CPU Scheduling

Question – Three processes with CPU burst time and I/O are given as follows -

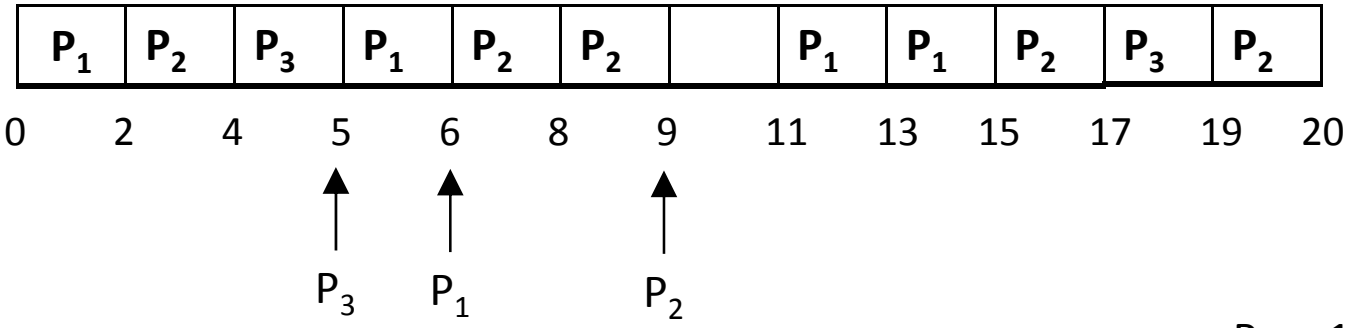
Process	CPU Burst,	I/O,	CPU Burst	Arrival
P_1	3,	5,	4	0
P_2	5,	5,	3	1
P_3	1,	10,	2	1.5

Each process does some job on CPU, then does some I/O operation, and then again resumes its operation on CPU. Time quantum is 2 ms.

Apply **Round Robin scheduling** and give Average Turnaround Time (ATT), Average Waiting Time (AWT), and CPU % utilization.

Process	CPU Burst,	I/O,	CPU Burst	Arrival
P_1	3,	5,	4	0
P_2	5,	5,	3	1
P_3	1,	10,	2	1.5

TQ = 2



$P_1 = 11$

$P_2 = 14$

$P_3 = 15$

Process	CPU Burst,	I/O,	CPU Burst	Arrival
P_1	3,	5,	4	0
P_2	5,	5,	3	1
P_3	1,	10,	2	1.5

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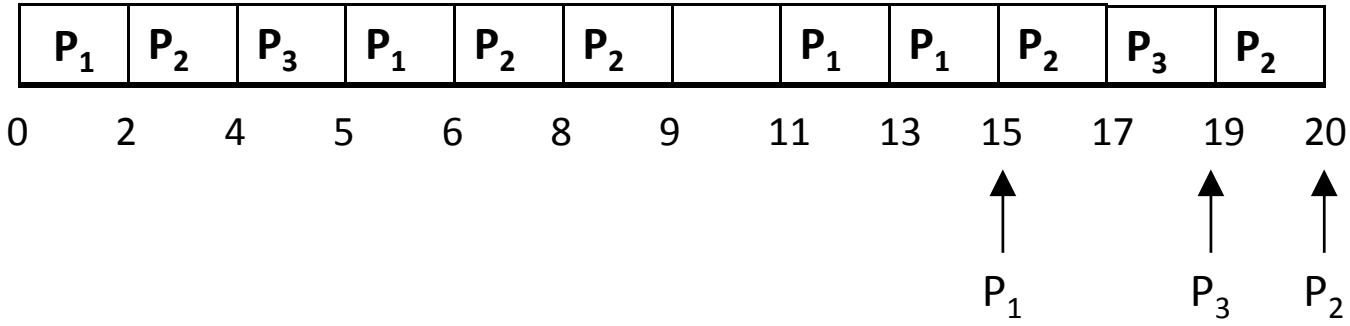


