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            Lecture 17 Demo Program 1, Character List Alphabetization
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#  Alphabetizes a sequence of ASCII lower-case letters and prints out the resulting
alphabetized list.
#  The list of letters is in the data declaration and contains all 26 alphabet
letters in random order.

#  $t0 -- Pointer to current spot in letters
#  $t1 -- Holds the “upstream compare character”
#  $t2 -- Holds the current character being analyzed
#  $t7 -- Pointer to the first character in string

        .text
main:   la $t0,string   # Load the string address into $t0
        la $t7,string   # Load the string address into $t7
comp:   lb $t1,0($t0)   # Load first two characters to be compared
        lb $t2,1($t0)
        beqz $t2,done   # If the new character = 0, done
        ble $t1,$t2,count # If characters in correct order, get next character
        jal rev         # Characters not in correct order; go to reverse
        j comp          # Character in correct position; get next character
count:  addi $t0,$t0,1  # Increment current character address
        j comp          # Return to next character compare

done:   la $a0,string   # Print out alphabetized string + CR
        li $v0,4
        syscall
        li $v0,10       # Done; end program.
        syscall

# Character reverse routine follows
rev:    sub $sp,$sp,4   # Store contents of $ra on the stack
        sw $ra,($sp)    # Decrement stack pointer.
        sb $t1,1($t0)   # Exchange two character positions
        sb $t2,0($t0)
        beq $t0,$t7,goback  # If at first position in the string, done

        sub $t0,$t0,1   # Decrement the letter pointer.
        lb $t1,0($t0)   # Compare letter to next "upstream" letter
        lb $t2,1($t0)
        ble $t1,$t2,goback  # If letter is properly placed, done
        jal rev         # Not done yet; move back another position

goback: addi $t0,$t0,1  # Reverse done; move back to current position
        lw $ra,($sp)
        addi $sp,$sp,4
        jr $ra

        .data
string: .asciiz "qwertyuiopasdfghjklzxcvbnm"    # Characters list
#  End of Lecture 17 Demo Program 1.
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