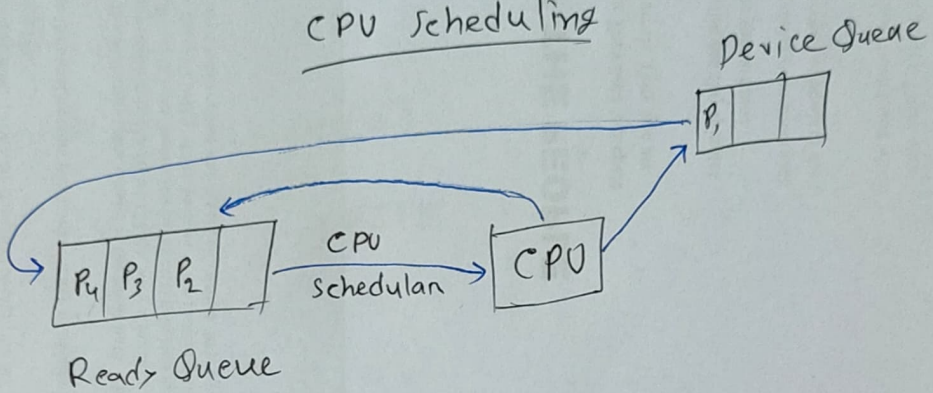
CSE 323 / L-23 / 16.05.2024 /

Chapter-6

CPU Scheduling



* CPU schedulan take decision when, process change their state.
  - running → waiting ⇒ non-preemptive (Device Queue)
  - running → ready ⇒ preemptive (CPU)
  - waiting → ready ⇒ preemptive
  - terminates ⇒ non-preemptive (Ready Queue)

* Preemptive:
  ⇒ if OS kick out the process from CPU for a interrupt, then it is known a preemptive. That means, where interrupt occurs,

Dispatcher Module:

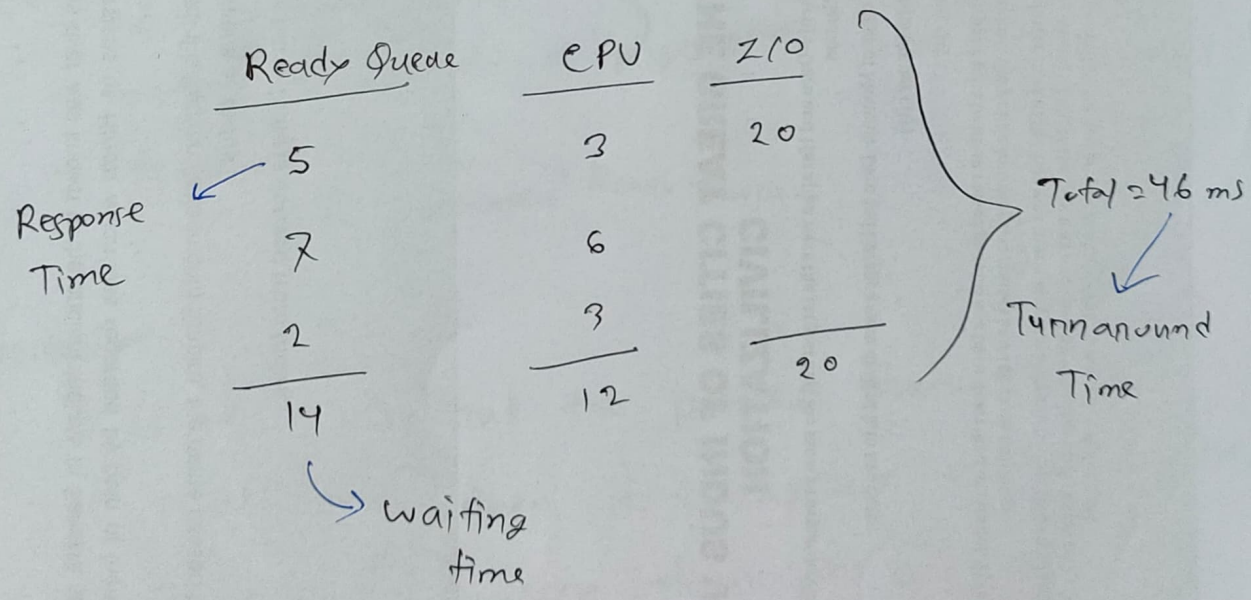
- used to control process that selected by ~~sort~~ short-term scheduler

⇒ - switching context
- switching to user mode
- jumping to the proper location in the user program for restart that program.

Dispatch latency:

- time required by the dispatcher to stop one process and ~~run~~ start another process.

Scheduling Criteria:



⇒ CPU utilization:

- keep the CPU as busy as possible.

⇒ Throughput

- # process completed execution in a time unit.

⇒ Turnaround Time:

- total time to execute a process and terminate

⇒ Waiting time:

- amount of time of a process to wait in the ready queue

⇒ Response time:

- waiting time to enter CPU for the very first time.

