10 016a5820 2 19 0x00000068 bne \$11,\$2,-2 (≠,转 60) 1562fffe 0 1a 0x0000006c addiu \$12,\$0,-2 240cfffe -2 1b 0x00000070 addiu \$12,\$12,1 258c0001 -1 1c 0x00000074 bltz \$12,-2 (<0,转 40)	0x00000058	slt \$9,\$8,\$14	010e482a	1	16
0x00000064 add \$11,\$11,\$10 016a5820 1 19 0x00000068 bne \$11,\$2,-2 (≠,转 60) 1562fffe -1 1a 0x00000064 add \$11,\$11,\$10 016a5820 2 19 0x00000068 bne \$11,\$2,-2 (≠,转 60) 1562fffe 0 1a 0x0000006c addiu \$12,\$0,-2 240cfffe -2 1b 0x00000070 addiu \$12,\$12,1 258c0001 -1 1c 0x00000074 bltz \$12,-2 (<0,转 40)	0x0000005c	slti \$10,\$9,2	292a0002	1	17
0x00000068 bne \$11,\$2,-2 (≠,转 60) 1562fffe -1 1a 0x00000064 add \$11,\$11,\$10 016a5820 2 19 0x00000068 bne \$11,\$2,-2 (≠,转 60) 1562fffe 0 1a 0x0000006c addiu \$12,\$0,-2 240cfffe -2 1b 0x00000070 addiu \$12,\$12,1 258c0001 -1 1c 0x00000074 bltz \$12,-2 (<0,转 40)	0x00000060	slti \$11,\$10,0	294b0000	0	18
0x00000064 add \$11,\$11,\$10 016a5820 2 19 0x00000068 bne \$11,\$2,-2 (≠,转 60) 1562fffe 0 1a 0x0000006c addiu \$12,\$0,-2 240cfffe -2 1b 0x00000070 addiu \$12,\$12,1 258c0001 -1 1c 0x00000074 bltz \$12,-2 (<0,转 40)	0x00000064	add \$11,\$11,\$10	016a5820	1	19
0x00000068 bne \$11,\$2,-2 (≠,转 60) 1562fffe 0 1a 0x0000006c addiu \$12,\$0,-2 240cfffe -2 1b 0x00000070 addiu \$12,\$12,1 258c0001 -1 1c 0x00000074 bltz \$12,-2 (<0,转 40)	0x00000068	bne \$11,\$2,-2 (≠,转 60)	1562fffe	-1	1a
0x0000006c addiu \$12,\$0,-2 240cfffe -2 1b 0x00000070 addiu \$12,\$12,1 258c0001 -1 1c 0x00000074 bltz \$12,-2 (<0,转 40)	0x00000064	add \$11, \$11 ,\$10	<mark>016a5820</mark>	2	19
0x00000070 addiu \$12,\$12,1 258c0001 -1 1c 0x00000074 bltz \$12,-2 (<0,转 40)	0x00000068	bne \$11,\$2,-2 (≠,转 60)	1562fffe	0	1a
0x00000074 bltz \$12,-2 (<0,转 40) 0580fffe 1d 0x00000070 addiu \$12,\$12,1 258c0001 0 1c 0x00000074 bltz \$12,-2 (<0,转 40)	0x0000006c	addiu \$12,\$0,-2	240cfffe	-2	1b
0x00000070 addiu \$12,\$12,1 258c0001 0 1c 0x00000074 bltz \$12,-2 (<0,转 40)	0x00000070	addiu \$12,\$12,1	258c0001	-1	1c
0x00000074 bltz \$12,-2 (<0,转 40) 0580fffe 1d 0x00000078 andi \$12,\$2,2 304c0002 2 1e 0x0000007c j 0x0000008c 08000023 1f	0x00000074	bltz \$12,-2 (<0,转 40)	0580fffe		1d
0x00000078 andi \$12,\$2,2 304c0002 2 1e 0x0000007c j 0x000008c 08000023 1f	0x00000070	addiu \$12,\$12,1	258c0001	0	1c
0x0000007c j 0x000008c 08000023 1f	0x00000074	bltz \$12,-2 (<0,转 40)	0580fffe		1d
	0x00000078	andi \$12,\$2,2	304c0002	2	1e
0x000008c halt FC000000 23	0x0000007c	j 0x000008c	08000023		1f
	0x000008c	halt	FC000000		23