Slide set A-7

**Part 1. Simple Accumulator Architecture Machine**

**Basics**

The machine has only 1 data register, called an **accumulator**

It has a **1-byte word size** (8 bits per word)

It has a **32-word memory** (32-bytes)

**Instructions are all one word long** (8 bits)

The leftmost 3 bits are an **opcode**: A code for the instruction type

The rightmost 5 bits are an **address** of a word/byte in memory

Every instruction works only on 8 bit data

The simple processor only has **2 types of instructions:**

1) **ALU** (add, sub, mul, div)

2) **Data movement** (load, store)

There are no control-flow instructions, such as call, ret, or jump/branch

Every one of the instructions reads a word/byte of data and also writes a word/byte of data. See the table below to understand the scheme:

**ALU Instructions**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Instruction | Opp  code | Read  (1st op) | Read  (2nd op) | Operation | Write  (result) |
| add | 000 (0) | acc | mem word | add | acc |
| sub | 001 (1) | acc | mem word | sub | acc |
| mul | 010 (2) | acc | mem word | mul | acc |
| div | 011 (3) | acc | mem word | div | acc |

**Data Movement Instructions**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Instruction | Opp  code | Read | Operation | Write |
| load | 100 (4) | mem word | load | acc |
| store | 101 (5) | acc | store | mem word |

Other Notes

Other registers in the processor (but not data registers – used for special purposes):

**PC**: Program Counter – to hold address of current instruction, until after address is sent to memory to read the instruction; then the address will be incremented by the **INC** unit (which always adds 1, since each instruction is 1-byte long).

**IR**: Instruction Register – to hold the bit string for the instruction, so that it can be decoded by **Decode** and then executed by the processor.

**MAR**: Memory Address Register – used for the processor to write an address to which will be sent to a **DECODER** for the memory.

**MDR**: Memory Data Register – used for the processor to either (1) write data which will be sent to the memory to be stored in a word OR (2) to read data which the memory has read from a word for a load instruction or for an ALU operation.