$P_1 = 11$

$P_2 = 14$

$P_3 = 15$

$$AWT = \frac{(3+0)+(1+2+1+2)+(2.5+2)}{3} = \mathbf{13.5}$$

$$ATT = \frac{15+19+17.5}{3} = \mathbf{17.16}$$

$$CPU\% = \frac{18}{20} \times 100 = \mathbf{90\%}$$

CPU Scheduling

Question – Two processes with CPU burst time and I/O are given as follows -

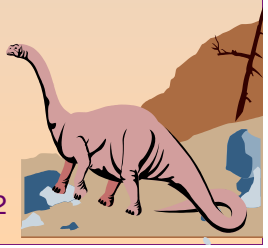
Process	CPU Burst,	I/O	Arrival
P_1	50,	100	0
P_2	500,	200	0

Each If both loop for 50 times, what is the CPU% utilization for -

1) FCFS
2) SJF

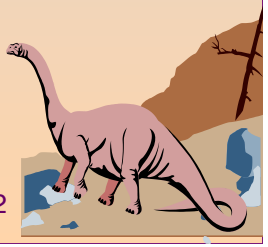
Basic Concepts

- Long-term scheduler is invoked very infrequently (seconds, minutes) ⇒ (may be slow)
- The long-term scheduler controls the *degree of multiprogramming (how many jobs are admitted to run on CPU)*
- Short-term scheduler is invoked very frequently (milliseconds) ⇒ (must be fast) = “process scheduling on CPU”
- Processes can be described as either:
  - **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

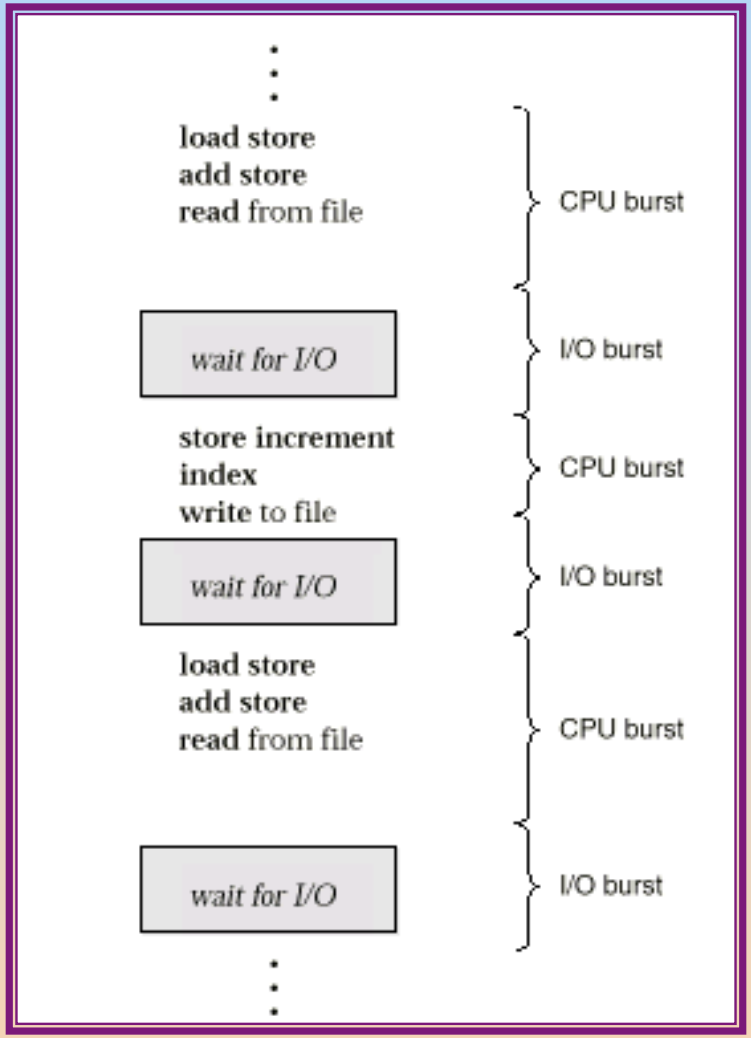


Basic Concepts

- Maximum CPU utilization obtained with multiprogramming
- CPU–I/O Burst Cycle – Process execution consists of a *cycle* of CPU execution and I/O wait.
- CPU burst distribution



