Digital & Embedded Systems
ELEC4314

Lab Assignment 2 – CPU Design
Points: 10

EQUIPMENT: PC/Mac with ReTrO simulation system

EXPERIMENT 1 (8 points)
Build a working CPU with 16-bit data bus (8-bit op-codes, and 8-bit operands / 8-bit addresses). Use a 16-bit wide RAM module. Implement the following ALU/CU functions:

0 v LOADC load constant into accum. acc := v
1 a LOADM load memory value into accum. acc := mem[a]
2 v ADDC add constant to accumulator acc := acc + v
3 a ADDM add memory value to accumulator acc := acc + mem[a]
4 a STORE store accumulator to memory (high byte 0) mem[a] := acc
5 a BZ branch cond. if acc = 0 to address a if acc=0 then pc := a
6 a BRA branch unconditionally to address a pc := a
7 * NOP no operation

EXPERIMENT 2 (2 points)
Write a program to calculate 1 + 2 + 3 ... + m, for a given value m with m≥1.

Data locations: value m in location $A0$
result in location $A1$

Algorithm: clear result
loop: add mem[m] to result
decrement mem[m]
if (m≠0) branch to loop
done: branch to done /* finished: endless loop */

Example:
m in mem[A0] result in mem[A1]
3 3
2 5
1 6
0 6