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# ROUND ROBIN (RR) SCHEDULING

# RR Scheduling

- Each process gets a small unit of CPU time (*time quantum*), usually 10-100 milliseconds. After this time has elapsed, the process is preempted and added to the end of the ready queue.
- If there are  $n$  processes in the ready queue and the time quantum is  $q$ , then each process gets  $1/n$  of the CPU time in chunks of at most  $q$  time units at once.
  - No process waits more than  $(n-1)q$  time units.

# RR Question 1

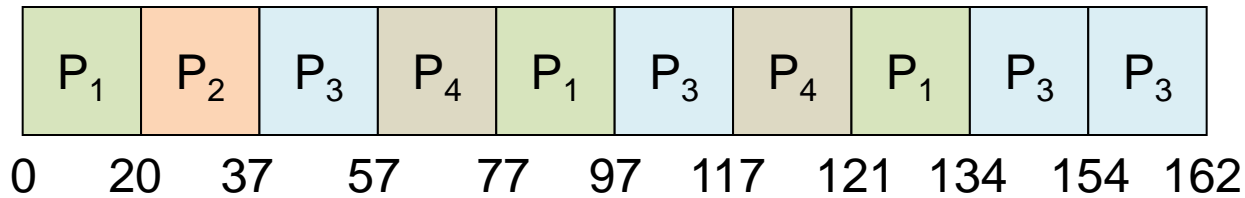
Process	Burst Time
$P_1$	53
$P_2$	17
$P_3$	68
$P_4$	24

Suppose that the processes arrive, at time 0, in the order:  $P_1$ ,  $P_2$ ,  $P_3$ , and  $P_4$ . Time Quantum: 20 unit

*Find:*

1. *Waiting Time*
2. *Average Waiting Time*
3. *Turnaround Time*
4. *Average Turnaround Time*

# RR Question 1: Solution<sup>1/2</sup>



- *Waiting Time*

➤  $P1wt = 0 + (77 - 20) + (121 - 97) = 0 + 57 + 24 = 81$  unit time

➤  $P2wt = 20$  unit time

➤  $P3wt = 37 + (97 - 57) + (134 - 117) = 37 + 40 + 17 = 94$  unit time

➤  $P4wt = 57 + (117 - 77) = 57 + 40 = 97$  unit time

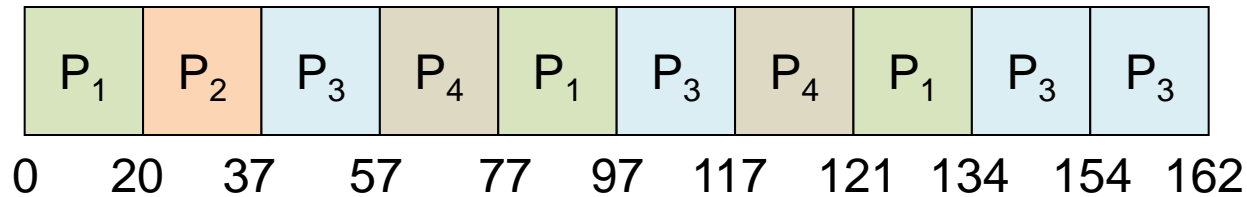
Process	Burst Time
$P_1$	53
$P_2$	17
$P_3$	68
$P_4$	24

- *Average Waiting Time*

➤  $AWT = (P1wt + P2wt + P3wt + P4wt) / 4$

➤  $AWT = (81 + 20 + 94 + 97) / 4 = 292 / 4 = 73$  unit time

# RR Question 1: Solution<sup>2/2</sup>



- *Turnaround Time*

➤  $P1tt = (134 - 0) = 134$  unit time

➤  $P2tt = (37 - 0) = 37$  unit time

➤  $P3tt = (162 - 0) = 162$  unit time

➤  $P4tt = (121 - 0) = 121$  unit time

Process	Burst Time
$P_1$	53
$P_2$	17
$P_3$	68
$P_4$	24

- *Average Turnaround Time*

➤  $ATT = (P1tt + P2tt + P3tt + P4tt) / 4$

➤  $ATT = (134 + 37 + 162 + 121) / 4 = 454 / 4 = 113.5$  unit time

# RR Question 2

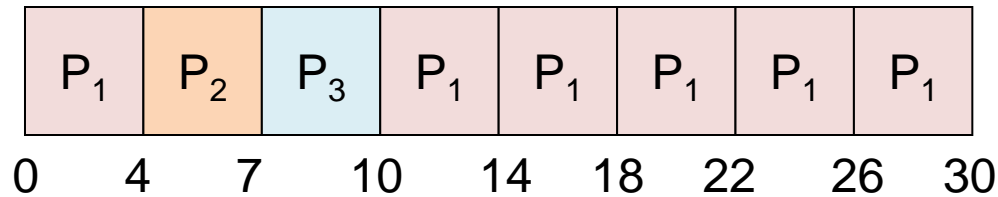
Process	Burst Time
$P_1$	24
$P_2$	3
$P_3$	3