Alternating Sequence of CPU And I/O Bursts



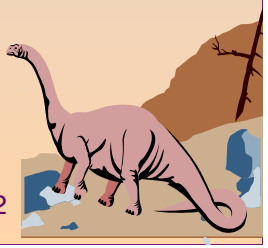
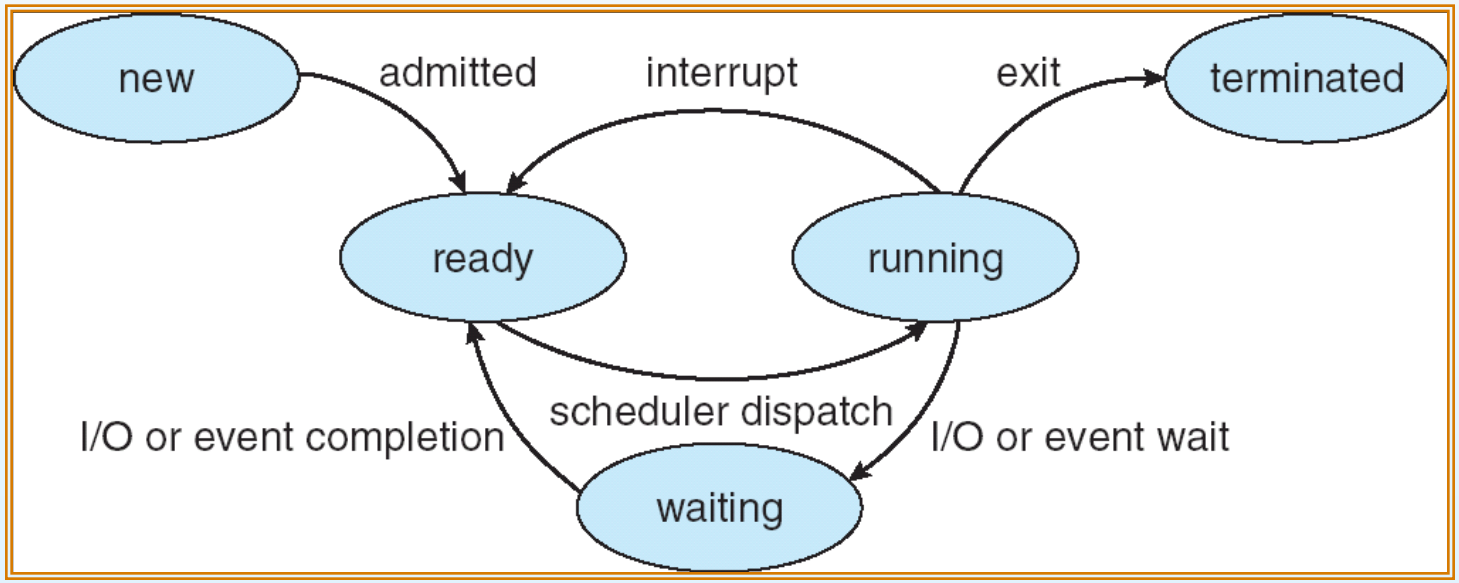
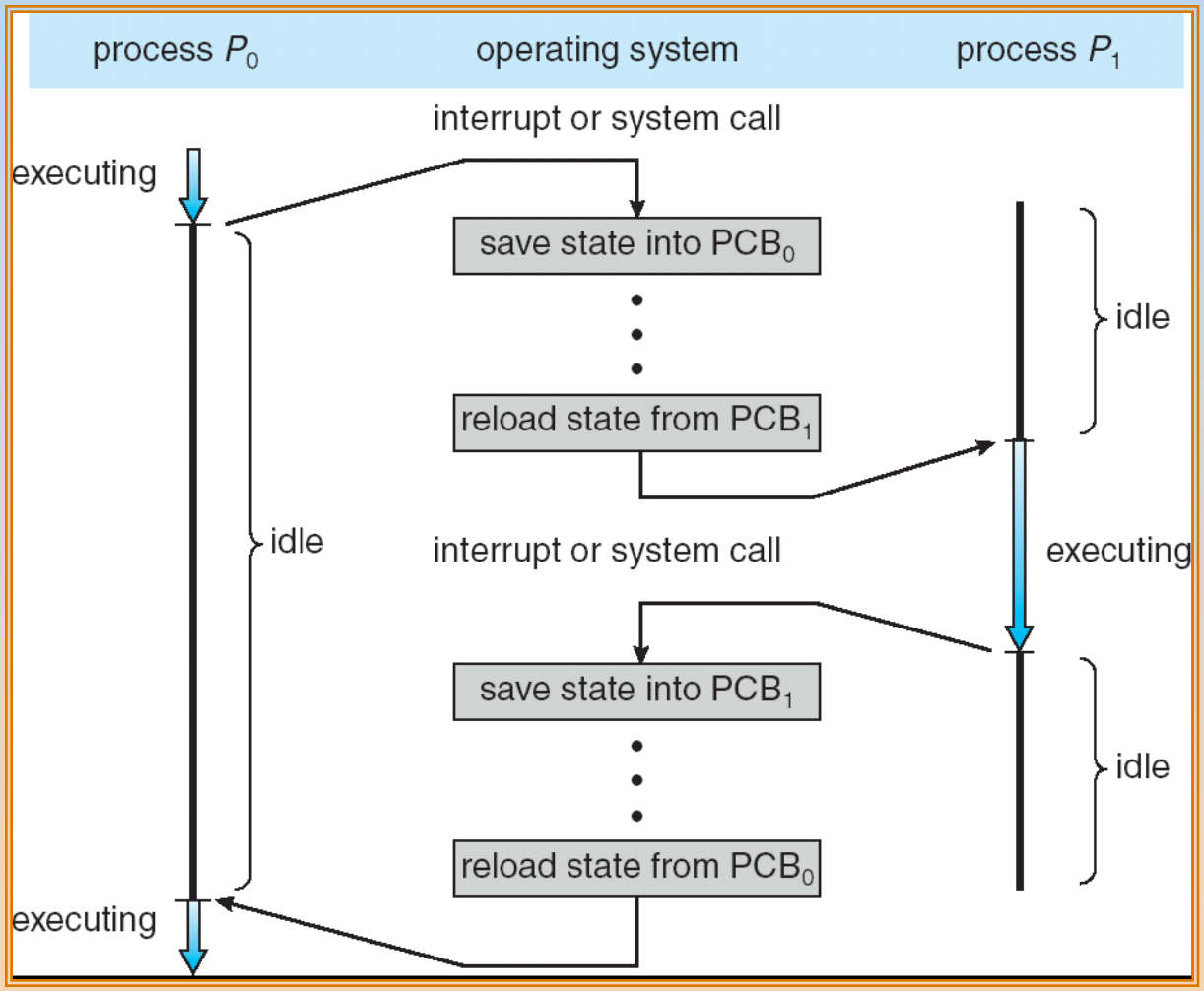


