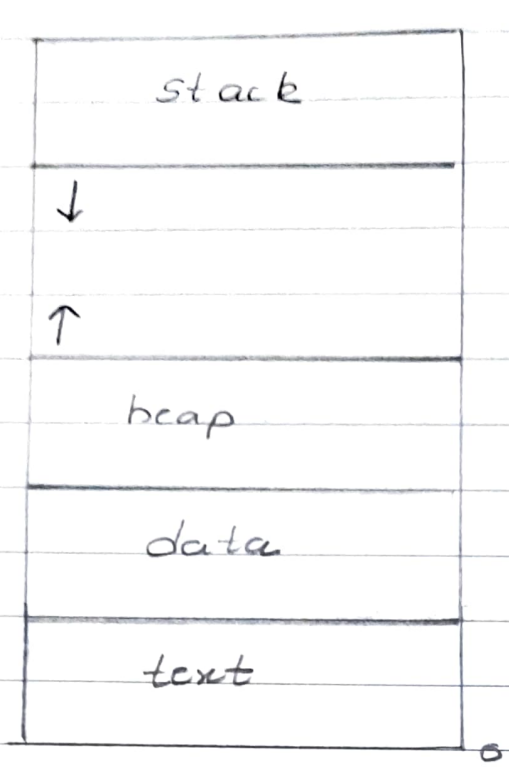
Chapter 02 : Process Management

- Process Concepts
- Process Scheduling
- Process Control
- Process Accounting
- Interaprocess Communication
- Multithreading models & Jthread API
- Jthread library
- Scheduling - basics, criteria and algorithms

The Process

Informally, a process is a program in execution.
A process,

- Is more than a program code, which is sometimes known as the text section
- It also includes the current activity, as represented by the value of the program counter and the contents of the processor's registers.
- A process generally also includes the process stack which contains temporary data such as function parameters, return addresses and local variables
- A data section, which contains global variables
- A process may also include heap, which is memory that is dynamically allocated during process run-time.



Process in memory

Program & Process

Program
File containing list of instructions on disk (executable)

Load executable to the memory

Process
PC to specify next instruction to execute along with resources

Passive Entity

Active Entity.

How to load executable?

- Double click on executable icon.
- Executable file name on command prompt.

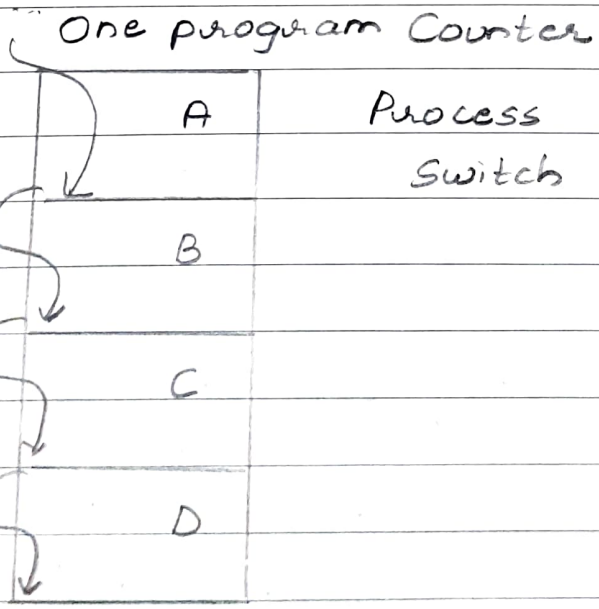
Note:

- Although two processes may be associated with the same program, they are nevertheless considered two separate execution sequences
  - Although text sections are equivalent, the data, heap and stack sections vary.

