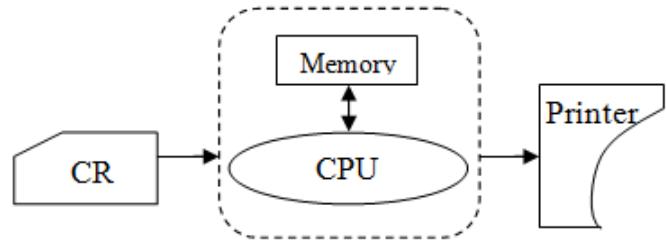


Tutorial Sheet 2

Exercise 1. Let us consider a calculator which must process a set of jobs. The characteristics of the calculator and typical job are as follows:



(a) Calculator: IBM 1401



(b) Diagram of calculator

Figure 1: Computing early days calculator

- the calculator is equipped with card reader (in left of the picture), central processing unit (in middle), and printer (in right). See figure above.
- card reader throughput: 1000 cards/min
- printer throughput: 1000 lines/min

One job (input, processing and output) goes as follows:

1. phase1: reading 300 cards (program and data)
2. phase 2: calculation for 1 minute
3. phase 3: printing 500 lines

Questions:

1. In order to study the general performance of this calculator, we will choose two parameters in relation with operating system.
 - Processor occupancy: $N = \frac{\text{time spent by the processor}}{\text{time of executing a job}}$.
 - Job throughput: $D = \frac{\text{number of jobs}}{\text{time unit}}$.

NB: N: profitability of the processor; D: user satisfaction.
2. We assume that the system is managed according to the open door where the calculator is completely assigned to each user for a duration of 15 minutes.

What are the values of N and D?
3. Now the system is managed by a automatic sequencing monitor.

Calculate the new values of N and D?

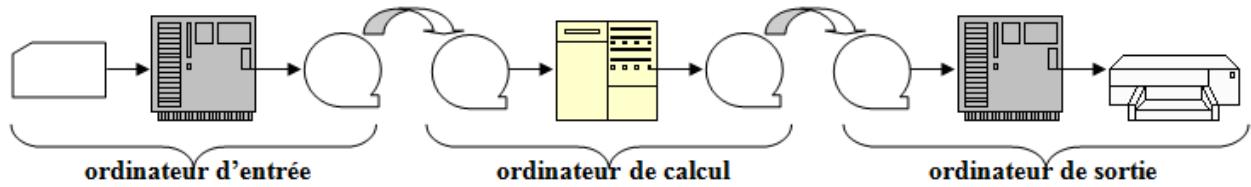


Figure 2: Off line processing

4. In the calculator configuration, there is no channel, this results in the disadvantage of occupying the central processor during the time of data entry and output of results. CPU efficiency can only be increased by running I/O and processing in parallel. To do this, we use the following configuration:

Assume that the tape contains 50 jobs and its transfer time is 5 min.

- What is the total execution time of a batch?
- What is the minimum waiting time for each job?

5. The waiting time can be reduced by making the communication of information between the two installations (computers) faster, which can be achieved by shared memory.

The configuration is then modified as follows:

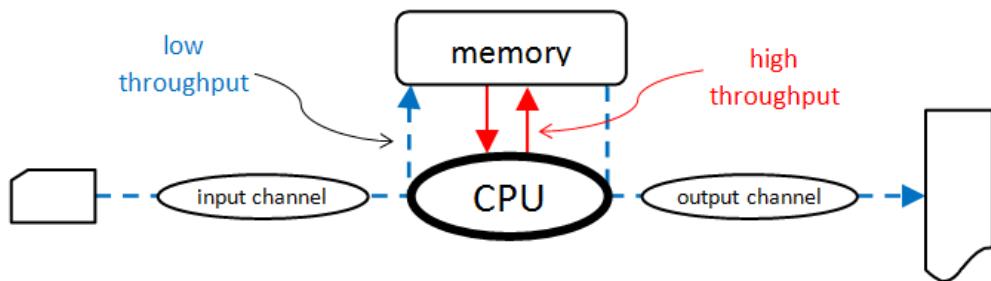


Figure 3: Nowadays configuration of computers

In this case, channels are introduced which allow the central processor to be unloaded from I/O operations.

- What are the problems posed by this configuration?

Exercise 2. consider the execution of two programs A and B on a single processor configuration (CPU, Memory, I/O Devices).

The sequence of actions of programs A and B are as follows:

Program A	Program B
4 CPU time units	2 CPU time units
3 I/O time units	3 I/O time units
4 CPU time units	

We will assume the following:

- An operating system control task is carried out in 1 unit of time (whatever its nature),
- Program A is the first to be run,
- The Quantum equals 2 units of time.

1. Give the response times of programs A and B in the three operating modes: mono-programming, multi-programming and time-sharing?
2. Discuss the results obtained according to individual and average response times?

Exercise 3. In a multi-programming system, several programs can coexist on the machine. Answer to the following:

1. What protection issues arise?
2. How to solve these problems?