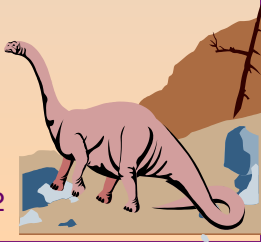
Diagram of Process State



CPU scheduling is a mechanism to migrate processes to various states from/to various queues

Context Switching





Dispatcher

- Dispatcher module gives control of the CPU to the process selected by the short-term scheduler; this involves:
  - switching context
  - switching to user mode
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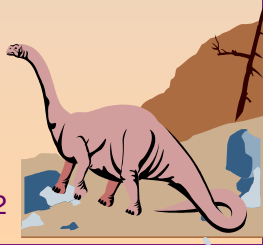
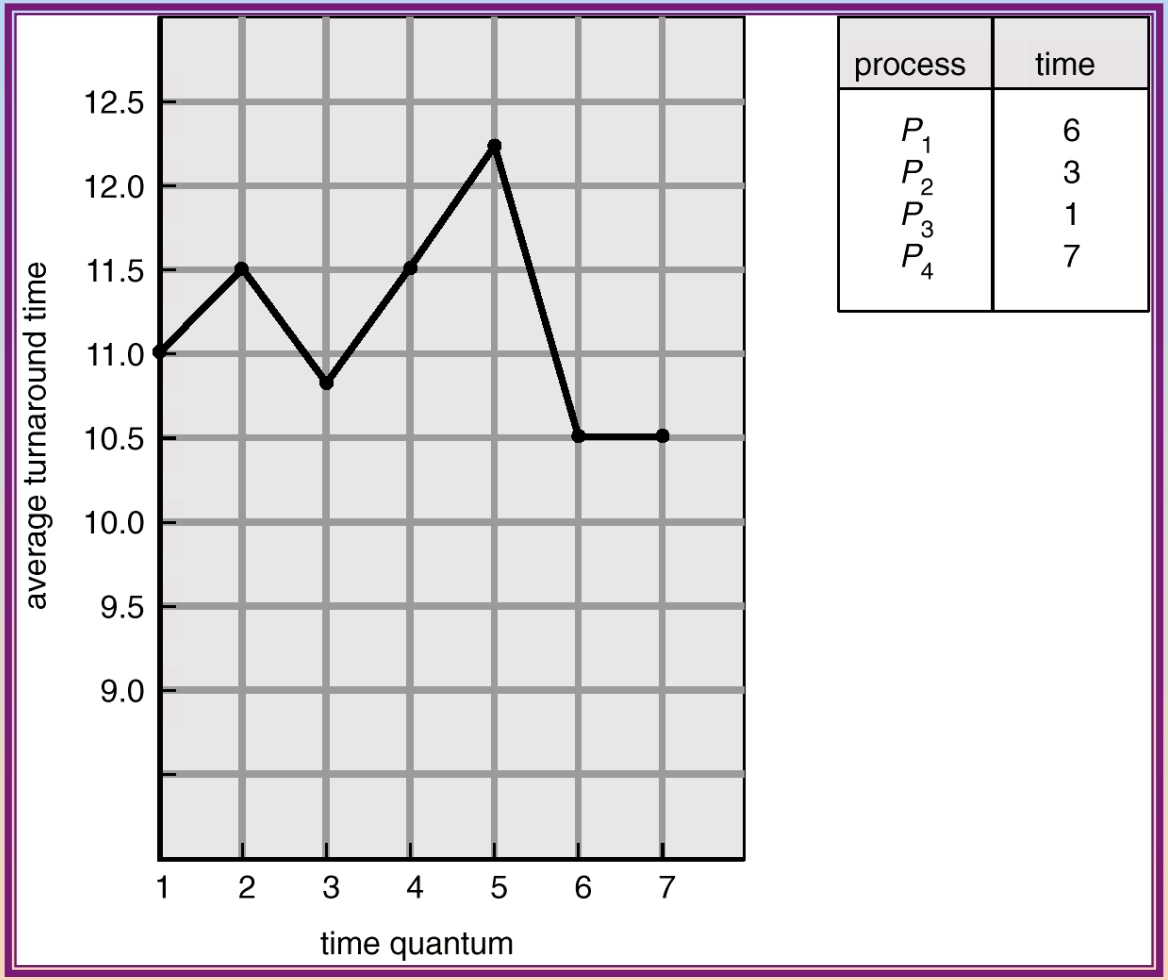
- *Dispatch latency* – time it takes for the dispatcher to stop one process and start another running.



Turnaround Time Varies With The Time Quantum



process	time
P_1	6
P_2	3
P_3	1
P_4	7

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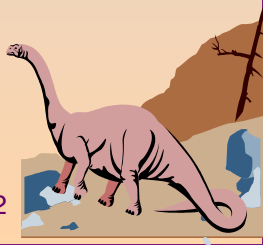

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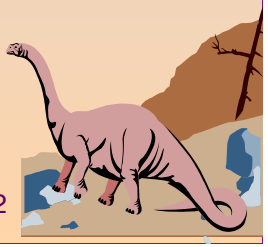