Multiprogramming

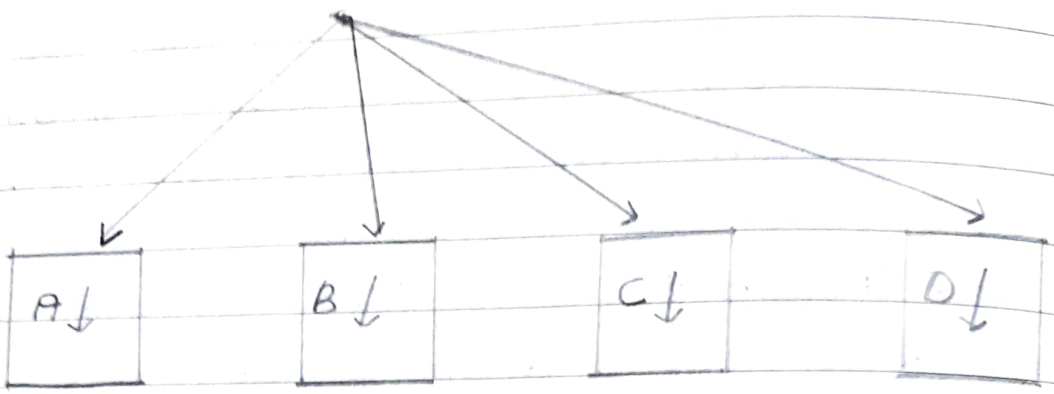
- Conceptually, each process has its own virtual CPU. In reality, the real CPU switches back and forth from process to process.

- This rapid switching back and forth is called multiprogramming.

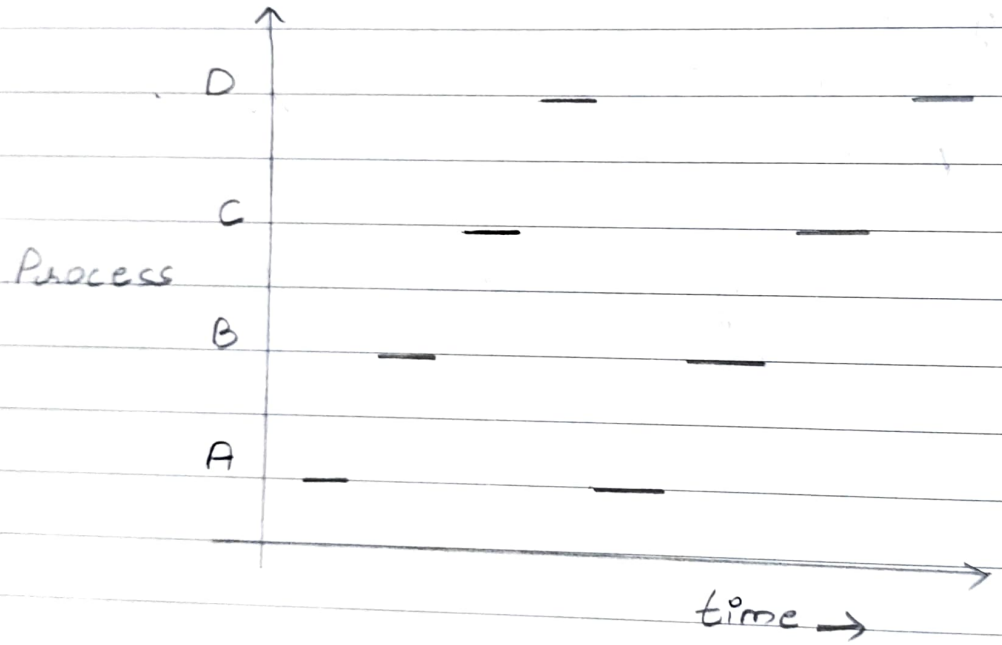


Multiprogramming of your programs

Four Program Counters



Conceptual model of your independent, Sequential processes.



Only one program is active at any instant.

While CPU is switching back and forth among processes, the rate at which a process performs its computation will not be uniform, and probably not even reproducible if the same process are run again.

↳ Processes must not be programmed with built-in assumptions about timing.

