# **Lecture Assignment-1**

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**Q1: compare Micro-processors and Micro-controllers, How are they different?**

Micro-Processor: is a controlling unit of a micro-computer all inside a small chip. It performs Arithmetic Logical Unit (ALU) operations and communicates with the other devices connected with it. It is a single Integrated Circuit in which several functions are combined.

A close-up of a computer chip

Description automatically generated

Micro-Controller: is an optimized chip that controls electronic devices, it’s stored in a single integrated circuit which is dedicated to performing a single and particular task and executing that specific application.

A diagram of several microprocessors

Description automatically generated

**Key differences between micro-processors & micro-controllers:**

|  |  |
| --- | --- |
| **Micro-Processors** | **Micro-Controllers** |
| Consists only of Central processing unit (CPU) | Contains a CPU, Memory, I/O all in one single chip |
| uses external bus to communicate with RAM, ROM and other peripherals | Uses an internal controlling bus to do interface with its peripherals |
| Its design is based on the Von Neumann model | Its design is based on the Harvard architecture |
| Complicated and expensive due to the large number of instructions to process | Inexpensive and straightforward with fewer instructions to process |
| Typically used in personal computers | Used in embedded systems |
| Used in complex systems due to its processing power | Used in simple systems with simple hardware |
| micro-processors have more memory but it’s external | Have less memory but faster because it’s internal memory |
| It has a higher clock speed | Lower clock speed |
| No power saving mode | Has power saving mode |
| Types of microprocessors:  Complex instruction set, reduced instruction set, digital signal multiprocessors | Types of microcontrollers: 8-bit, 16-bit,32-bit microcontrollers, embedded microcontroller, external memory microcontroller |
| Examples: intel 8085, 8086, etc. | Examples: 8051 and PIC microcontroller |

**References: (**[**Guru99**](https://www.guru99.com/difference-between-microprocessor-and-microcontroller.html#:~:text=Microprocessor%20vs%20Microcontroller%3A%20Key%20Difference,used%20in%20an%20embedded%20system.)**,** [**prepbytes**](https://www.prepbytes.com/blog/general/difference-between-microprocessor-and-microcontroller/#:~:text=The%20main%20difference%20between%20a%20microprocessor%20and%20a%20microcontroller%20is,embedded%20on%20a%20single%20chip.)**)**

**Q2: What are the differences between System on Chip (SoC) and field Programmable Gate Arrays (FPGA)?**

System-on-Chip (SoC) is a silicon chip that contains one or more processors cores (MPUs, MCUs, DSPs), along with memory installed on its chip and hardware accelerator functions, other peripheral functions, and all sorts of stuff.

A diagram of a computer chip

Description automatically generated

Field programmable gate array is a relatively simple device as it’s just an array of programmable blocks linked by programmable interconnect, the great thing about it is that we can program its fabric to implement any digital functions we want, and we can implement algorithms in a massively parallel way.

A diagram of a circuit board

Description automatically generated

So basically, both SoC and FPGA are semiconductor chips that sit on chip platforms but the difference between the two is the approach to designing and integrating them into a system.

The SoC architecture combines several processing components into one device, as a result, it is a powerful and flexible way to implement complex logic instructions.

The FPGA is a type of configurable integrated circuit that can be reprogrammed after manufacturing, it is a part of a broad set of logic devices (PLDs), and there’s a SoC FPGA

They both participate in the process of making embedded systems.

Different type of FPGA’s:

1. Ball Grid Array.
2. Quad Flat Package.
3. Single In-line Package.
4. Dual In-line Package.

Types of SoC:

1. SoC built around a microcontroller.
2. SoC built around a microprocessor.
3. SoCs designed for specific applications.

**References: ([EETimes](https://www.eetimes.com/asic-assp-soc-fpga-whats-the-difference/),** [**Ebics**](https://ebics.net/socfpga/#:~:text=SoC%20and%20FPGA%20are%20semiconductor,way%20to%20implement%20complex%20logic.)**,** [**Wikipedia**](https://en.wikipedia.org/wiki/Field-programmable_gate_array)**)**