Suppose that the processes arrive, at time 0, in the order:  $P_1$ ,  $P_2$ ,  $P_3$ .  
*Time Quantum: 4 unit.*

*Find:*

1. *Waiting Time*
2. *Average Waiting Time*
3. *Turnaround Time*
4. *Average Turnaround Time*

# RR Question 2: Solution<sup>1/2</sup>



- *Waiting Time*

➤  $P1wt = 0 + (10 - 4) = 6$  unit time

➤  $P2wt = 4$  unit time

➤  $P3wt = 7$  unit time

Process	Burst Time
$P_1$	24
$P_2$	3
$P_3$	3

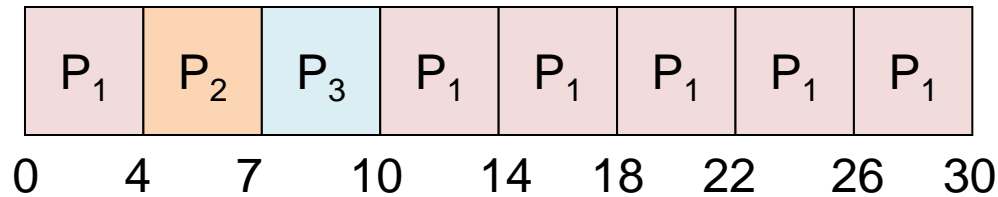
- *Average Waiting Time*

➤  $AWT = (P1wt + P2wt + P3wt) / 3$

➤  $AWT = (6 + 4 + 7) / 3 = 17 / 3 = 5.7$  unit time



# RR Question 2: Solution<sup>2/2</sup>



Process	Burst Time
P <sub>1</sub>	24
P <sub>2</sub>	3
P <sub>3</sub>	3

- *Turnaround Time*

- $P1tt = (30 - 0) = 30$  unit time

- $P2tt = (7 - 0) = 7$  unit time

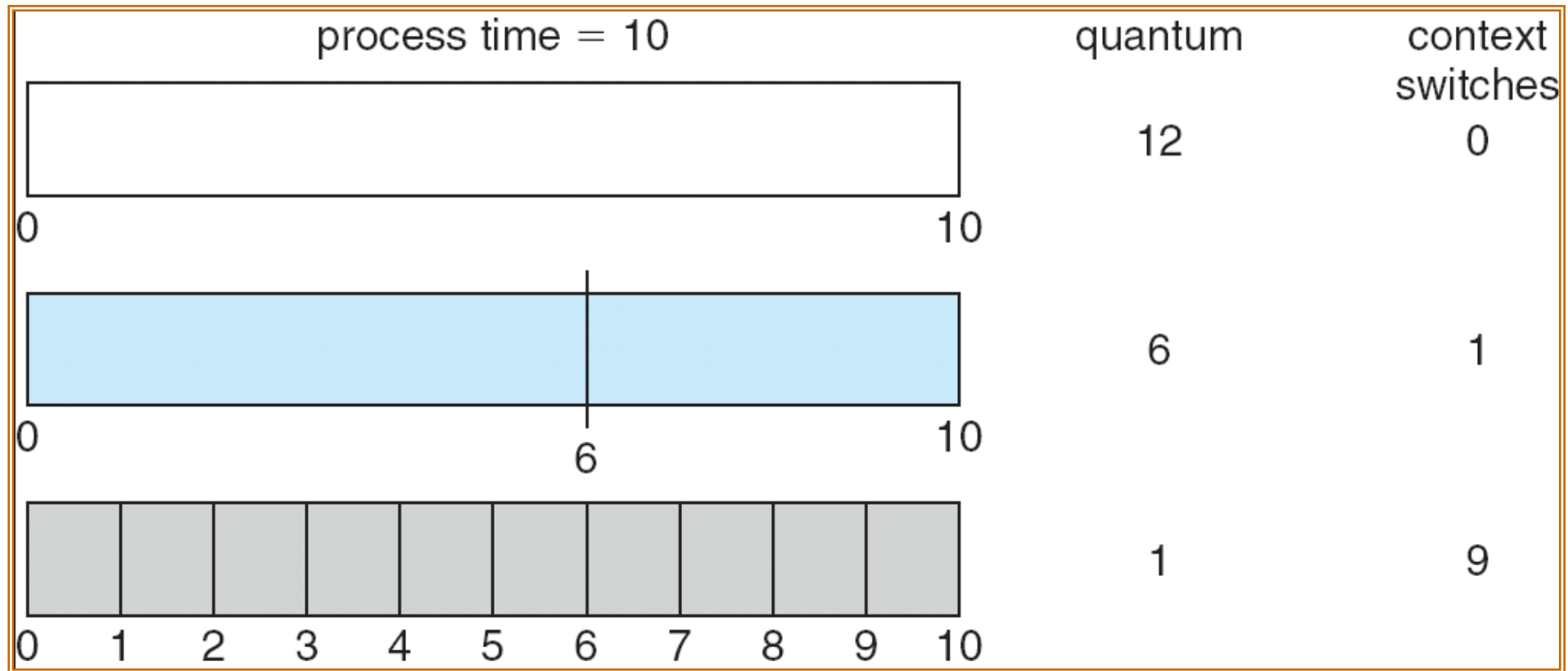
