EGCP-3210   Computer Architecture   Spring 2026

Homework 3   **Brandon Aikman**

1. For the mano machine we discussed in class, assume we want to replace the AND instruction with a SUB instruction, whose function will be:

   (a) AC←AC - M[addr]
   Write the complete isntruction cycle analysis by specifying microoperations clock cycle by clock cycle along with its condition. (10 pts)

   T0: AR←PC
   T1: IR←M[AR], PC←PC + 1
   T2: I←IR(15), AR←IR(0-11), D7...D0←Decode(IR(12-14))
   T3 $\cdot$ I $\cdot$ D7$'$: AR←M[AR]
   T4 $\cdot$ D1: DR←M[AR]
   T5 $\cdot$ D1: AC←AC - DR, E←C_{out}, SC←0

   (b) What if we want to replace the AND instruction with a SEQ instruction. SEQ is defined as: SEQ: if (M[AR]==AC), skip next instruction. Do the same instruction analysis to the SEQ.(10pts)

   T0: AR←PC
   T1: IR←M[AR], PC←PC + 1
   T2: I←IR(15), AR←IR(0-11), D7...D0←Decode(IR(12-14))
   T3 $\cdot$ I $\cdot$ D7$'$: AR←M[AR]
   T4 $\cdot$ D0: DR←M[AR]
   T5 $\cdot$ D0 $\cdot$ (AC - DR = 0): PC←PC + 1, SC←0
   T5 $\cdot$ D0 $\cdot$ (AC - DR ≠ 0): SC←0

2. The operations to be performed with a flip-flop F are specified by the following register transfer statement:
   xT3: F←1; set F
   yT1: F←0; clear F
   zT2: F←/F; complement F
   wT5: F←G; load G
   Implement with a JK flip-flop (10 pts)

   J = xT3 ∨ zT2 ∨ (wT5 ∧ G)
   K = yT1 ∨ zT2 ∨ (wT5 ∧ ¬G)