

## EE 2310 Homework #6 Solutions – Using Branch Instructions: Loops

Write the following programs as directed or answer questions about the programs below that are given.

1. In the box at right, compose a loop program to store the value 0xffff in data locations w, x, y, z (the program can be written without a loop, but you must use a loop in this problem). Then answer these questions:

1.1. What are the memory addresses of w, x, y, z?

0x10010000, 0x10010004, 0x10010008, 0x1001000c.

1.2. How do you decide when you are done?

Use a counter.

2. In the program segment at the right:

2.1. What is the program doing?

Looking for the character w, and counting ASCII characters before it is found.

2.2. What is being put in \$t2, and what will the final value be?

The character count before w is encountered: 6.

3. In the area to the right, construct a program that will print out the datawords in memory in the reverse order that they are declared in the data statement. To do this, use the stack to reverse the data sequence.

```
.text
main:  la $t0,w
      li $t1,4
      li $t8,0xffff
loop:  sw $t8,0($t0)
      sub $t1,$t1,1
      beqz $t1,done
      addi $t0,$t0,4
      j loop
done:  li $v0,10
      syscall

.data
w:     .word 0
x:     .word 0
y:     .word 0
z:     .word 0
```

```
.text
main:  li $t1, 0x77
      li $t2, 0
      la $t8,str
go:    lb $t0,($t8)
      beq $t0,$t1,done
      addi $t8,$t8,1
      addi $t2,$t2,1
      j go
done:  li $v0, 10
      syscall

.data
str:   .asciiz "hello world\n"
```

```
.data
nums:  .word 4,3,2,1

.text
main:  la $t1,nums
onstk: lw $t0,0($t1)
      sub $sp,$sp,4
      sw $t0,0($sp)
      addi $t4,$t4,1
      addi $t1,$t1,4
      bne $t4,4,onstk
ptnum: lw $a0,0($sp)
      addi $sp,$sp,4
      li $v0,1
      syscall
      addi $t4,$t4,1
      bne $t4,8,ptnum

      li $v0,10
      syscall
```

4. The code sequence on the right is a loop that performs an analysis. Answer the following questions:

4.1. What is the program doing?

Printing out capital letters in data words “w” and “x.”

4.2. How many times does the program go through the loop?

Eight times.

4.3. What does the program print out?

The program prints out “UTD ECS\n.”

```
.text
main: li $t1,8
      la $t5,w
go:   lb $t0,0($t5)
      blt $t0,0x30,prt
      bgt $t0,0x39,prt
      j next
prt:  move $a0,$t0
      li $v0,11
      syscall

next: sub $t1,$t1,1
      beqz $t1,end
      addi $t5,$t5,1
      j go
end:  li $a0,0x0a
      li $v0,11
      syscall
      li $v0,10
      syscall

.data
w:    .word 0x55543044
x:    .word 0x45374353
```

5. A simple, non-recursive program can be developed to compute  $n!$  for any number  $n$  less than 12 (due to the fact that we are not using floating-point computations). Write such a program using the data declarations given to the right and make sure that it operates properly.

5.1. What is the decimal value of  $(10!)$  ?

3,628,800

```
.text
main: la $a0,input
      li $v0,4
      syscall
      li $v0,5
      syscall

      move $t6,$v0
      move $t9,$v0
      move $t1,$v0
fact: sub $t6,$t6,1
      beqz $t6,prt
      mul $t1,$t1,$t6
      j fact

prt:  move $a0,$t9
      li $v0,1
      syscall
      la $a0,ans
      li $v0,4
      syscall
      move $a0,$t1
      li $v0,1
      syscall
      li $v0,10
      syscall

.data
input: .asciiz "Input integer (0-11): "
ans:   .ascii " factorial is "
```