Operating Systems Concepts

Chapter 4

Process management

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CHAPTER 4

4. Process Management

A computer system consists of a collection of processes:

1- O/S processes: execute system code.

2- User processes: execute user code.

4.1 Process Concept

A **Process**: is a program in execution.

Or   **process**: is a unit of work.

Or   **process**: is an active entity.

Program	Process
It is a passive entity	It is an active entity.
Stored in disk (i.e. file).	Stored in memory.
It is a sequence of instructions (static).	Sequence of actions (dynamic).

4.2 Process States

1- **New**: The process is being created.

2- **Ready**: The process is waiting to be assigned to a processor.

3- **Running**: instructions are being executed.

4- **Waiting**: The process is waiting for some event to occur.

5- **Terminated**: The process has finished execution.
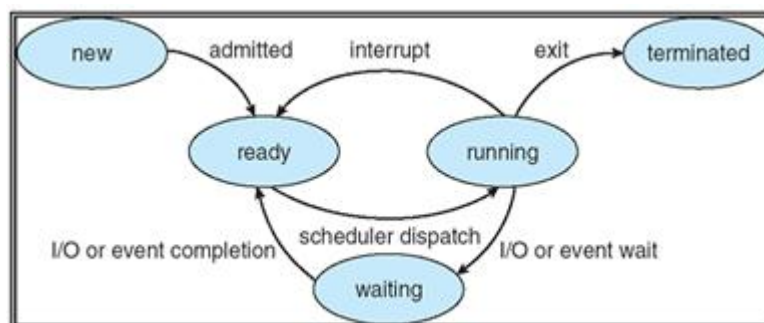
4.3 PROCESS CONTROL BLOCK (PCB)

PCB: is a data structure containing all the necessary information for representing a process in the system.

It contains many pieces of information such as:

1- **Process Identifier**: ID number that identifies the process.

2- **Process state**: new, ready, running, waiting, or terminated.

3- **Program counter**: contains the address of the next instruction to be executed.

4- **CPU registers**: index registers, stack pointers, and general purpose registers.

5- **CPU scheduling**: process priority, and any other scheduling parameters.

6- **Memory management information**: value of base and limit registers.

7- **Accounting information**: amount of CPU and real time.

8- **I/O status information**: list of I/O devices, list of open files.

pointer	process state
process number	
program counter	
registers	
memory limits	
list of open files	
⋮	
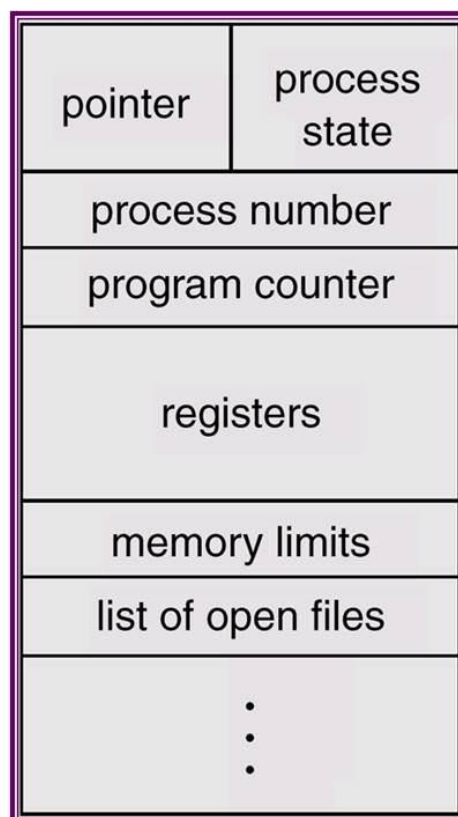
4.4 Process Scheduling

4.4.1 Scheduling: is a task by which the operating system decides to introduce new processes into the system.

4.4.2 Scheduling aims:

Maximize → CPU utilization, throughput.

Minimize → Response time, waiting time, and turnaround time.

4.4.3 Scheduling Criteria: (definitions)

a. CPU utilization: the percentage of the time CPU doing useful work to the total elapsed time.

b. Throughput: is the total number of processes that complete their execution per unit of work.

c. Turnaround time: is the total time between submission of a process and its completion.

d. Waiting time: is the time the process remains in the ready queue.

e. Response time: is the time from the submission of a request until the first response is produced.

f. Balance: keep all parts of the system busy.

Processes can be described as :

1- **I/O-bound process**: spends more time doing I/O than computations.

2- **CPU-bound process**: spends more time doing computations.

4.5 Scheduling Levels

There are three levels (terms) of scheduling:(there are three types of schedulers)

4.5.1 **Long -Term Scheduler**: (or **job scheduler**) selects which processes should be brought from secondary storage devices (e.g. disk) into memory for execution.

L.T.S control the degree of multi programming.

L.T.S select a good process mix of I/O-bound process and CPU-bound process.

4.5.2 **Short-Term Scheduler**: (or **CPU scheduler**) selects which ready processes should be executed next and allocates CPU to it.

S.T.S select a good process mix of I/O-bound process and CPU-bound process.

4.5.3 **Medium Term Scheduler**: it removes processes from the memory, it reduces the degree of multiprogramming.

4.6 **Context Switch**: Switching the CPU to another process by saving the state of the old process and loading the saved state for the new process.

Disadvantages: **Context-switch time is Pure overhead** , because the system does no useful work while switching.

4.**6.1 Swapping**: removing a process from memory for some reason and later it can be reloaded into memory.
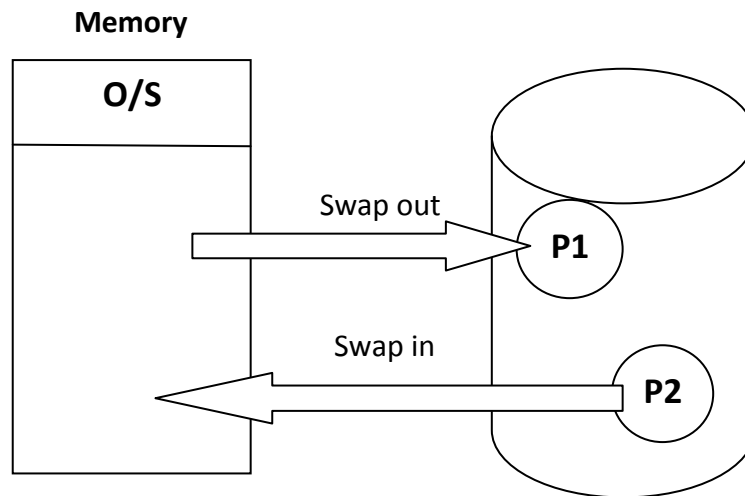
Memory

A process can be swapped out of memory to a backing store and then brought back into memory for continued execution.

Chapter 4 Questions

Q1: Fill in the blanks the following statements with **MAXIMIZE** or **MINIMIZE**:

1-The objective of the O/S is to ---------------------------- response time.
2- The objective of the O/S is to --------------------------- waiting time.
3 The objective of the O/S is to --------------------------- throughput.
4- the objective of the O/S is to --------------------------- turnaround time.
5- the objective of multi programming is to ------------- CPU utilization.