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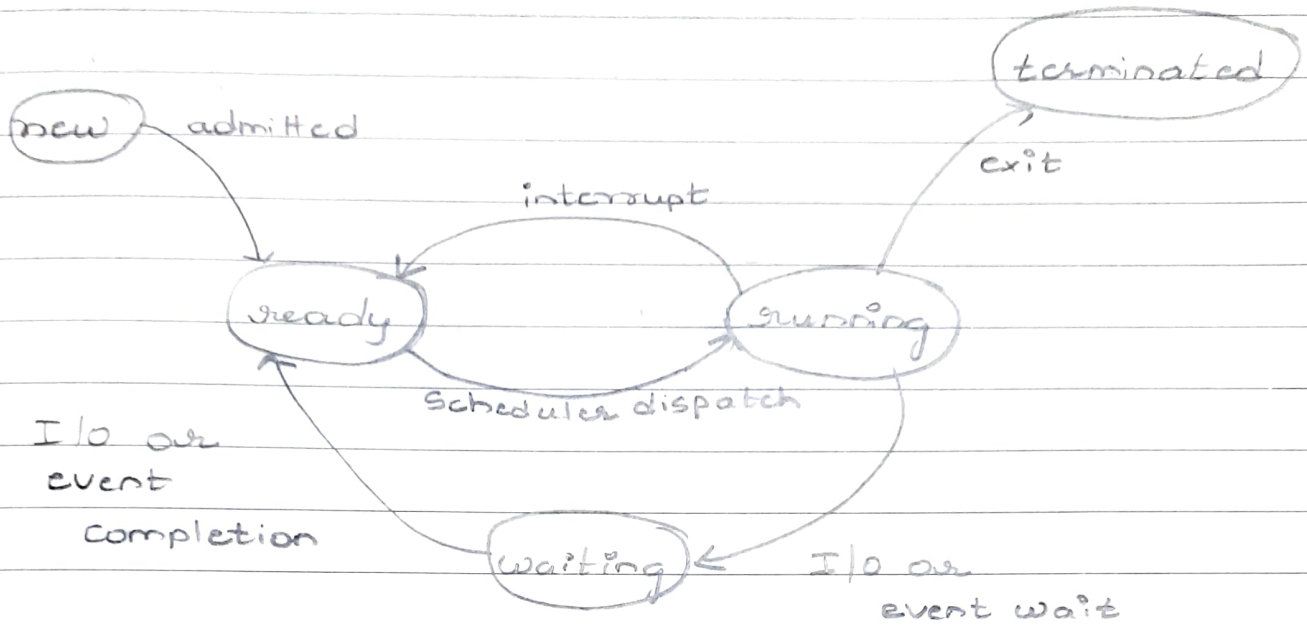
Process States:



New. The process is being created.

Running. Instructions are being executed.

Waiting. The process is waiting for some event to occur.
Such as I/O completion or reception of a signal.

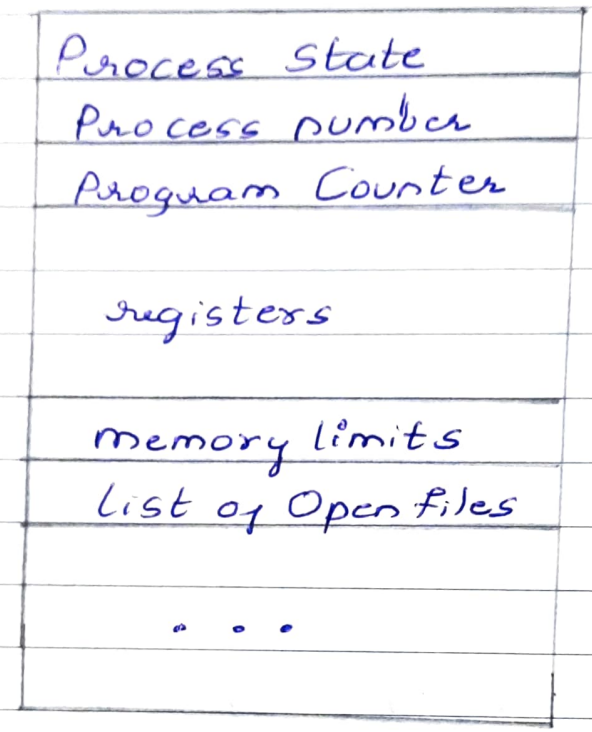
Ready. The process is waiting to be assigned to a processor.

Terminated. The process has finished execution.

The names are arbitrary and they vary across O.S. Only one process can be running on any processor at any instant.

Process Control Block

Each process in OS is represented by a PCB.



Process State.

