

COMPUTER ARCHITECTURE

2020 - 2021

TD n°1

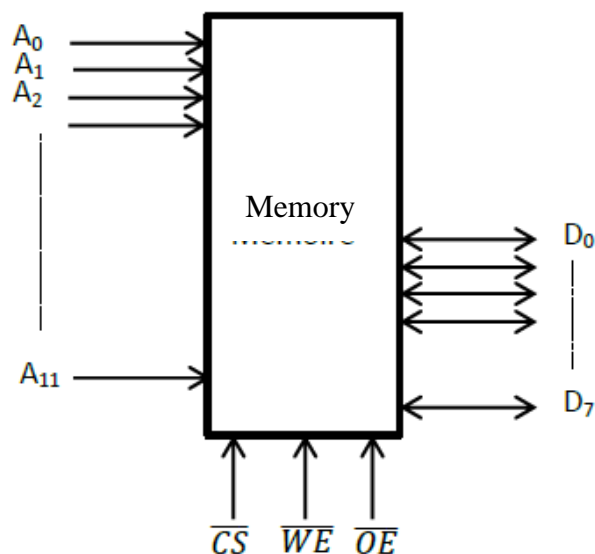
Exercise 1:

Calculate the time (in terms of a clock pulse) needed to perform the operation:

$$X = Y + Z$$

Exercise 2:

The memory of a computer consists of an assembly of several memory circuits, such as the one shown in the following figure:



A_i entries encode the address of a memory word. The D_j inputs/outputs communicate with the data bus (writing or reading a word in memory). This box has 3 control inputs \overline{CS} , \overline{WE} , and \overline{OE} , active in reverse.

During a reading operation, the *CS* (*chip select*) signal role is to select one of the boxes: for a given box, this input allows reading or writing. In this case, *WE* (*write enable*) causes writing, while *OE* (*output enable*) causes reading. The size of a memory is expressed in Kilos (1Kilo, noted $1K = 2^{10} = 1024_{(10)}$).

1. Determine the size of the memory words and the capacity of this box in KB.
2. By assembling boxes of this type: how to create a 4K word 16-bit memory space?
3. What is the size of the address bus necessary to cover a memory space of 8K words of 16 bits if we assume that the data bus is 16 bits in size?

Exercise 3:

Johnny is a simulator of a simple (virtual) Von Neumann Computer. Its principal application is education; therefore, a number of simplifications are made : a reduced instruction set, simplified bus operations, etc.

It visualizes the function of Memory, Arithmetic Logic Unit and Control Unit. Machine Programs can be created and edited using a comfortable GUI and run on the virtual machine step by step.

After installing the **Johnny** simulator on your machine (unzip file available on Moodle), launch it and discover its use via the two programs "[addition of two numbers](#)" and "[multiplication of two numbers](#)" proposed in the user manual.

1. Give the sequence of instructions to determine the size of a table from the range of valid indices ([index_max](#) - [index_min](#) + 1).
2. Give the sequence of instructions that allows the sum of the first 10 integers to be calculated.
3. Based on an iterative algorithm of the Fibonacci sequence, give the sequence of instructions that allows to calculate F_6 .