- $P3tt = (10 - 0) = 10$  unit time

- *Average Turnaround Time*

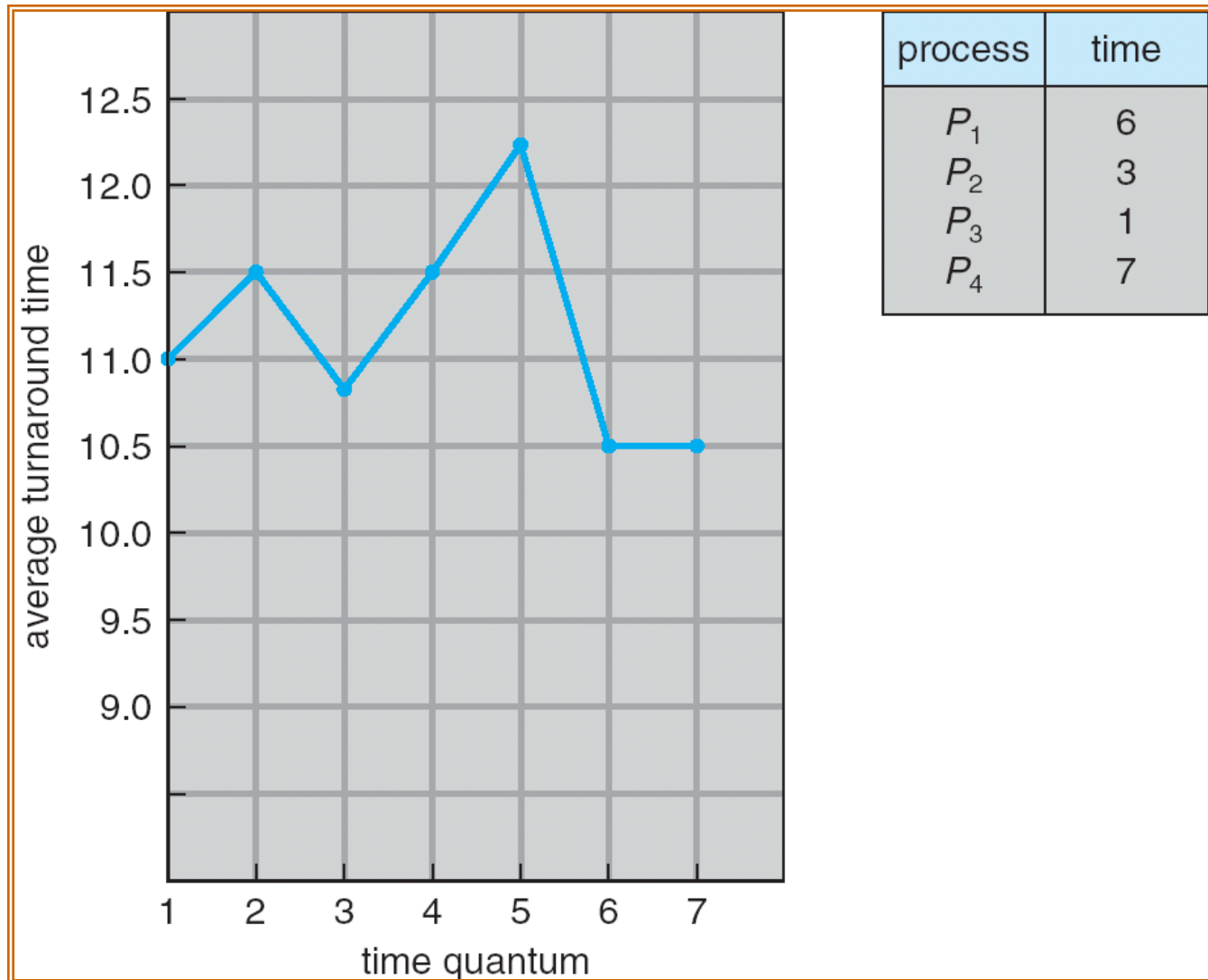
- $ATT = (P1tt + P2tt + P3tt) / 3$

- $ATT = (30 + 7 + 10) / 3 = 47 / 3 = 15.7$  unit time

# Time Quantum and Context Switch Time



# Turnaround Time Varies With The Time Quantum



# RR Scheduling: Analysis

- If the time quantum is too large then the RR scheduling works as

➤ **FCFS**

- **Performance issue**

➤  $q$  must be large with respect to context switch, otherwise

➤ overhead is too high.

# References

1. Silberschatz, Galvin and Gagne, “Operating Systems Concepts”, Wiley.
2. William Stallings, “Operating Systems: Internals and Design Principles”, 6<sup>th</sup> Edition, Pearson Education.
3. D M Dhamdhere, “Operating Systems: A Concept based Approach”, 2<sup>nd</sup> Edition, TMH.

**Thank You.**

