RISC and CISC

- A **microprocessor** is a processing unit on a single chip. It is an integrated circuit which performs the core functions of a computer CPU.
- It is a multipurpose programmable silicon chip constructed using Metal Oxide Semiconductor (MOS) technology which is clock driven and register based.
- It accepts binary data as input and provides output after processing it as per the specification of instructions stored in the memory.
- These microprocessors are capable of processing 128 bits at a time at the speed of one billion instructions per second.

- **Characteristics of a micro processor:**
- **Instruction Set –**
  Set of complete instructions that the microprocessor executes is termed as the instruction set.
- **Word Length –**
  The number of bits processed in a single instruction is called word length or word size. Greater the word size, larger the processing power of the CPU.
- **System Clock Speed –**
  Clock speed determines how fast a single instruction can be executed in a processor. The microprocessor's pace is controlled by the System Clock. Clock speeds are generally measured in million of cycles per second (MHz) and thousand million of cycles per second (GHz). Clock speed is considered to be a very important aspect of predicting the performance of a processor.

- **Classification of Microprocessors:**
  Besides the classification based on the word length, the classification is also based on the architecture i.e. Instruction Set of the microprocessor.
- These are categorized into RISC and CISC.

- **RISC:**
  It stands for Reduced Instruction Set Computer. It is a type of microprocessor architecture that uses a small set of instructions of uniform length.
- These are simple instructions which are generally executed in one clock cycle.
- RISC chips are relatively simple to design and inexpensive.
- The setback of this design is that the computer has to repeatedly perform simple operations to execute a larger program having a large number of processing operations.
  Examples: SPARC, POWER PC etc.

- **CISC:**
  It stands for Complex Instruction Set Computer. These processors offer the users, hundreds of instructions of variable sizes.
- CISC architecture includes a complete set of special purpose circuits that carry out these instructions at a very high speed.
- These instructions interact with memory by using complex addressing modes.
- CISC processors reduce the program size and hence lesser number of memory cycles are required to execute the programs. This increases the overall speed of execution.
  Examples: Intel architecture, AMD

- **EPIC:**
  It stands for Explicitly Parallel Instruction Computing.
- The best features of RISC and CISC processors are combined in the architecture.
- It implements parallel processing of instructions rather than using fixed length instructions.
- The working of EPIC processors are supported by using a set of complex instructions that contain both basic instructions as well as the information of execution of parallel instructions. It substantially increases the efficiency of these processors.

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- Reduced Set Instruction Set Architecture (RISC) –
- The main idea behind is to make hardware simpler by using an instruction set composed of a few basic steps for loading, evaluating and storing operations just like a load command will load data, store command will store the data.

- Complex Instruction Set Architecture (CISC) –
- The main idea is to make hardware complex as a single instruction will do all loading, evaluating and storing operations just like a multiplication command will do stuff like loading data, evaluating and storing it.

- Both approaches try to increase the CPU performance

- RISC: Reduce the cycles per instruction at the cost of the number of instructions per program.
- CISC: The CISC approach attempts to minimize the number of instructions per program but at the cost of increase in number of cycles per instruction.

- Earlier when programming was done using assembly language, a need was felt to make instruction do more task because programming in assembly was tedious and error prone due to which CISC architecture evolved but with uprise of high level language dependency on assembly reduced RISC architecture prevailed.

- **Characteristic of RISC –**
- Simpler instruction, hence simple instruction decoding.
- Instruction come under size of one word.
- Instruction take single clock cycle to get executed.
- More number of general purpose register.
- Simple Addressing Modes.
- Less Data types.
- Pipeling can be achieved.

- Characteristic of CISC –

- Complex instruction, hence complex instruction decoding.
- Instruction are larger than one word size.
- Instruction may take more than single clock cycle to get executed.
- Less number of general purpose register as operation get performed in memory itself.
- Complex Addressing Modes.
- More Data types.

- **Example –** Suppose we have to add two 8-bit number:
- **CISC approach:** There will be a single command or instruction for this like ADD which will perform the task.
- **RISC approach:** Here programmer will write first load command to load data in registers then it will use suitable operator and then it will store result in desired location.
- So, add operation is divided into parts i.e. load, operate, store due to which RISC programs are longer and require more memory to get stored but require less transistors due to less complex command.

Difference –

RISC	CISC
Focus on software	Focus on hardware
Transistors are used for more registers	Transistors are used for storing complex Instructions
Code size is large	Code size is small
A instruction execute in single clock cycle	Instruction take more than one clock cycle
A instruction fit in one word	Instruction are larger than size of one word