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CPE221

Final Exam

**1.** True

**2.** MIPS

**3.** Embedded

**4.** True

**5.** Scope

**6**. r2 = -240 = **1111 0001**

**7.** -145 = 1111 1111 0110 1111

+379 = 0000 0001 0111 1011

= **1111 1110 0001 0100**

**8**. r2 = 0000 0100 0110 1000 0011 0001 1110 0110

r3 = 0101 1001 0011 0010 1100 1101 0000 0111

r2 = **1110 0000 1011 0011 0100 1100 1001 1010**

**9.**

|  |  |  |
| --- | --- | --- |
| Cycle | Concrete RTL | Signals |
| 1 | MAR <- R1 | EIR\_B = 1, M\_ALU = 1, C MAR |
| 2 | MBR <- MAR | M\_MBR, CMBR, READ = 1 |
| 3 | R1 <- MBR | EMBR = 1, M\_ALU, Cr1 |
| 4 | MAR <- r0 | ER0\_B = 1, M\_ALU = 1, CMAR |
| 5 | MBR <- MAR | M\_MBR, CMBR, Read = 1 |
| 6 | MBR < MBR + r1 | ALU(F1, F2) = 1, 0, EMBR\_B = 1, M\_MBR = 1, CMBR |
| 7 | MAR <- IR | EIR\_B, M\_ALU = 1, CMAR |
| 8 | M[MAR] <- MBR | Write |
| 9 |  |  |

**10.**

|  |  |  |
| --- | --- | --- |
| Address |  | Hit / Miss |
| 0xFFa | 1111 1111 1010 | Miss |
| 0x010 | 0000 0001 0000 | Miss |
| 0xFE8 | 1111 1110 1000 | Hit |
| 0x497 | 0100 1001 0111 | Miss |
| 0x 8E5 | 1000 1110 0101 | Miss |
| 0x483 | 0100 1000 0011 | Hit |
| 0x392 | 0011 1001 0010 | Miss |
| 0x027 | 0000 0010 0111 | Miss |
| 0x135 | 0001 0011 0101 | Miss |
| 0x592 | 0101 1001 0010 | Miss |

Index = log28 = 3 bits, block = log28 = 3 bits

Byte = 2 bits Tag = 12-(3+3+2) = 4 bits

|  |  |  |
| --- | --- | --- |
| Set | Tag | data |
| 0 | 0000 | M[000-01F] |
| 1 | 0000 0001 | M[020-03f], m[120-13f] |
| 2 |  |  |
| 3 |  |  |
| 4 | 0100, 0101, 0011 | M[480-49F], M[580-59F], M[380-39F] |
| 5 |  |  |
| 6 |  |  |
| 7 | 1111, 1000 | M[Fe0-FFF], M[8E0-8FF] |

**11.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |  |  |  |  |  |  |  |  |  |
| STR R2, [r4] | IF | R | E | MR | MW | W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ADD r6, r2, r5 |  | IF | R | E | MR | MW | W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| LDR r7. [r3] |  |  | IF | R | E | MR | MW | W |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| MOV r9, r6 |  |  |  | IF | R | R | R | R | E | MR | MW | W |  |  |  |  |  |  |  |  |  |  |  |  |
| EOR r7, r7, r6 |  |  |  |  | IF | IF | IF | IF | R | E | MR | MW | W |  |  |  |  |  |  |  |  |  |  |  |

**13 cycles**

**12.**

AREA PROB\_12, CODE, READONLY

ENTRY

LDR r3, size

LDR r4, i

loop CMP r4, r3 ; for(I = 0; I < 10; i++)

BGE done ; if i is greater than 10, exit loop

ADD r5, r4, #1 ; j = i + 1

loop2 CMP r5, r3 ; for(j = i+1; j < 10; j++)

BGE done2 ; if j is greater than 10, exit loop

LDR r6, [r5, LSL #2] ; r6 <- x[j]

LDR r7, [r4, LSL #2] ; r7 <- x[i]

CMP r6, r7 ;if(x[j] < x[i])

BGE done ; if x[j] is greater than x[i] then end

LDR r8, r7 ; temp <- x [ i ]

LDR r7, r6 ; x[ i ] <- x[ j ]

LDR r6, r8 ; x[j] <- temp

ADD r4, r4, #1 ; i++

ADD r5, r5, #1 ; j++

B loop2

done2 B loop

done B done

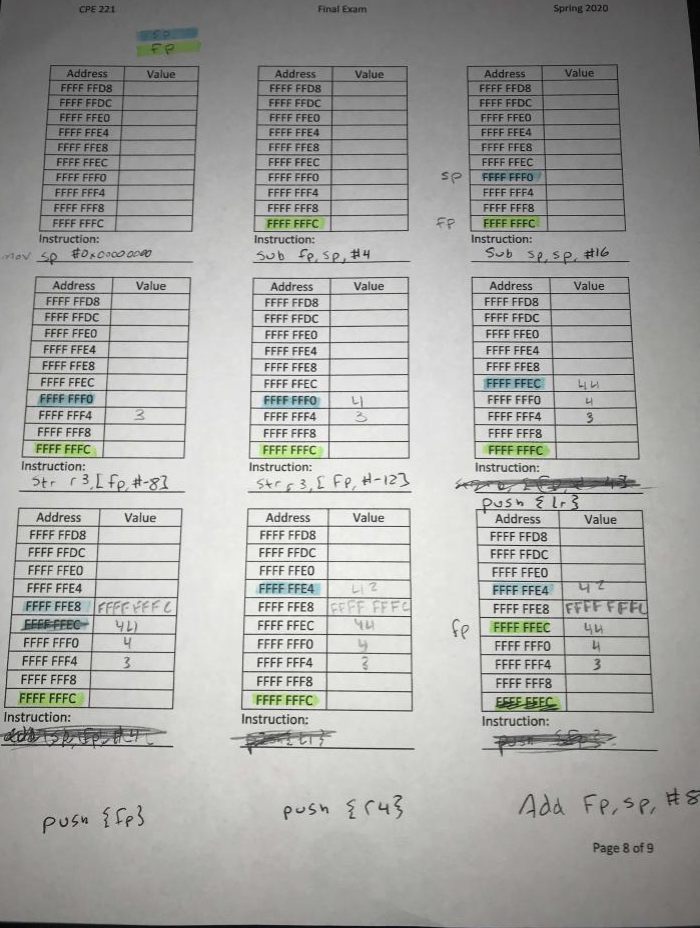
X DCD 400, 2, -3, 285, 47, 11, -13, 17, 19, -95

temp SPACE 4

i DCD 0

size DCD 10

END

**#13 I highlighted sp in blue, and fp in green.**

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