

UNIVERSITY OF CALIFORNIA, RIVERSIDE
Department of Computer Science and Engineering
CS61 – Machine Organization and Assembly Language
Homework 2
Given August 14, Due August 20, 2001

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1. Consider the following machine language program:

Address	Content
x3000	x54A0
x3001	x127F
x3002	x127F
x3003	x127F
x3004	x0807
x3005	x14A1
x3006	x0E01
x3007	xF025

What are the possible initial values of R1 that cause the final value in R2 to be 3?

Answer

9, 10, and 11

2. Write a LC-2 assembly language program that will display the numbers from 1 to 10 on the console.

Answer

```

.orig    x3000
ld      r0, one
trap    x21                ;echo number
ld      r0, 1f
trap    x21                ;next line
ld      r0, two
trap    x21                ;echo number
ld      r0, 1f
trap    x21                ;next line
ld      r0, three
trap    x21                ;echo number
ld      r0, 1f
trap    x21                ;next line
ld      r0, four
trap    x21                ;echo number
ld      r0, 1f
trap    x21                ;next line
ld      r0, five
trap    x21                ;echo number
ld      r0, 1f
trap    x21                ;next line
ld      r0, six
trap    x21                ;echo number
ld      r0, 1f

```

```

trap    x21                ;next line
ld      r0, seven
trap    x21                ;echo number
ld      r0, lf
trap    x21                ;next line
ld      r0, eight
trap    x21                ;echo number
ld      r0, lf
trap    x21                ;next line
ld      r0, nine
trap    x21                ;echo number
ld      r0, lf
trap    x21                ;next line
ld      r0, one
trap    x21                ;echo number
ld      r0, zero
trap    x21                ;echo number
ld      r0, lf
trap    x21                ;next line
halt

zero    .fill    x0030
one     .fill    x0031
two     .fill    x0032
three   .fill    x0033
four    .fill    x0034
five    .fill    x0035
six     .fill    x0036
seven   .fill    x0037
eight   .fill    x0038
nine    .fill    x0039
lf      .fill    x000a          ;line feed
.end

```

3. Write a LC-2 assembly language program that calculates the GCD (Greatest Common Divisor) of two numbers. The two numbers are in R0 and R1. Put the result in R3.

The algorithm to find the GCD of two numbers x and y is as follows:

```

while (x ≠ y) do{
    if (x < y)
        y = y - x
    else
        x = x - y
}
result in x

```

Answer

```

.orig    x3000

;x in R0, y in R1
ld      r0, x
ld      r1, y
loop    ;test x>y
not     r2, r1
add     r2, r2, #1

```

```

    add    r2, r2, #1
    add    r2, r0, r2
    brz    done          ;x=y
    brzp   greater       ;x>=y
    ;y = y - x
    not    r2, r0
    add    r2, r2, #1
    add    r1, r1, r2
    br     loop
greater  ;x = x - y
    add    r0, r2, #0      ;
    br     loop
done    ;result in x
    ld     r1, asciidi
    add    r0, r0, r1
    trap   x21             ;echo number
    halt

x       .fill    #12
y       .fill    #4
lf      .fill    x000a      ;line feed
asciidi .fill    x0030
        .end
```