What does process include ?

- Program counter
- Stack
- Data section

List the process states ?

- **new**: The process is being created
- **running**: Instructions are being executed
- **waiting**: The process is waiting for some event to occur
- **ready**: The process is waiting to be assigned to a processor
- **terminated**: The process has finished execution

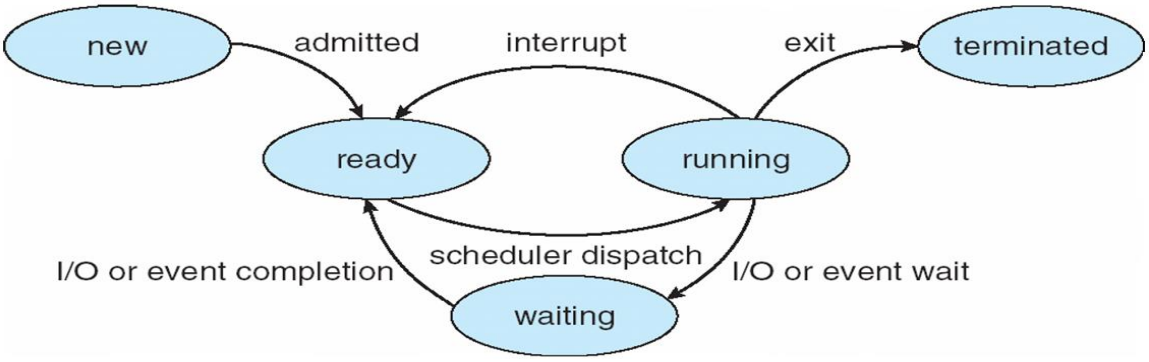
What is the information that associated with each process PCB ?

- **It allow OS to control the process**
- **Process state** : new, wait, ready, terminated, run
- **Program counter** : when process stop store the instruction address
- **CPU registers** : store the process date when process stop
- **CPU scheduling information** : priority
- **Memory-management information** : limit register (how much) – base register(from what)
- **Accounting information** : which user use this process
- **I/O status information** : which data the process hold

What is the process data in the memory ?

- **Stack** : Contains the temporary data such as function program and local variables .
- **Heap** : Is memory that is dynamically allocated during the run and it efficient related
- **Data** : such as global variable
- **Text** : code

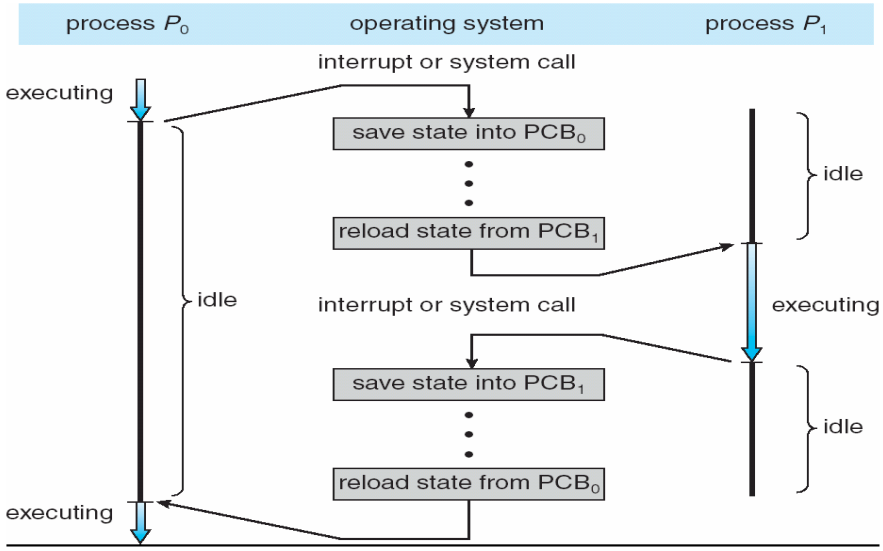
Explain the process life cycle ?



What is dispatch responsibility ?

- Save process state into PCB
- Load process state from PCB

Explain the switching between the processes ?



List the process scheduling queues ?

- **Job queue** : set of all processes in the system
- **Ready queue** : set of all processes residing in main memory, ready and waiting to execute
- **Device queues** : set of processes waiting for an I/O device

Processes migrate among the various queues

What is types of scheduler ?

- **Long-term scheduler** (or job scheduler) : selects which processes should be brought into the ready queue
- is invoked very infrequently (seconds, minutes) ⇒ (may be slow)
- It controls the *degree of multiprogramming*

- **Short-term scheduler** (or CPU scheduler) : selects which process should be executed next and allocates CPU
- is invoked very frequently (milliseconds) ⇒ (must be fast)

What is the types of process ?

- **I/O-bound process** : spends more time doing I/O than computations, many short CPU bursts
- **CPU-bound process** : spends more time doing computations; few very long CPU bursts

What is the context twitch ?

When CPU switches to another process, the system must save the state of the old(stopped) process and load the saved state for the new process via a **context switch**

What is the context of process ?

