

CPEN 211 Computer Systems I, 2023
Lab Proficiency Test #2

Question 1 [3 marks, part marks possible]: Create a file named “q1.s” and inside it write ARM assembly to implement the C code for function func below. Assume that i, j, and k are 32-bit signed integers stored in registers R1, R2, and R3 respectively, and that the base of array A is in R0.

```
int func(int *A, int i, int j, int k) {
    if ( i == j ) {
        A[0] = A[1] + k;
    } else {
        A[1] = A[0] - k;
    }
    if ( i < k ) {
        if ( i < j ) {
            A[2] = -j;
        }
    } else {
        A[3] = j + 1;
    }
    return i + j - k;
}
```

The autograder requires the result returned by func be in R0 after your code executes. Your q1.s must contain the ARM code below where you must replace the comment “// ADD YOUR CODE HERE” with ARM code for func. Ensure the ARM code you add does not modify R13 or R14. Your ARM code should work with any values of i, j, k and any array A, not just the values used in the ARM code below. To test your code, you may change the inputs to func by modifying the values in R0 to R3 by changing the lines before “BL func” and/or changing the array “data” in q1.s. Ignore warnings about “Function clobbered registers(s)” in the online simulator. Your solution for Question 1 will get zero if any of the following are true: (1) Your **last** “Lab Proficiency Test #2” attempt on Canvas does not include “q1.s”; (2) Your “q1.s” file does not compile with the Monitor Program configured to use the DE1-SoC Computer or the online simulator: <https://cpulator.01xz.net/?sys=arm-de1soc>

```
.global _start
_start:
    LDR R0, =data // set base of A = first address of array “data”
    MOV R1, #1    // i=1
    MOV R2, #1    // j=1
    MOV R3, #1    // k=1
    BL func
END: B END // infinite loop; R0 should contain return value of func

.global func
func:
    // ADD YOUR CODE HERE
    MOV PC, LR

data:
    .word 0
    .word 0
    .word 0
    .word 0
```