Computer Architecture

Fall, 2019

Week 5

2019.10.7

[group9]

1. [Multiple Choice]. Choose the correct statement.
   (A) sb,sh are the instructions dealing with "byte""/"half word". Moreover, they store leftmost "byte"/"half word" data from register to RAM.
   (B) Assume that we use sb instruction to store data "A7"; due to signed extension, the data will be stored as "AAAAAAA7".
   (C) Assume that we use lbu instruction to load data "A7", the data will be stored as "FFFFFFA7".
   (D) Assume that we use sb instruction to store data "A7"; due to signed extension, the data will be stored as "FFFFFFA7".

Ans: (D)

(A) leftmost -> rightmost

(B) "AAAAAAA7" -> "FFFFFFA7"

(C) "FFFFFFA7" -> "000000A7"

(D) is correct

[group12] **(對抗賽)**

2. 在下列五種 MIPS Addressing Mode 中，請簡述各個 mode 取得 data 的方式。
   1. Immediate addressing
   2. Register addressing
   3. Base addressing
   4. PC-relative addressing
   5. Pseudodirect addressing

Ans:

1. **直接在 immediate 裡面**
2. 透過 rs rt rd 取得 reg 編號 再去對應的 reg 裡面拿
3. 透過描述的編號去對應的 reg 裡面拿到 base address 後 再加上一個 offset(immediate 的值)去到 memory 拿資料
4. Program counter 加上 immediate 的值得到 memory 位址再取得資料
5. Program counter 的前 4 個 bit 連接 instruction 的地址得到 memory 位址後，再去到 memory 這個位址拿

[group1] **(對抗賽)**

3. In the execution of a procedure, the program must follow some steps. What is the correct order of these 6 steps?

A. Acquire the storage resources needed for the procedure.
B. Perform the desired task.
C. Put the result value in a place where the calling program can access it.
D. Put parameters in a place where the procedure can access them.
E. Transfer control to the procedure.
F. Return control to the point of origin, since a procedure can be called from several points in a program.

Ans:

D -> E -> A -> B -> C ->F

[group11] **(對抗賽)**

4. If the current value of the PC is 0x00000600, can you use a single branch instruction to get to the PC address=0010 0000 0000 0001 0100 1001 0010 0100_2?

Ans:

No. Branch is i-format.

opcode(6 bits)	rs(5 bits)	rd(5 bits)	offset(16 bits)

so, the maximum distance to branch is +-2^15

Rewrite 0010 0000 0000 0001 0100 1001 0010 01002 to hexadecimal

0010 0000 0000 0001 0100 1001 0010 0100_2=0x2001492416

The difference between current address and destination address

= 0x2001492416-0x0000060016=0x2001432416=53695363610>2^15=32768

Hence, we can't use a single branch instruction to get to the PC address=0010 0000 0000 0001 0100 1001 0010 0100_2.

[group10]

5. 當 caller 呼叫 subroutine 時 $ra 暫存器會存放 caller program 的返回位置，請問若 caller 呼叫 subroutine_1，此時$ra 存放 caller 返回位置，subroutine_1 呼叫 subroutine_2，此時$ra 存放 subroutine_1 返回位置，subroutine_2 呼叫 subroutine_3，此時$ra 存放 subroutine_2 返回位置，請問(1)subroutine 全部執行完畢，要用什麼機制回到一開始 caller 呼叫 subroutine_1 的返回記憶體位置？(2)此機制有什麼特性？

Ans:

(1) caller 必須將$ra 暫存器 push 到 stack 中，當完成 subroutine 後 pop 出$ra。

(2) Stack 設計為後進先出，剛好符合比較晚被呼叫到的 subroutine 先執行完

[group6] **(對抗賽)**

6. Fill in the blanks below to practice with target addressing.

addi $s4, $zero, 1	80000	8	0	17	1

bne $s1, $s4, C2_COND	80004	5	17	20	**(a)**
j C1_BODY	80008	2	**(b)**		
C2_COND: addi $s4, $zero, 2	80012	8	0	17	2
bne $s1, $s4, C3_COND	80016	5	17	20	**(c)**
j C2_BODY	80020	2	**(d)**		
C3_COND: addi $s4, $zero, 3	80024	8	0	17	3
bne $s1, $s4, EXIT	80028	5	17	20	**(e)**
j C3_BODY	80032	2	**(f)**		
C1_BODY: addi $s1, $s1, 1	80036	8	17	17	1
j EXIT	80040	2	**(g)**		
C2_BODY: addi $s1, $s1, 2	80044	8	17	17	2
j EXIT	80048	2	**(h)**		
C3_BODY: addi $s1, $s1, 3	80052	8	17	17	3
EXIT: …	80056				

Ans:

(a) 1

(b) 20009

(c) 1

(d) 20011

(e) 6

(f) 20013

(g) 20014

(h) 20014

[group8] **(對抗賽)**

7.

```
        beq $s0,$s1,L1
        ...
        ...
        ...
         L1:
```

假設在以上 MIPS 指令中的 L1，其相對於 beq 指令的記憶體位址超過 16 位元所可以表示的距離，則我們可以如何改寫上述指令來達成原本的目的？

Ans:

```
    bne $s0,$s1,L2
        j L1
    L2:...
       ...
```

...

L1:

[group3] **(對抗賽)**

8. 下列敘述哪些正確，若有錯請改出錯誤

(A) Leaf procedure doesn't call any other procedure

(B) Use lb $rt, offset($rs)，11 1111 0001 is sign extended to 32 bit in $rt, the new representation is 0000 0011 0001

(C) This is a jump address. The first 4 bits of the program counter are 1111. If target field = 00 0000 1100 0011 1110 0101 1011, the 32-bit address = 1100 0000 0011 0000 1111 1001 0110 1100.

(D) Design principles: (1)Simplicity favors regularity. (2)Smaller is faster. (3)Make the common case fast. (4)Good design demands good compromises.

Ans: (A) (D)

數量前面應該要為而不是

[group4]

9. 這題應該要為而不是

```
void strcpy (char x[], char y[]){
int i;
i = 0;
while ((x[i] = y[i]) != '\0')
i += 1; }
```

What is the MIPS assembly code? Please fill in the blanks.

```
addi $sp, ___, ___
sw $s0, 0($sp)
add $s0, $zero, ___
L1:
add $t1, ___ , ___
lbu $t2, 0($t1)
___ $t3, $s0, $a0
sb $t2, __($t3)
beq $t2, ___ , L2
addi $s0, $s0, 1
j ___
L2:
lw $s0, 0($sp)
addi $___, $___, 4
```

___ $___

Ans:

```
addi $sp, $sp, -4
sw $s0, 0($sp)
add $s0, $zero, $zero
L1:
add $t1, $s0, $a1
lbu $t2, 0($t1)
add $t3, $s0, $a0
sb $t2, 0($t3)
beq $t2, $zero, L2
addi $s0, $s0, 1
j L1
L2:
lw $s0, 0($sp)
addi $sp, $sp, 4
jr $ra
```