

COMPUTER ARCHITECTURE & ASSEMBLY LANGUAGE

14:332:331

Rutgers University

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Quiz 2

1. Please compile the MIPS assembly code for the following C code? Assume that m and k are passed in \$a0 and \$a1 respectively. Assume that result returned in \$v0.

```
int func (unsigned int m, unsigned int k ) {  
    if (k == 0)  
        return 4;  
    else  
        return 2m+func(m,k-1);  
}
```

Solution:

Func:

```
addi $sp, $sp, -8  
sw $a1, 0($sp)  
sw $ra, 4($sp)  
beq $a1, $0, Exit  
addi $a1, $a1, -1  
jal func  
lw $a1, 0($sp)  
lw $ra, 4($sp)  
addi $sp, $sp, 8  
add $v0, $v0, $a0  
add $v0, $v0, $a0  
jr $ra
```

Exit:

```
addi $v0, $0, 4  
jr $ra
```

2. What does the following function compute?

```
i)  
int fn( unsigned int a, unsigned int b){  
    if (b == 0)  
        return b;  
    else  
        return (a * fn(a, b - 1));  
}
```

Solution:

This function returns always 0. When the second argument reaches 0 the function will return 0. From that point on the return value will be the product of the first argument with 0, which is always 0.

ii) Please change the above code such that it returns a^b and compile the assembly code for your function.

Solution:

You can follow one of these two options: Change `b == 0` to `b == 1` or change `return b` to `return 1`.

Assume that `a` and `b` are stored in `$a0` and `$a1` respectively. Also, we assume that the number a^b will always fit in a 32-bit register correctly.

Fn:

```
addi $sp, $sp, -8
sw $a1, 0($sp)
sw $ra, 4($sp)
beq $a1, $0, Exit
addi $a1, $a1, -1
jal fn
lw $a1, 0($sp)
lw $ra, 4($sp)
addi $sp, $sp, 8
mul $v0, $v0, $a0
jr $ra
```

Exit:

```
addi $v0, $0, 1
jr $ra
```