ECE/CSE 469 – Computer Design and Organization  
HW #1

1. Pseudo-instructions are instructions in assembly language that are not part of the ARM instruction set. Instead, the assembler converts them into a small set of real ARM instructions. For each of the following instructions, convert them to an equivalent (VERY short) set of real ARM instructions. If you need a temporary variable, use X16 (a register reserved for the assembler as a temporary). You will also want to read about the MOVZ and MOVK instructions (Chapter 2.10 in the book, or online references).

| **Pseudo-instruction** | **What it accomplishes** |
| --- | --- |
| **LI X2, 32’bigUnsigned** | X2 = bigUnsigned (note: solved below) |
| **CLEAR X1** | X1 = 0 |
| **BNE X1, 16’smallUnsigned, L** | if (X1 != smallUnsigned) go to L |
| **LDUR X0 [X1, 48’bigUnsigned]** | X0 = Memory[X1 + bigUnsigned] |

Note that constants have their bitwidths given as bitwidth’const. If you need to access a portion of the constant, you can do that. For example, to implement “LI X2, 32’big”, you would write:

MOVZ X2, bigUnsigned[31:16], LSL 16 // zero X2, set [31:16]  
 MOVK X2, bigUnsigned[15:0], LSL 0 // set bottom 16 bits

Warning: most math operations (ADDI, ANDI, etc) allow only 12-bit constants! Loads only allow 9 bits!

2.) Convert the following code to ARM instructions. Assume a is in X0, b in X1, n in X2, and the result should go into X10. You may change the values in any of these registers. Implement the subroutine call by simply branching to the top of your code, but with the arguments updated appropriately. To end your program, call “BR X30” to return to the subroutine caller. Shorter and faster programs will be given more credit.

int fib\_iter(int a, int b, int n) {   
 if (n == 0)   
 return b;   
 else   
 return fib\_iter(a+b, a, n-1);