



### TD N°1: Introduction to operating systems

**Q1:** What is the definition of a computer system and what are the three classes of computer system?

**Q2:** What is a time-sharing operating system?

**Q3:** Are the command interpreter and compilers part of the operating system?

**Q4:** Establish the correspondences between the terms and definitions presented in the table below:

Terms	Definitions
1- Multi-programming	A- Manages computer components
2- Operating system	B- Increases processor performance
3- Virtual machine	C- Test the computer's components
4- Time sharing	D- The processor is shared equally between users
5- BIOS (Basic Input Output System)	E- Allows you to share resources on a network
6- Distributed system	F- Allows you to hide the complexity of the hardware

**Q5:** An operating system is a set of programs that groups together a certain number of services needed to run the programs that a user can command. It is through its basic software component (or system kernel) that it manages all the operations designed to control and command the computer and its various peripherals. The second component consists of a set of utilities that are probably not needed to start the computer cold.

In what follows, we are interested in classifying the various system services according to which one they belong to. To do this, we ask you to fill in the following table by placing a cross in the appropriate box.

System service	System kernel	System utility
1. Managing hardware interruptions	<input type="checkbox"/>	<input type="checkbox"/>
2. Calculate the current date	<input type="checkbox"/>	<input type="checkbox"/>
3. Reading data from a USB flash drive	<input type="checkbox"/>	<input type="checkbox"/>
4. Sharing memory between processes	<input type="checkbox"/>	<input type="checkbox"/>
5. Detecting the existence of a virus	<input type="checkbox"/>	<input type="checkbox"/>
6. Checking a user's access permissions	<input type="checkbox"/>	<input type="checkbox"/>
7. Translating a program written in C	<input type="checkbox"/>	<input type="checkbox"/>
8. Renaming a directory	<input type="checkbox"/>	<input type="checkbox"/>
9. Interpret user commands	<input type="checkbox"/>	<input type="checkbox"/>
10. Editing a text document	<input type="checkbox"/>	<input type="checkbox"/>
11. Archiving and restoring files	<input type="checkbox"/>	<input type="checkbox"/>
12. Compressing data in a file	<input type="checkbox"/>	<input type="checkbox"/>
13. Read current mouse position	<input type="checkbox"/>	<input type="checkbox"/>
14. Configuring a printer	<input type="checkbox"/>	<input type="checkbox"/>
15. Display a diagnosis of errors encountered during	<input type="checkbox"/>	<input type="checkbox"/>

**Q7:** Compare a single-tasking system and a multi-tasking system, specifying their qualities and defects according to the following criteria:

1. Complexity
2. Response time
3. Execution time
4. System size
5. Resource management

**Q8:** What is the difference between user mode and kernel mode on a processor?

**Q9:** Which instructions should only be able to run in kernel mode?

**Q10:** What happens when a program executed in user mode receives an instruction from the processor that should only be executed in kernel mode?

### Exercise

*This exercise concerns the historical development of operating systems and illustrates their performance (It is a simplified operating system).*

Consider a computer whose peripherals are a card reader (1000 cards/minute) and a printer (1000 lines/minute). An "average job" is defined as follows:

- Read 300 cards,
- Use the processor for 1 minute,
- Print 500 lines.

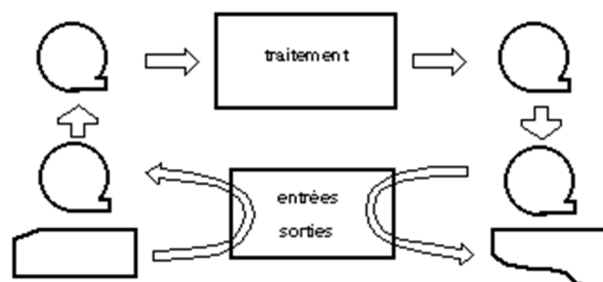
It is assumed that all jobs submitted by users have characteristics identical to those of this average job. We define two measures of system performance:

- Average job throughput D: number of jobs completed in one hour.
- CPU efficiency R: fraction of the total time the CPU is in use during which it is performing useful work (other than managing peripherals).

A) First, assume that the peripherals are managed by the CPU. Calculate R and D according to the following operating assumptions:

- The system is operated in open door mode; the duration of a session is limited to 15 minutes. It is assumed that a user needs 4 minutes to correct his program in the light of the results, and make a new submission.
- The system is operated with a job sequencing monitor.

B) It is now assumed that the peripherals are managed by a separate computer, which creates an input magnetic tape from the cards and lists the contents of an output magnetic tape on a printer. The computer is fed by the input magnetic tape and produces the output tape; the time taken to read and write the tapes is neglected. The time taken to transfer the tapes from one computer to another is 5 minutes in each direction; it is assumed that one tape contains a batch of 50 jobs (see figure below).



It is assumed that the rate at which jobs are submitted is sufficient to keep the computer running full time. Calculate the values of R and D.