Faculty of Engineering and Technology
Electrical and Computer Engineering Department

Operating Systems
ENCS33990

Homework 2
Scheduling

Prepared by:
Abdel Rahman Shahen 1211753

Partners:
no partners

Instructor: Dr. Abdel Salam Sayyad

Section: 2
Date: 12/6/2023

Processes:

Process	Arrival Time	Burst Time	Priority
P1	0	10	3
P2	1	8	2
P3	3	14	3
P4	4	7	1
P5	6	5	0
P6	7	4	1
P7	8	6	2

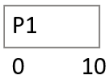
For each of the following scheduling algorithms, show the Gantt chart, average waiting time, and average turnaround time.

S: time unite (not second)

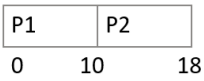
All these calculations were simulated by drawing a ready queue and work done on the given table.

1- First come first served:

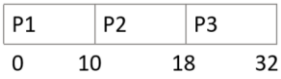
For p1 it will arrive @ t = 0s and executes for 10s but it will wait for 0s



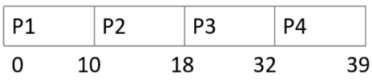
For p2 it will arrive @ t = 1s and executes for 8s but it will wait for 10s



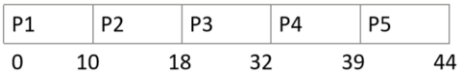
For p3 it will arrive @ t = 3s and executes for 14s but it will wait for 18s



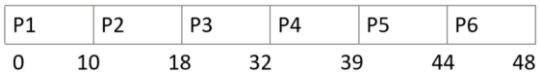
For p4 it will arrive @ t = 4s and executes for 7s but it will wait for 32s



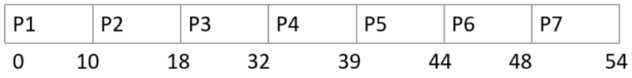
For p5 it will arrive @ t = 6s and executes for 5s but it will wait for 39s



For p6 it will arrive @ t = 7s and executes for 4s but it will wait for 44s



For p7 it will arrive @ t = 8s and executes for 6s but it will wait for 48s



Turn around time = completion time – arrival time

P1: 10 – 0 = 10 P2: 18 – 1 = 17 P3: 32 – 3 = 29 P4: 39 – 4 = 35

P5: 44 – 6 = 38 P6: 48 – 7 = 41 P7: 54 – 8 = 46

Average turnaround time:

(10 + 17 + 29 + 35 + 38 + 41 + 46) / 7 = 216/7 = 30.857s

Waiting time = Turnaround time – burst time

P1: 10 – 10 = 0 P2: 17 – 8 = 9 P3: 29 – 14 = 15 P4: 35 – 7 = 28

P5: 38 – 5 =33 P6: 41 – 4 =37 P7: 46 – 6 =40

Average Waiting time = (0 + 9 + 15 + 28 + 33 + 37 + 40)/7 = 162/7 = 23.143s

2- Shortest Job First:

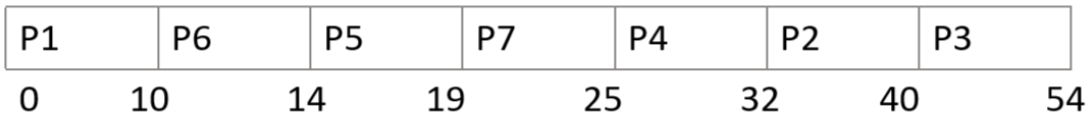
Gantt chart will not remain as it is.

Assuming non-preemptive scheduling:

P1 will arrive first so the processer will begin with it.

Since non-preemptive the processer will not leave p1 when p2 arrives

And so on.



Turnaround time = completion time – arrival time

P1: 10 – 0 = 10 P6: 14 – 7 = 7 P5: 19 – 6 = 13 P7: 25 – 8 = 17

P4: 32 – 4 = 28 P2: 40 – 1 = 39 P3: 54 - 3 = 51

Average Turnaround time = (10 + 7 + 13 + 17 + 28 + 39 + 51) /7 = 165/7 = 23.571s

Waiting time = Turnaround time – burst time

P1: 10 – 10 = 0 P6: 7 – 4 = 3 P5: 13 – 5 = 8 P7: 17 – 6 = 11

P4: 28 – 7 = 21 P2: 39 – 8 = 31 P3: 51 – 14 = 37

Average Waiting time = (0 + 3 + 8 + 11 + 21 + 31 + 37)/7 = 111/7 = 15.857s

3- Shortest Remaining Time First.

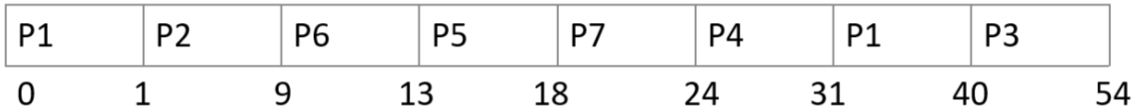
Gantt chart will not remain as it is.

Assuming preemptive scheduling:

P1 will arrive first so the processer will begin with it.