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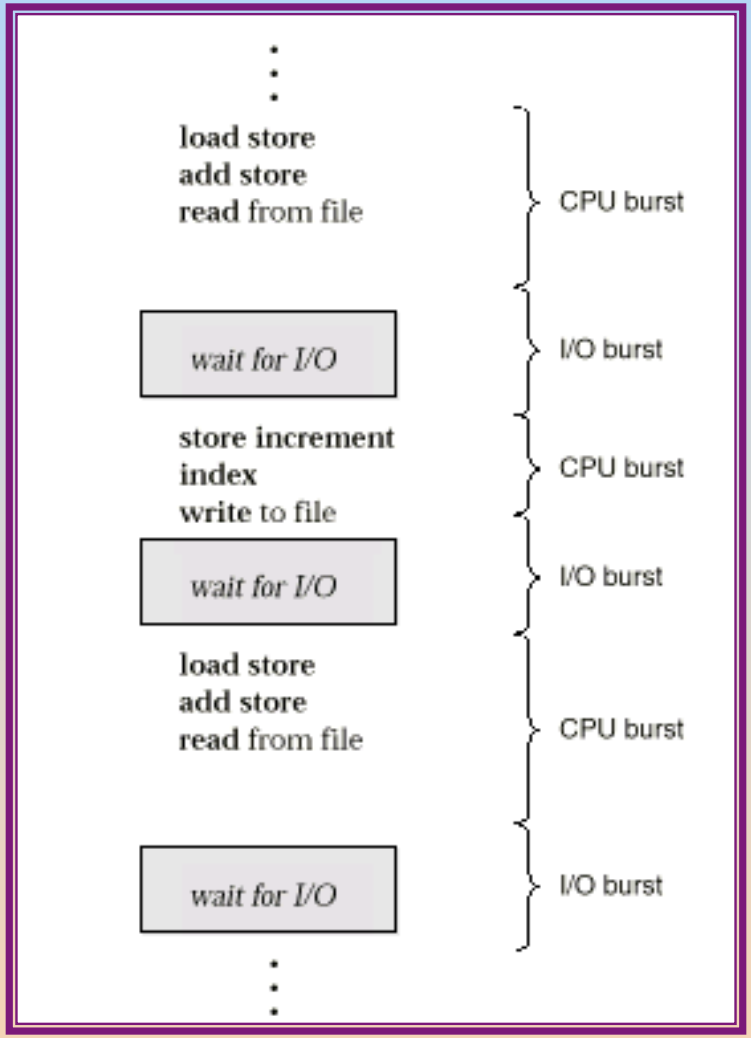

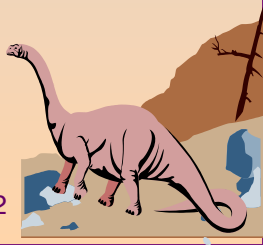

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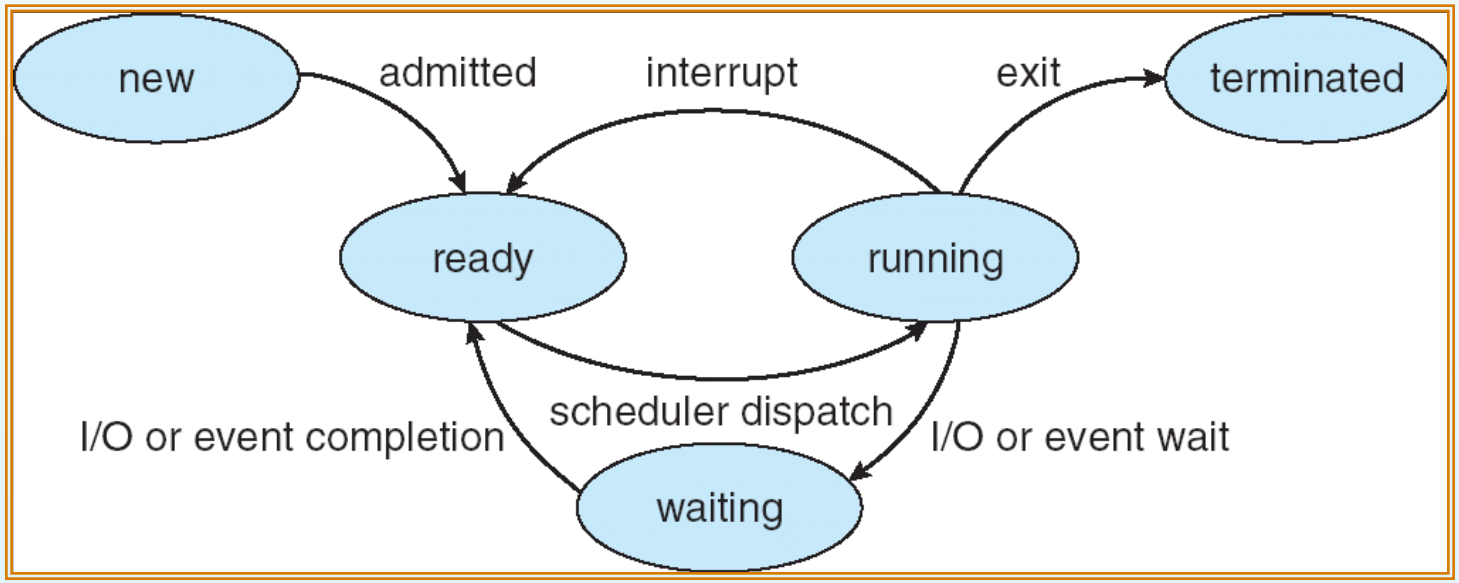