* Scheduling Algorithm Optimization Criteria:

- MAX CPU utilization
- MAX Throughput
- MIN Turnaround time
- MIN waiting time
- MIN Response time

FCFS Scheduling

First-Come First-Served

must one question in final

Given a table of content:

Process	Burst Time → Time needed to run a process. Estimated time generated by OS.
P_1	24
P_2	3
P_3	3

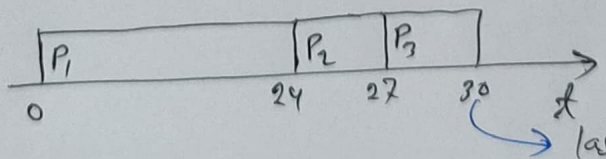
total time = 30 ⇒ last time of the Gantt Chart. Need to verify at the end of the solutions.

Arrival time: time, when the process arrived in the Ready Queue.

⇒ Here arrival time is not given. Then, we assume that all arrived at the same time, 0 in ~~the~~ a sequence as the given table.

FCFS ⇒ non-preemptive
- process can't interrupt by others.
- will run until terminate.

Gantt chart:



Here, waiting time,

$P_1 = 0$
$P_2 = 24$
$P_3 = 27$

Average waiting time
$= \frac{0+24+27}{3} = 17$

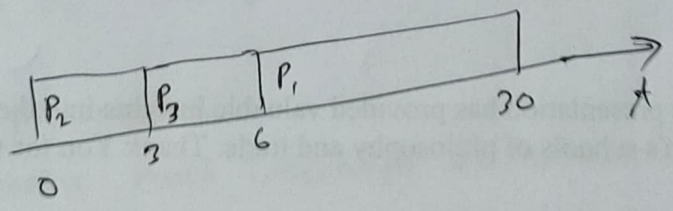
✱ Question Pattern:

⇒ For any algorithm
- find out CPU Gantt Chart
- Calculate waiting time
- Calculate average waiting time.
- Average response time may also be asked!

✱ Let's change the sequence of that table.

$P_2 \rightarrow P_3 \rightarrow P_1$

Gantt Chart:



Waiting time,

$P_1 = 6$
$P_2 = 0$
$P_3 = 3$

Average waiting time
$= \frac{6+0+3}{3} = 3$

✳ Therefore,

if we run the shortest process first, then the average time will be significantly reduced.

⇒ This is known as convoy effect.

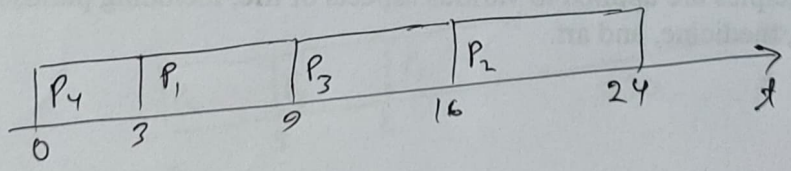
⇒ 1 CPU-bound & many I/o-bound process

✳ SJF Scheduling

Shortest Job First ⇒ for non-preemptive process.

Process	Burst Time
P_1	6
P_2	8
P_3	7
P_4	3
	Total = 24

Gantt Chart:



waiting time:

$P_1 = 3$
$P_2 = 16$
$P_3 = 9$
$P_4 = 0$

average waiting time

$= \frac{3+16+9+0}{4} = 7$

Shortest Remaining Time First

Preemptive SJF scheduling

Process	arrival time	Burst Time
P_1	0	8
P_2	1	4
P_3	2	9
P_4	3	5

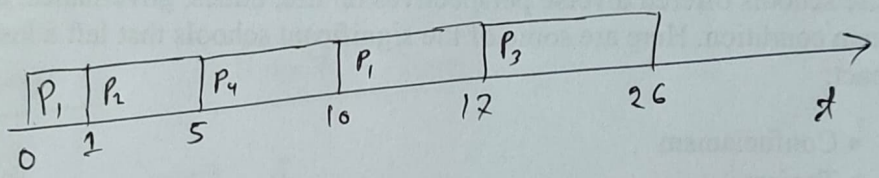
Total = 26

after 1 second remaining time
$P_1 = 7$
$P_2 = 4$

after 2
$P_1 = 7$
$P_2 = 3$
$P_3 = 9$

after 3
$P_1 = 7$
$P_2 = 2$
$P_3 = 9$
$P_4 = 5$

Gantt Chart:



Waiting Time:

$P_1 = (0-0) + (10-1) = 9$ (Re-arrival time)

$P_2 = 1 - 1 = 0$

$P_3 = 17 - 2 = 15$

$P_4 = 5 - 3 = 2$

P_4: 5 = execution start time, 3 = arrival time

Average waiting time $= \frac{9+0+15+2}{4} = 6.5$

Tommorow Friday
Online Class - 8pm

Project Show
16 & 23rd May