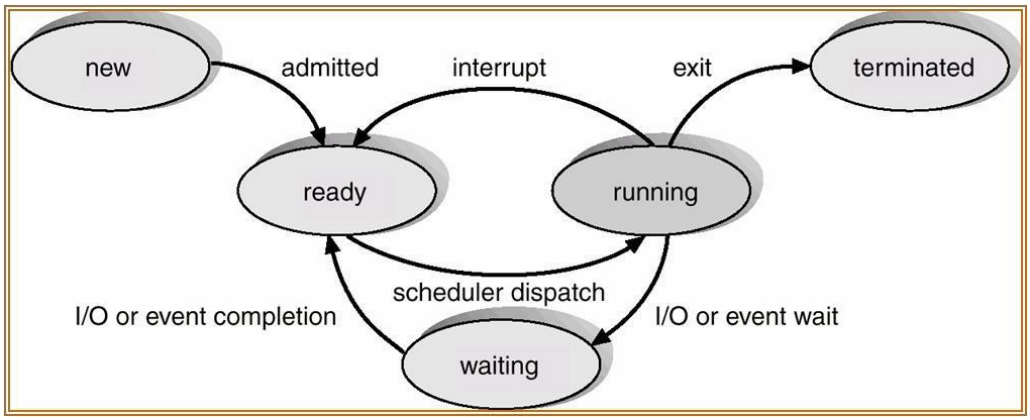
3)

A process is a program in execution. It includes the

- current activity, as represented by the value of the **program counter**
- the contents of the processor's registers
- the process **stack,** which contains temporary data (such as function parameters,return addresses, and local variables)
- a **data section,** which contains global variables
- It may also include a **heap,** which is memory that is dynamically allocated during process run time

A program becomes a process when an executable file is loaded into memory.

Process State Diagram:



When a process executes, it passes through different states. These stages may differ in different operating systems, and the names of these states are also not standardized. In general, a process can have one of the following five states at a time.

Processes in the operating system can be in any of the following states:

- NEW- The process is being created.
- READY- The process is waiting to be assigned to a processor.
- RUNNING- Instructions are being executed.
- WAITING- The process is waiting for some event to occur (such as an I/O completion or reception of a signal).
- TERMINATED- The process has finished execution.

- Each process is represented in the operating system by a **Process Control Block (PCB)**—also called a *task control block.* A PCB is shown in following figure. It contains
  many pieces of information associated with a specific process, including these:
  - **Process state.** The state may be new, ready, running, waiting, halted, and so on.
  - **Program counter.** The counter indicates the address of the next instruction to be executed for this process.
  - CPU **registers.** The registers include accumulators, index registers, stack pointers, and general-purpose registers, plus any condition-code information.
  - **CPU-scheduling information.** This information includes a process priority, pointers to scheduling queues, and any other scheduling parameters.
  - **Memory-management information.** This information may include such information as the value of the base and limit registers, the page tables, or the segment tables, depending on the memory system used by the operating system.
  - **Accounting information.** This information includes the amount of CPU and real time used, time limits, and so on.
  - **I/O status information.** This information includes the list of I/O devices allocated to the process, a list of open files, and so on.