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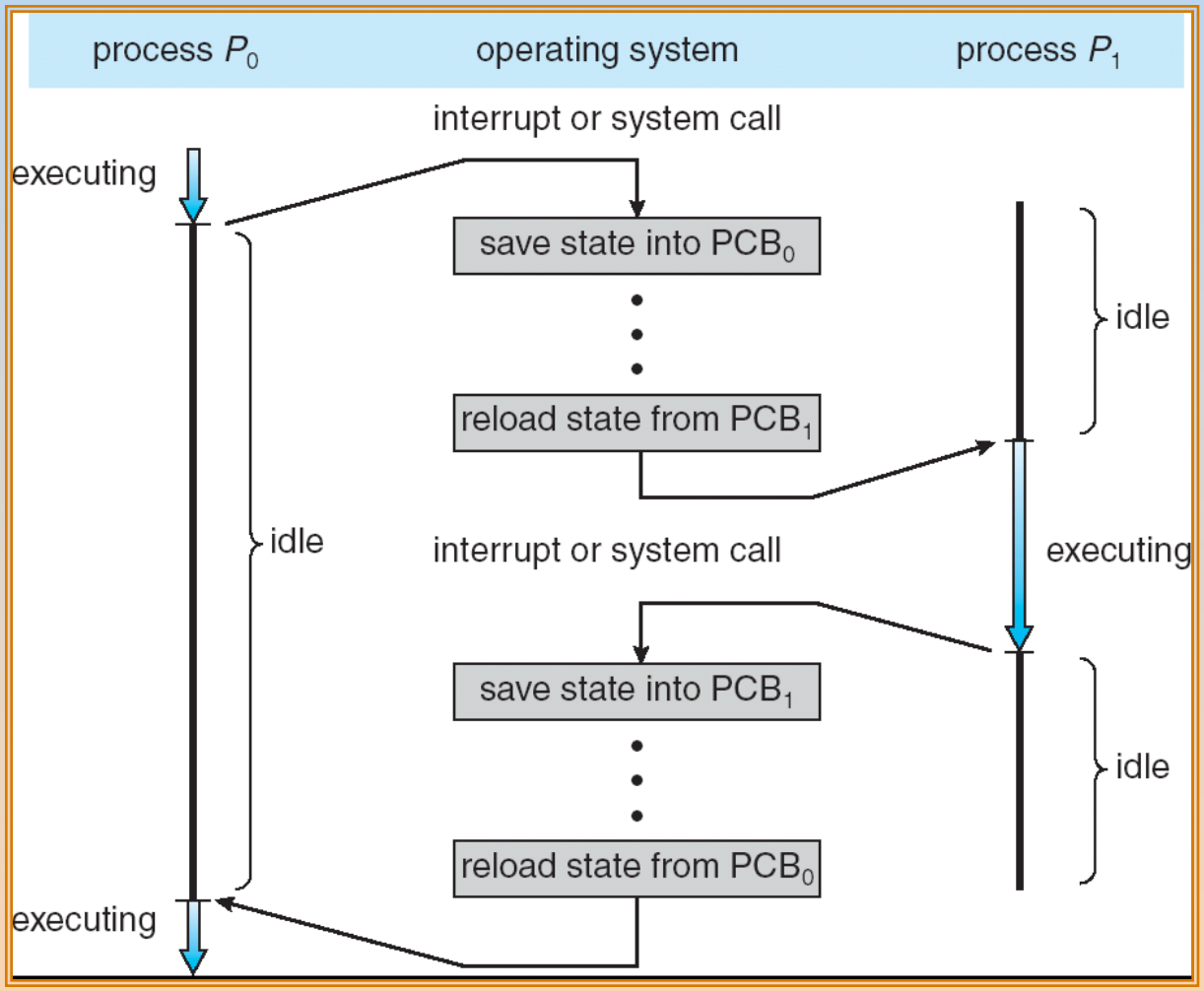

