

1. Based on what we covered in class,
 - a) ENIAC is the first general-purpose, digital computer. IF NOT name the first general purpose computer (T)
 - b) Is it true that The task done by any software program can also be done by hardware. (T)
 - c) GHz is often used to measure the frequency/clock speed of a computer , if not what is used to measure the speed of computer (T)
 - d) Because of VLSI technologies, current computers become cheaper and more powerful. (T)
 - e) ALU, registers, and a control unit are typically included inside CPU (t)
2. What does the control unit in a CPU do?

The control unit of a CPU is in charge of sequencing operations performed by the datapath, and makes sure that correct data are where they need to be at the correct time.

3. what are the different types of registers ? Where are registers located ?

There are special-purpose registers that holds some particular type of information all the time, and general-purpose registers that can hold various types of information. Special-purpose registers are solely controlled by the CPUs, and programmers do not have accesses to them. General-purpose registers are exposed and manipulated by programmers so that the programmers can use these registers in their programs. In addition, there are status registers which hold status of information as the results of operations performed by the CPU. These are also special purpose registers.

Registers are located in the datapath of a CPU.

4. How does the ALU know which function to perform?

the ALU knows which operation to perform as it is controlled by the signals coming from the control unit.

5. Explain the differences between data buses, address buses, and control buses.

Data bus : is the collection of wires that specifically carries data, which is the actual information that needs to be moved from one location in a CPU to another.

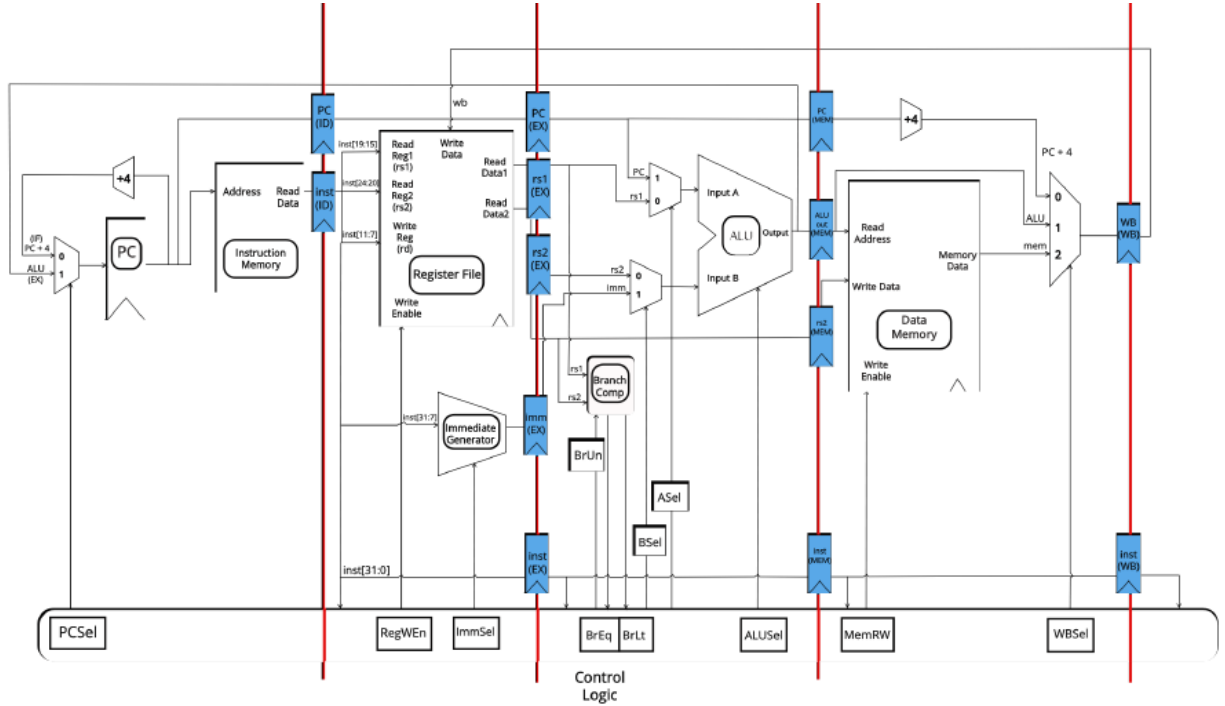
An address bus : is a collection of wires that carries address information for accessing memory or register IDs for accessing specific registers.

A control bus : is the collection of wires carries the information specifying the particular operations that need to be performed by the ALU, or read/write operations that need to be performed by the memory, or IO requests for IO communications, etc.

6. Explain the relation between clock cycle time and clock frequency.

Clock cycle time means the amount time each clock cycle takes, while the clock frequency is the reciprocal of the cycle time. For example, an 1 GHz clock signal has a cycle time of 1 ns.

1. In order to pipeline, we add registers between the five datapath stages.
 - a. Label each of the five stages (IF, ID, EX, MEM, and WB) on the diagram below.



- b. What is the purpose of the new registers?

When we pipeline the datapath, the values from each stage need to be passed on at each clock cycle. Each stage in the pipeline only operates on a small set of values, but those values need to be correct with respect to the instruction that is currently being processed. Say we use load word (lw) as an example: if it is in the EX stage, then the EX stage should look like a snapshot of the single-cycle datapath. The values on the rs1, rs2, immediate, and PC values should be as if lw was the only instruction in the entire path. This also includes the control logic: the instruction is passed in at each stage, the appropriate control signals are generated for the stage of interest, and that stage can execute properly.

- c. Why do we need to save the instruction in a register multiple times?

We need to save the instruction in a register multiple times because each pipeline stage needs to receive the right control signals for the instruction currently in that stage.

2. Extra question: What are the main roles of operating Systems (OS)?

There are four main roles that an OS plays:

- Provides functions/SW packages to control HW, and serves as an interface of HW to SW.
- Manage HW resources to maximize the overall system efficiency.
- Make the system user-friendly and easy to use.
- Protect HW of the system from harmful actions of user applications or external