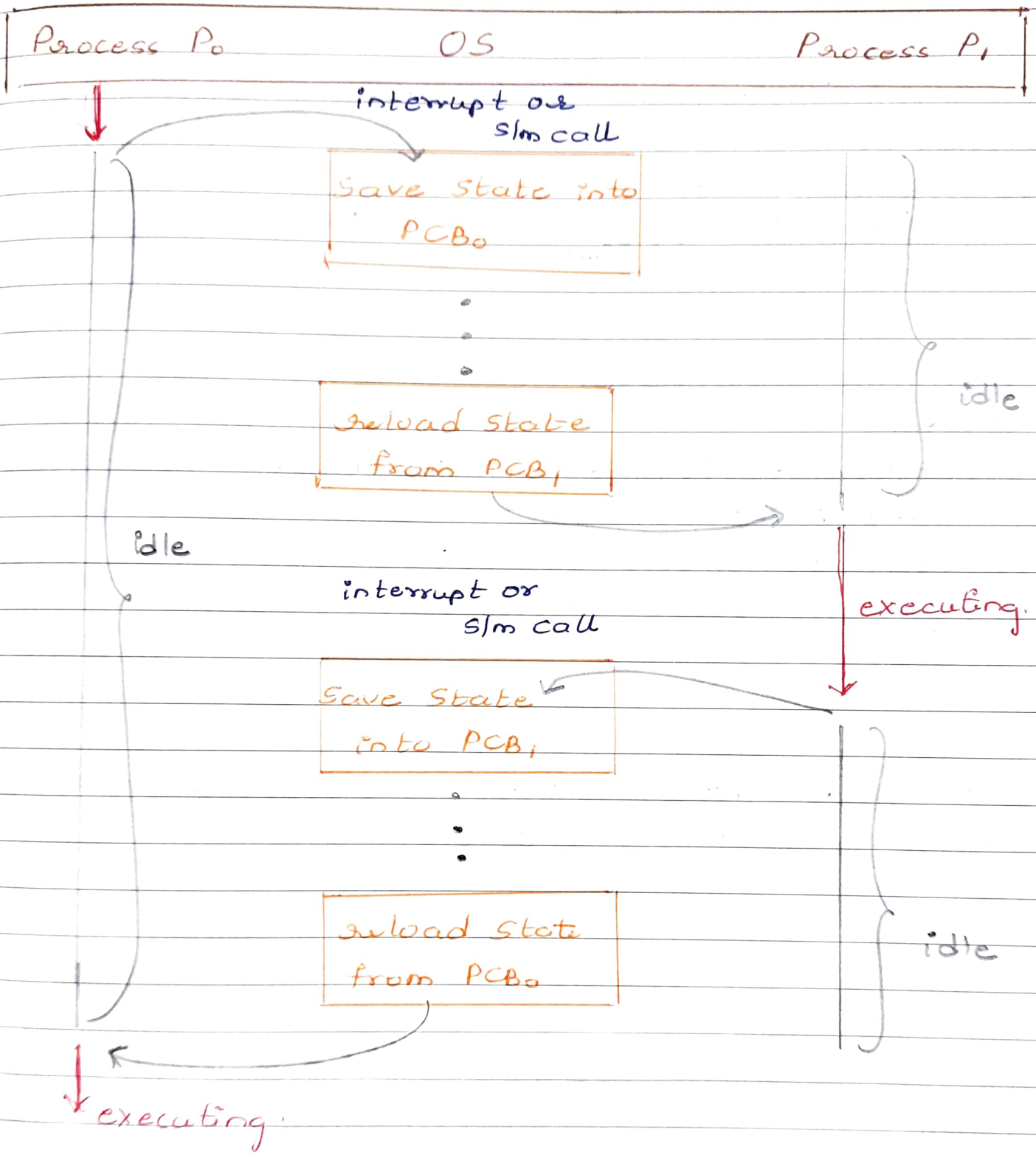
The State maybe new, ready, running, halted and so on.

Program Counter.

Indicates the address of the next instruction to be executed you this process.

CPU Registers

Registers, depending on Computer architecture include accumulators, index registers, stack pointers, general-purpose etc. Along with program counter, State information must be saved.



CPU-scheduling Information.

Process priority, pointers to scheduling queues & other scheduling parameters.

Memory-management information.
Information depending on the memory system used by OS.
- ↳ Page tables
- ↳ segment tables.

Accounting information.
Includes
- amount of CPU and real time used
- time limits
- account numbers
- job or process numbers
- etc.

I/O status information.
This includes list of I/O devices allocated to the process, a list of open files, etc.

GATE Question

Process Control Block does not contain

a. Process ID

b. User identification number

c. Registers

d. None of the above

Answer: d.