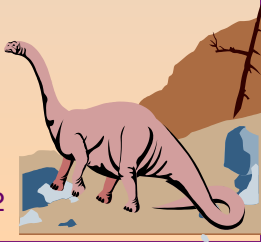

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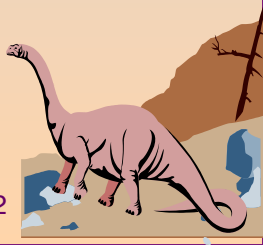

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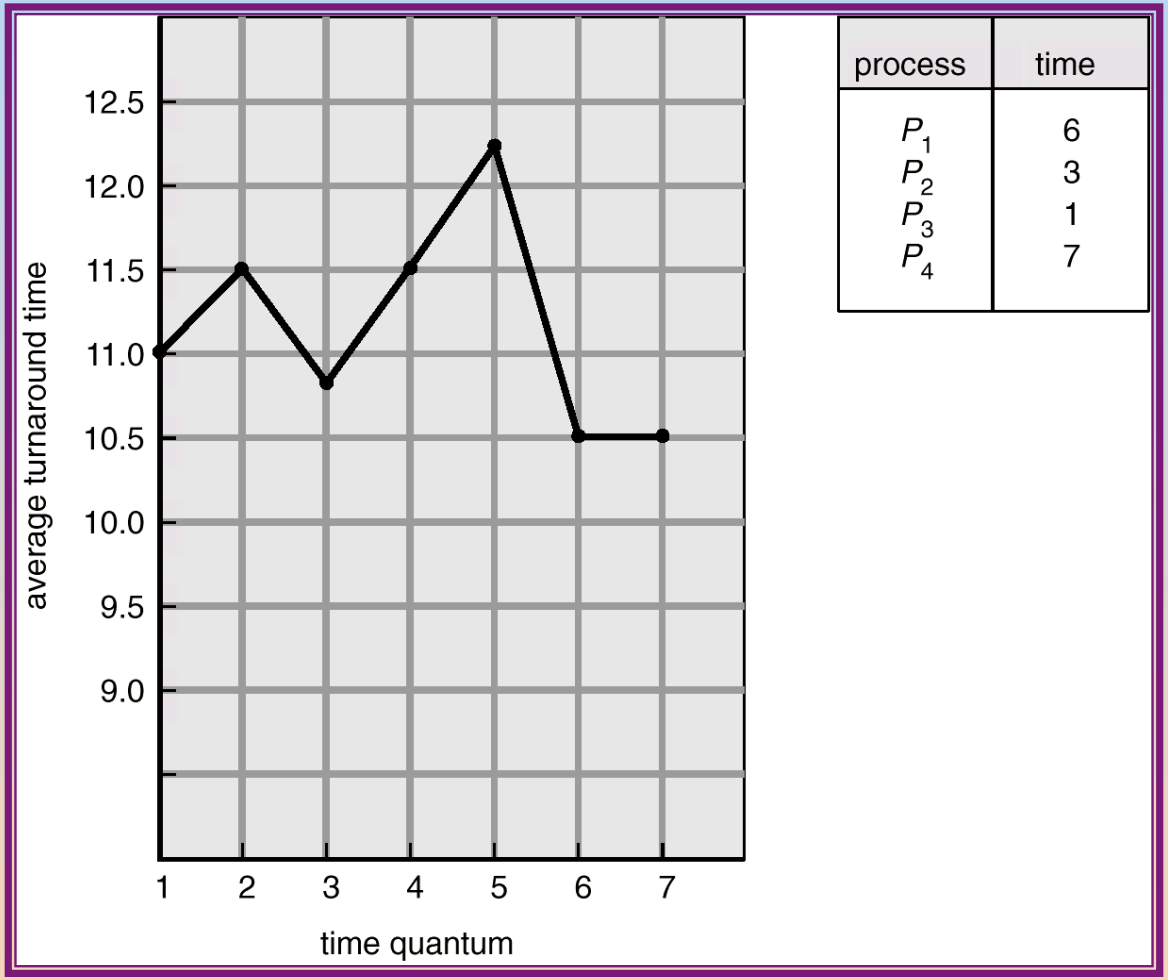

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