Since preemptive the processer will leave p1 when p2 arrives

And so on.



Turnaround time = completion time – arrival time

P1: 40 – 0 = 40 P2: 9 – 1 = 8 P6: 13 – 7 = 6 P5: 18 – 6 = 12

P7: 24 – 8 = 16 P4: 31 – 4 = 27 P3: 54 – 3 = 51

Average Turnaround time = (40 + 8 + 6 + 12 + 16 + 27 + 51)/7 = 160/7 = 22.857s

Waiting time = Turnaround time – burst time

P1: 40 – 10 = 30 P2: 8 – 8 = 0 P6: 6 - 4 = 2 P5: 12 – 5 = 7

P7: 16 – 6 = 10 P4: 27 – 7 = 20 P3: 51 – 14 = 37

Average Waiting time = (30 + 0 + 2 + 7 + 10 + 20 + 37)/7 = 106 / 7 = 15.143s

4- Round Robin, with q = 5

Gantt chart will not remain as it is.
P1 will arrive first so the processer will begin with it.
After Q the processer will leave p1 when serve the first in queue
And so on. If a process is finished then it goes out of queue else it goes back to the tail of the queue

Turnaround time = completion time – arrival time

P1:25 – 0 = 25 P2: 42 – 1 = 41 P3: 54 – 3 = 51 P4: 49 – 4 = 45

P5: 30 – 6 = 24 P6: 34 – 7 = 27 P7: 50 - 8 = 42

Average Turnaround time = (25 + 41 + 51 + 45 + 24 + 27 + 42)/7 = 255/7 = 36.429s

Waiting time = Turnaround time – burst time

P1:25 – 10 = 15 P2: 41 – 8 = 33 P3: 51 – 14 = 37 P4: 45 – 7 = 38

P5: 24 – 5 = 19 P6: 27 – 4 = 23 P7: 42 - 6 = 36

Average Waiting time = (15 + 33 + 37 + 38 +19 + 23 + 36) / 7 = 201/7 = 28.714s

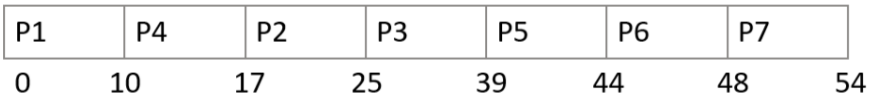
5- Priority Scheduling, with aging; where priority is decremented by 1 if the process remains in the ready queue for 5 units (s).

Since the priority is not decided if higher priority is higher value or
Higher priority is lower value, I will decide this by myself.
By looking at the aging we can notice that the process is decremented 1 priority unite each 5s waiting in the ready queue. Hence, the style will be followed is higher priority lower value.

I decided this as my understanding of the aging approach. The first place that the aging approach came is to solve a problem which is that some processes may stay at the ready queue for a long time which may be forever (starved processes or blocked processes).

So, if the style was high value for high priority the problem is still not solved.
As a result, the high value high for low priority is chosen.

As always, the first arriving process comes to the CPU first.



Turnaround time = completion time – arrival time

P1: 10 – 0 = 10 P2: 25 – 1 = 24 P3: 39 – 3 = 36 P4: 17 – 4 =13

P5: 44 – 6 = 38 P6: 48 – 7 = 41 P7: 54 – 8 = 46

Average Turnaround time = (10 + 24 + 36 + 13 + 38 + 41 + 46)/7 = 208/7 = 29.714s

Waiting time = Turnaround time – burst time

P1: 10 – 10 = 0 P2: 24 – 8 = 16 P3: 36 – 14 = 22 P4: 13 – 7 = 6

P5: 38 – 5 = 33 P6: 41 – 4 = 37 P7: 46 – 6 = 40

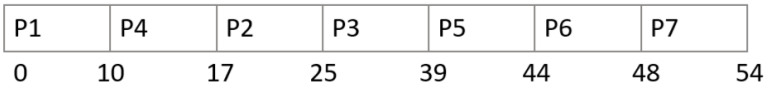
Average Waiting time = (0 + 16 + 22 + 6 + 33 + 37 + 40)/7 = 154/7 = 22s

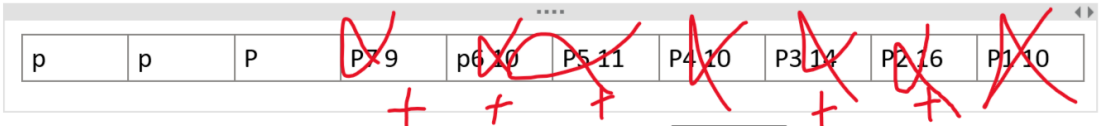
I am really happy to do these home works because through these home works and tasks I am for the first time being able to apply all my knowledge on something practical and interesting.

I appreciate your hard work for marking these tasks and home works. Thank you.

I would like to share my work on solving the last problem

Process	Arrival Time	Burst Time	Priority
P1	0	10	3
P2	1	8	2
P3	3	14	3
P4	4	7	1
P5	6	5	0
P6	7	4	1
P7	8	6	2





Ready Queue