❖ **Context of a process represented in the PCB**

- Process state
- SPU register
- Memory management info

Is the context switching overhead ? why ?

Yes, because the system does no useful work while switching. And Time dependent on hardware support

Explain the process tree creation ?

Parent process create **children** processes, which, in turn create other n processes, forming a tree of processes

Via what the process identified and managed ?

via a process identifier (**pid**)

What is the types of Resource sharing between parent and children ?

- Parent and children share all resources
- Children share subset of parent's resources
- Parent and child share no resources

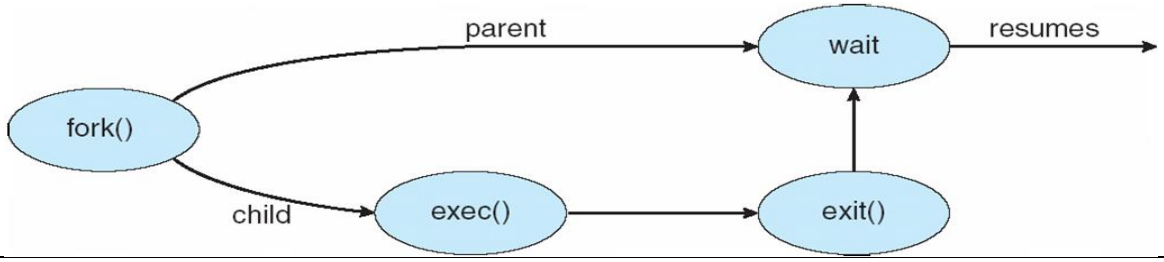
What is the types of Resource sharing between parent and children ?

- Parent and children execute concurrently (**communication**)
- Parent waits until children terminate

Give the UNIX example create the process ?

- **fork** system call creates new process
- **exec** system call used after a **fork** to replace the process' memory space with a new program

Explain the process creation in diagram ?



explain the process termination ?

- Process executes last instruction and asks the operating system to delete it (**exit**)
- Output data from child to parent (via **wait**)
- Process' resources are deallocated by operating system

why Parent terminate children processes by (**abort**) ?

- Child has exceeded allocated resources
- Task assigned to child is no longer required

What happen for children processes when the parent exiting ?

- Some operating system do not allow child to continue if its parent terminates , all children terminated - **cascading termination**
- Some operating system allow child to continue if its parent terminates

What is the reasons for cooperating processes ?

- **Information sharing**
- **Computation speedup** : in case of multiprocessor
- **Modularity** : dividing the system functionality into separate process or threads
- **Convenience** : user can work on many program concurrently

What is the IPC and what is the models of it ?

- Cooperating processes need **interprocess communication** (**IPC**)
- Two models of IPC
  - Shared memory
  - Message passing

What is the types of process in term of sharing ?

- **Independent** process cannot affect or be affected by the execution of another process
- **Cooperating** process can affect or be affected by the execution of another process

Explain cooperating between the process ?

Paradigm for cooperating processes, producer process produces information that is consumed by a consumer process

What is the types of buffer ?

- ***unbounded-buffer*** : places no practical limit on the size of the buffer
- ***bounded-buffer*** : assumes that there is a fixed buffer size

What is IPC ?

t is mechanism for processes to communicate and to synchronize their actions.

What is message passing?

Processes communicate with each other without resorting to shared variables.

What is the operations provided by IPC ?

- **send**(*message*) – message size fixed or variable
- **receive**(*message*)

How the process communicate in message passing ?

- establish a *communication link* between them
- exchange messages via send/receive

What is the types of communications in message passing ?

- **Direct Communication** : Processes must name each other explicitly
- **Indirect Communication** : Messages are directed and received from

mailboxes

Explain the direct commutation operations ?

- **Send (P, message)** : send a message to process P
- **Receive(Q, message)** : receive a message from process Q

What is the properties of communication link in direct communication ?

- Links are established automatically
- A link is associated with exactly one pair of communicating processes
- Between each pair there exists exactly one link
- The link may be unidirectional, but is usually bi-directional

Explain the indirect communication ?

- **Messages are directed and received from mailboxes (also referred to as ports)**
- Each mailbox has a unique id
- Processes can communicate only if they share a mailbox

What is the properties of communication link in indirect communication ?

- Link established only if processes share a common mailbox
- A link may be associated with many processes
- Each pair of processes may share several communication links
- Link may be unidirectional or bi-directional

What is the operations in indirect communication ?

- create a new mailbox
- send and receive messages through mailbox
- destroy a mailbox

- **send**(*A, message*) – send a message to mailbox A
- **receive**(*A, message*) – receive a message from mailbox A

where A = mailbox ID

Give three solutions for the following ?

- P_1, P_2, and P_3 share mailbox A
- P_1, sends; P_2 and P_3 receive
- Who gets the message?

- Allow a link to be associated with at most two processes
- Allow only one process at a time to execute a receive operation
- Allow the system to select arbitrarily the receiver. Sender is notified who the receiver was.