

Computer Architecture

Innovative Assignment

Topic : Basic Computer

(16-bit computer implemented on a 4096 x 16 RAM)

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Introduction :

We have implemented and demonstrated the construction and working of a basic 16-bit computer. The aim was to see the inner workings of the computer, the usage of various registers in storing and modifying data, and the implementation of memory in storing these data.

List of circuits implemented by us in this construction :

- Control Unit (which coordinates all the signals, control functions, bus selection, etc.)
- Bus control unit (which selects the register data to be loaded on bus)
- Register control circuits (which tell which of the following (LOAD, INCREMENT or CLEAR) operations are to be performed on which register/s).
- Adder circuit : This circuit gives us a list of operations which can be performed with the data present in the accumulator. This circuit is made of two sub-components :

1. Adder stage : This gives us the bitwise operations between all of the DR and AC bits.
 2. Gate control structure : This control circuit selects which of the operations is to be allowed to be sent to the AC.
- Sequence Counter CLEAR : This circuit clears the sequence counter whenever the given instruction is completed.

All of the above sub-components are combined in the main circuit and hence, we have created the basic computer. The instruction length of the micro-instruction is 12 bits and the operand length is 16 bits.

The overall size of the memory unit (RAM) in this computer is 4096×16 bits. The registers AR and PC have sizes 12 bits, as they store addresses of instructions. The registers DR, AC, IR, TR have sizes of 16 bits, as they store either memory words (operands) or instructions. However, the registers AR and PC have 16 bits for this computer, as they would be a bit convenient to implement this onto the bus.

The input and output registers have 16 bits each too, as it would be convenient to load them onto the MUX without difficulties.