Chapter 2

Computer Organisation

Lesson 5

Arithmetic Logic Unit

Objective —

- **Understand the operations in ALU**

ALU for Program instructions

- The arithmetic and logic unit (ALU) performs the instructed operation on the operands.
- The instruction set of a processor contains the instructions that a given processor ALU can execute.

Operands in Program instructions

- Source Operands
- Destination Operand
- Implied Accumulator as one of the source and the destination operands

Operands Load and Store

- Most often, the required operands are *loaded* in the register from the memory *before* the arithmetic or logic operation instruction.
- Most often, the operands are *stored* from the register to the memory address *after* the arithmetic or logic operation instruction

ALU arithmetic operations on two operands

(a) addition,

(b) addition with previous operation carry,

(c) subtract,

(d) subtract with previous operation borrow,

ALU arithmetic operations on two operands

(e) multiply integers without sign considerations,

(f) multiply integers with sign considerations,

ALU arithmetic operations on two operands

(g) divide integers without sign considerations,

(h) Divide integers with sign considerations,

(i) Increment, decrement, and negate (multiply by –1]

ALU Logic Operations

- AND, OR, and XOR. NOT operation on an operand is also done.

ALU Logic Operations

- Test (hypothetical AND, and set flags as per result of ANDing) and Compare (hypothetical subtraction and set flags as per result of comparing - equal or greater or less).

ALU Logic Operations

(a) left shift by one or specified number of bits,

(b) right shift by one or specified number of bits,

(c) arithmetic shift-right by one or specified number of bits,

ALU Logic Operations

(d) rotate left by one or specified number of bits, and

(e) rotate right by one or specified number of bits

Example The processor 8086 ALU

Executes most of the arithmetic and logic instructions and also provides a number of addressing modes for one of the source operands

Example ARM processor ALU MLA instruction

- Multiply one register by another and add the result into the first register. The ARM processor ALU adds one register operand by other operand after left-shift by *n* bits. [Left shift by 2 is equivalent to multiply by 2^2 and thus the operation is $A + 4 \times B$.]

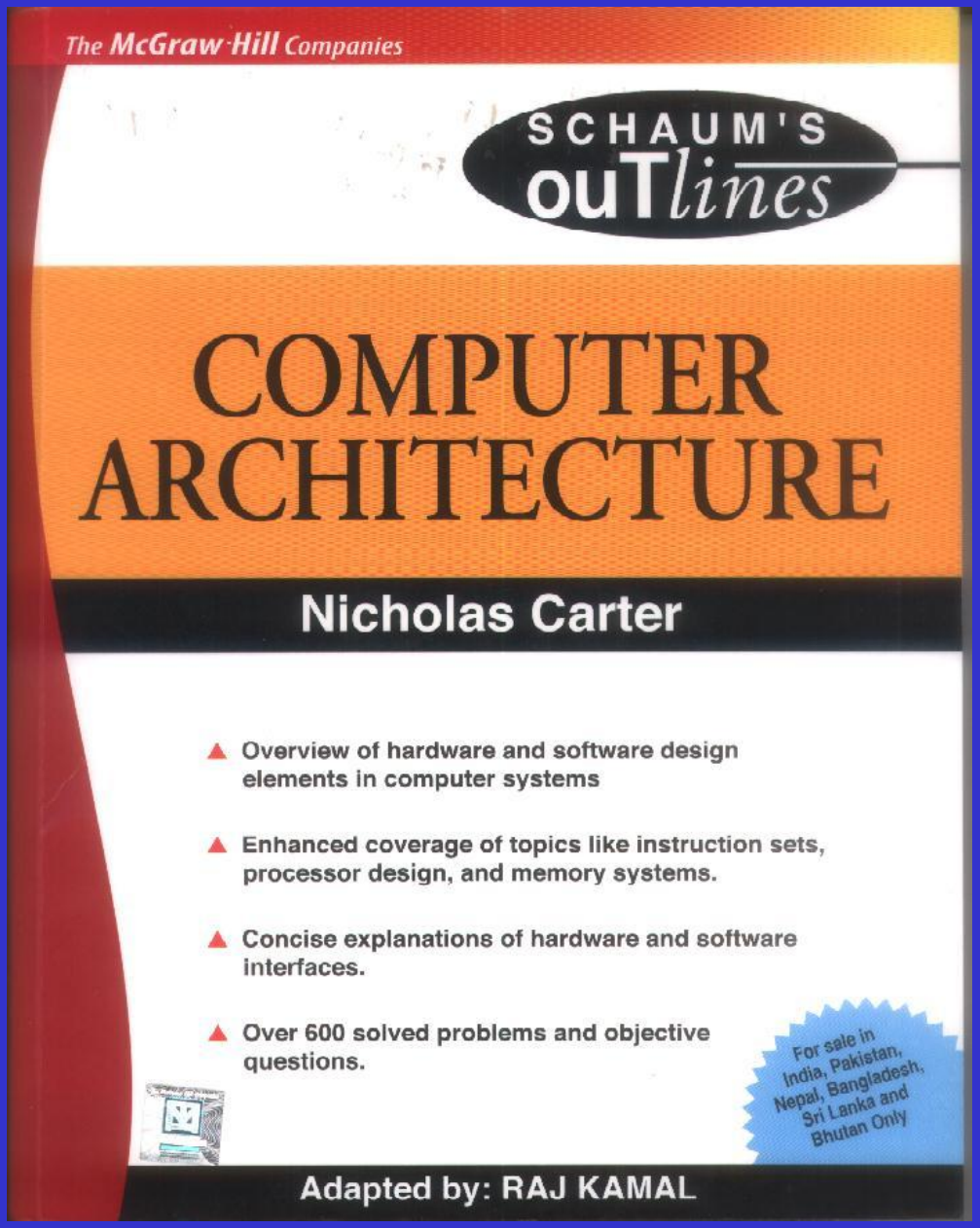
Summary

We learnt

ALU does all the arithmetic and logic operations which instruction set provides and uses addressing mode provided in an instruction

End of Lesson 5 on

Arithmetic Logic Unit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