**Operating Systems Design** : Tutorial 01

*Question 1 : What are the differences between Interactive and Real time systems?*

> An Interactive System is easier to use than a Real time System, but slower. Debugging is fast on the Interactive System and this can be interesting for example during a test phase. The Real time System is the fastest and the most used in critical cases that need to be always functional (100 percent responsive, 100 percent of the time), as for example in the fields of industry, medical, military or even logistics. Which means that the Real time System must take into account time constraints and the priority of each task.

*Question 2 : What is the difference between main memory and auxiliary memory?*

> The main memory is used to store data during computer operations, so it can communicate directly with the CPU or auxiliary memory. The Memory Manager takes care of managing the main memory (RAM). Programs not currently needed in main memory are transferred into auxiliary memory to provide space in main memory for other programs that are currently in use. The main difference is that the auxiliary memory is not directly accessible to the CPU, but the main memory is.

*Question 3 : Explain each of the following :*

1. Multi-user operating system : Operating system that allows more than one user to access a computer system at one time, such as Ubuntu (Server) or macOS (Server).
2. Multiprocessing operating system : Introduced in the 80s, multiprocessing OS allows running programs in parallel. There are two configurations for the multiprocessing OS : Symmetric (allows for several CPUs to process multiple jobs at the same time) and Asymmetric (some OS functions are assigned to subordinate processors, which take their instructions from the main CPU).
3. Multitasking operating system : Operating system that allows a user to perform more than one computer task at the time. For example, if you open two applications at the same time, the OS is doing multitasking.
4. Multithreading operating system : Not to be confused with multitasking OS explained above, the multithreading OS can manage usage by more than one user at a time or manage multiple requests from the same user. Multithreaded applications programs can have several threads running at one time with the same or different priorities.
5. Distributed processing : Setup in which multiple individual CPU work on the same programs or systems, to provide more capability for a computer. Network PCs gave impetus to the concept of distributed processing.

*Question 4 : What is a thread?*

> The thread is a portion of a program that can run independently of other portions.

*Question 5 : Describe micro computers and mini computers and outline the differences between them.*

> A micro computer, developed in the late of the 70s, is a small and inexpensive computer with a microprocessor as its CPU. It was developed for only single users. One of the first highly successful microcomputer was the Apple II designed by Apple Computer in 1977. The mini computer, developed in the 60s, was designed, unlike the micro computer, for institutions or companies. It was cheaper than mainframe, but bigger and more expensive than the micro computer.

*Question 6 : Briefly describe batch processing and interactive processing operating systems and outline the contradicting characteristics.*

> During a batch processing, all commands and data are pre-selected and run without human contact (execution of one or more task on a environment without manual intervention). Interactive processing requires input from a user or a administrator, using a command line or a GUI. Batch processing is the best for longer running processes, but interactive processing may be interesting for example if a person (like a user or an administrator) wants to become familiar with the environment and test its solutions before a deployment using the batch processing.

*Question 7 : What is the kernel of an operating system? When is the kernel loaded into memory so that it can run?*

> The Kernel is the main center control of the operating system and is also the internal part of this same operating system. Rest of the OS is built on the top of Kernel. The Kernel is the only program that runs at all time on the computer and is loaded into memory after the selection of possible boot options (or default option) in the boot loader. Once the selection is made, the boot loader loads the Kernel into memory.

*Question 8 : Describe the mechanism through which a user process transitions from user mode to kernel mode. What is this mechanism called?*

> The main steps of the transition from User to Kernel mode are : set interrupt after specific period, then operating system decrements counter, then when counter zero generate an interrupt, set up before scheduling process to regain control or terminate program that exceeds allotted time. This mechanism is called Dual-mode (User mode and Kernel Mode).