

decode2.c:

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// decode2.c
// Homework Problem 3.58 decode2

#include <stdio.h>

//decode2(x,y,z)

//now lets get t1 = y - z.
//then compute t2 = x * t1.
//C=and then compute t3 = (t1 << 63) >> 63,
//which is 0 if t1 ≥ 0, or -1 if t1 < 0.
//Finally, compute t4 = t2 XOR t3.
// This function returns t2 XOR t3, i.e. conditionally complement t2 when t1 is
negative.

long decode2(long x, long y, long z) {
    long t1 = y - z;           // t1 = y - z
    long t2 = x * t1;          // t2 = x * t1
                                // t2 = x * (y - z) = x * y - x * z
    long t3 = (t1 << 63) >> 63; // t3 = sign-mask of t1 (0 or -1)
    long t4 = t3 ^ t2;          // t4 = t2 XOR t3
    return t4;
}

// Main function to test decode2
int main(void) {
    // Example usage of decode2
    long x = 5, y = 2, z = 7;
    long result = decode2(x, y, z);
    printf("decode2(%ld, %ld, %ld) = %ld\n", x, y, z, result);
    return 0;
}
```

decode2.s:

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| .file "decode2.c" |
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.text
.globl decode2
.type decode2, @function
decode2:
.LFB23:
.cfi_startproc
endbr64
# Parameter-to-register mapping:
# x: %rdi
# y: %rsi
# z: %rdx
# Return value in %rax
subq %rdx, %rsi # Compute t1 = y - z
imulq %rsi, %rdi # Compute t2 = x * t1
salq $63, %rsi # Shift t1 left by 63 to isolate sign bit
sarq $63, %rsi # Arithmetic right shift by 63 to get t3 = 0 or -1
movq %rdi, %rax # Move t2 to %rax
xorq %rsi, %rax # Compute t4 = t2 XOR t3
ret
.cfi_endproc
.LFE23:
.size decode2, .-decode2
.section .rodata.str1.1,"aMS",@progbits,1
.LC0:
.string "decode2(%ld, %ld, %ld) = %ld\n"
.text
.globl main
.type main, @function
main:
.LFB24:
.cfi_startproc
endbr64
subq $8, %rsp
.cfi_def_cfa_offset 16
movl $7, %edx
movl $2, %esi
movl $5, %edi
call decode2
movq %rax, %r9
movl $7, %r8d
movl $2, %ecx
movl $5, %edx
leaq .LC0(%rip), %rsi
movl $1, %edi

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    movl  $0, %eax
    call  __printf_chk@PLT
    movl  $0, %eax
    addq  $8, %rsp
    .cfi_def_cfa_offset 8
    ret
    .cfi_endproc
.LFE24:
    .size  main, .-main
    .ident "GCC: (Ubuntu 11.4.0-1ubuntu1~22.04) 11.4.0"
    .section      .note.GNU-stack,"",@progbits
    .section      .note.gnu.property,"a"
    .align 8
    .long  1f - 0f
    .long  4f - 1f
    .long  5
0:
    .string "GNU"
1:
    .align 8
    .long  0xc0000002
    .long  3f - 2f
2:
    .long  0x3
3:
    .align 8
4:

```