The University of Western Australia
Electrical, Electronic and Computer Engineering
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Embedded Systems
ENGT2303

Lab Assignment 2   week 4

EQUIPMENT: PC with ReTrO simulation system

EXPERIMENT 1
Build a full working CPU with 8-bit data bus (8-bit op-codes, 8-bit operands, 8-bit addresses).
Then write a program to calculate 1 + 2 + 3 ... + m, for a given value m. So:

$$result = \sum_{i=1}^{m} i$$

ALU: single accumulator, functions: nop / add / subtract

CU: with the following op-codes:
- 0 --   **nop**
- 1 v   **load** constant   acc := v
- 2 v   **add** constant   acc := acc + v
- 3 v   **subtract** constant   acc := acc - v
- 4 a   **store** accumulator value to memory address a   mem[a] := acc
- 5 a   **load** memory value from address a in accumulator   acc := mem[a]
- 6 a   **add** memory value from address a in accumulator   acc := acc + mem[a]
- 7 a   **subtract** memoryvalue from address a in accumulator acc := acc = mem[a]
- 8 a   **branch unconditionally** to address pc+a   pc := pc+a
- 9 a   **branch conditionally** if acc $\leq$ 0 to address pc+a   if acc$\leq$0 then pc := pc+a
- 10 v   **branch conditionally** if acc $=$ v to address pc+4   if acc$=$v then pc := pc+4
                                                                         else pc := pc+2

- all other opcodes are "no operation"

Data locations: value m in location $F0
                result in location $F1

Algorithm: clear result_value   **/* Assume m $\geq$ 1 */**
            loop:
                add mem[m] to result
                decrement mem[m]
                if (m$\neq$0) branch to **loop**

Example: | m | Result |
|---|---|
| 3 | 3 |
| 2 | 5 |
| 1 | 6 |
| 0 | 6 |