The Von Neumann architecture: a summary
CSE101 fall 2010

This is a summary of the core attributes of the Von Neumann computer architecture, which is illustrated in figure 1. In modern computers, the control unit and ALU are part of the CPU.
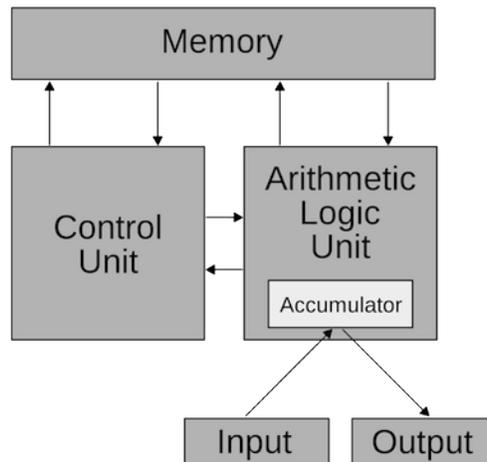

Figure 1. The Von Neumann architecture model.

The Von Neumann architecture is a design model for a stored-program digital computer. Its main characteristic is a single separate storage structure (the memory) that holds both program and data.

Some important features of the Von Neumann architecture are:

- both instructions (code) and data (variables and input/output) are stored in memory;
- memory is an collection of binary digits (bits) that have been organized into bytes, words, and regions with addresses;
- the code instructions and all data have memory addresses;
- to execute each instruction, it has to be moved to registers;
- only the registers have the "smarts" to do anything with the instructions; memory locations have no "smarts";
- to save a result computed in the registers, it has to be moved back to memory;
- the granularity of instructions at the machine or assembler level is much smaller than the granularity at the MATLAB programming language level; that is, each MATLAB instruction corresponds to many machine instructions;
- operating systems and compilers keep the instructions and data in memory organized so it doesn't get mixed up together;
- if a program execution goes past its legal last instruction (for example) it can overwrite other instructions/data in memory and cause strange things to happen;
- one of the advantages of modern operating systems and compilers is the concept of relocatable code — that is, code that can be loaded and run from any location in memory.

— Greg Phillips (http://arity.ca/greg.html)