OPERATING SYSTEMS

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HOMEWORK 5

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Process Burst Time Priority
P1   **2**   **2**
P2   **1**   **1**
P3   **8**   **4**
P4   **4**   **2**
P5   **5**   **3**

a.The Gnatt Chart of the four scheduling mechanisms w.r.t above mentioned time is as follows

1.FCFS

P1	P2	P3	P4	P5
0 2	3	11	15	20

Waiting Time

Waiting Time	Turnaround Time
P1 – 0	P1=2+0=2
P2 – 2	P2=2+1=3
P3 – 3	P3=3+8=11
P4 – 11	P4=11+4=15
P5 – 15	P5=15+5=20

Average Waiting Time : 0+2+3+11+15/5 =6.2 secs

Average TurnAround Time= 2+3+11+15+20/5=10.2 secs

2.SJF

P2	P1	P4	P5	P3	
0	1	3	7	12	20

Waiting Time

Waiting Time	Turnaround Time
P1 – 1	P1= 1+2=3
P2 – 0	P2=0+1=1
P3 – 12	P3= 12+8=20
P4 – 3	P4=3+4=7
P5 – 7	P5=7+5=12

Average Waiting Time : 1+0+12+3+7/5 = 4.6 secs

Average TurnAround Time= 3+1+20+7+12/5=8.6 secs

3.**Non Premptive Priority**

P3	P5	P1	P4	P2	
0	8	13	15	19	20

Waiting Time	Turnaround Time
P1 – 13	P1= 13+2=15
P2 – 19	P2= 19+1=20
P3 – 0	P3= 0+8=8
P4 – 15	P4= 15+4=19
P5 – 8	P5= 8+5=13

Average Waiting Time: 13+19+0+15+9/5=11

Average Turnaround Time= 15+20+8+19+13/5=15

4.Round Robin Time Quantum=2

P1	P2	P3	P4	P5	P3	P4	P5	P3	P5	P3
0	2	3	5	7	9	11	13	15	17	18 20

Waiting Time of p1=0
Waiting Time of p2=2
Waiting Time of p3=3+4+4+1=12
Waiting Time of p4=5+4=9
Waiting Time of p5=7+4+2=13

Average Waiting Time=0+2+12+9+13/5=7.2

Average Turn around Time

Turnaround Time of p1= 0+2 =2
Turnaround Time of p2= 2+1 =3
Turnaround Time of p3= 12 +8=20
Turnaround Time of p4= 9 +4=13
Turnaround Time of p5= 13 + 5=18

Average Turn Around Time:2+3+20+13+18/5=11.2

b.

 Turnaround Time of FCFS   = 10.2 secs
Turnaround Time of   SJF=   8.6 secs
Turnaround Time of   Non-Preemptive Priority = 15secs
Turnaround Time of Round Robin= 11.2 secs

c.

Waiting Time of FCFS= 6.2 secs
Waiting Time of SJF=4.6 secs
Waiting Time of   Non-Preemptive Priority =11 secs
Waiting Time of Round Robin = 7.2 secs

d. **SJF Algorithm results in average minimum waiting time of 4.6 secs**

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Thread	Priority	Burst	Arrival
P1	40	20	0
P2	30	25	25
P3	30	25	30
P4	35	15	60
P5	5	10	100
P6	10	10	105

a.Gannt Chart

The length of a time quantum is 10 units.

P1	P1	Pidle	P2	P3	P2	P3	P4	P4	P2	P3	Pidle	P5	P6	P5
0	10	20	25	35	45	55	60	70	75	80	90	100	105 115	120

b.Turn Around Time for Each Process

Thread	Turnaround Time
P1	0+20=20
P2	30+25=55
P3	35+25=60
P4	0+15=15
P5	10+10=20
P6	0+10=10

Average Turnaround Time=20+55+60+15+20+10/6=30

c.Waiting Time for each process

Thread	Waiting Time
P1	0
P2	10+20=30
P3	5+10+20=35
P4	0
P5	10
P6	0

Average Waiting Time=0+30+35+0+10+0/6=12.5

d. CPU Utilization rate:

CPU is idle for 15 secs

Therefore, $105/120 = 87.5$ %

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FCFS: All jobs are executed in a sequence, therefore there won't be any starvation

RR: All jobs are given equal amount of time slot for execution, therefore they wont be any starvation

SHORTEST JOB FIRST: may cause large jobs wait indefinitely for execution slot, this could lead to starvation,

PRIORITY BASED SCHEDULING: algorithms may cause low priority jobs to wait definitely for execution slot, this could result in starvation

Therefore SJF and Priority based scheduling may lead to starvation.

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a. FCFS: if the short jobs are placed after the long jobs, then there short jobs have to wait for a long time to get hold of the processor, thus FCFS discriminates short Jobs.

b. RR: Here all processes are given equal time quantum therefore there are no discrimination in terms of short jobs

c. Multilevel Feedback Queues : Uses a combination of RR and FCFS, but still it is favorable to the short jobs

Question 5 :Slide 21

Validate the turn around time

Process	Burst Time
P1	6
P2	3
P3	1
P4	7

a. Time Quantum=1

P1	P2	P3	P4	P1	P2	P4	P1	P2	P4	P1	P4	P1	P4	P1	P4	P4
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16 17

Process	Waiting Time	Turnaround Time
P1	0+3+2+2+1+1=8	9+6=15
P2	1+3+2=6	6+3=9
P3	2	2+1=3
P4	3+2+2+1+1+1=9	7+10=17

Average Turnaround Time=15+9+3+17/4=11
The average turnaround time for the given processes when time quantum is 1 is
11 which agrees with the time quantum –turn around time relationship

b.Time Quantum 2

P1		P2		P3		P4		P1		P2		P4		P1		P4		P4	
0	2		4		5		7		9		10		12		14		16		17

Process	Waiting Time	Turnaround Time
P1	0+5+3=8	8+6=14
P2	2+5=7	7+3=10
P3	4	4+1=5
P4	5+3+2=10	10+7=17

Average Turnaround Time=14+10+5+17/4=11.5
The average turnaround time for the given processes when time quantum is 2 is
11.5 which agrees with the time quantum –turn around time relationship

c.Time Quantum 3

P1		P2		P3		P4		P1		P4		P4	
0	3		6		7		10		13		16		17

Process	Waiting Time	Turnaround Time
P1	0+7=4	7+6=13
P2	3	3+3=6
P3	6	6+1=7
P4	7+3=10	10+7=17

Average Turnaround Time=13+6+7+17/4=10.75
The average turnaround time for the given processes when time quantum is 3 is
10.75 which agrees with the time quantum –turn around time relationship

d. Time Quantum 4

P1	P2	P3	P4	P1	P4	
0	4	7	8	12	14	17

Process	Waiting Time	Turnaround Time
P1	0+8=8	8+6=14
P2	4	4+3=7
P3	7	7+1=8
P4	8+2=10	10+7=17

Average Turnaround Time=14+7+8+17/4=11.5
The average turnaround time for the given processes when time quantum is 4 is
11.5 which agrees with the time quantum –turn around time relationship

e. Time Quantum 5

P1	P2	P3	P4	P1	P4	
0	5	8	9	14	15	17

Process	Waiting Time	Turnaround Time
P1	0+9=9	9+5=15
P2	5	5+3=8
P3	8	8+1=9
P4	9+1=10	10+7=17

Average Turnaround Time=15+8+9+17/4=12.25
The average turnaround time for the given processes when time quantum is 5 is
12.25 which agrees with the time quantum –turn around time relationship

f. Time Quantum 6

P1	P2	P3	P4	P4	
0	6	9	10	16	17

Process	Waiting Time	Turnaround Time
P1	0	0+6=6
P2	6	6+3=9
P3	9	9+1=10
P4	10	10+7=17

Average Turnaround Time=6+9+10+17/4=10.5
The average turnaround time for the given processes when time quantum is 6 is
10.5 which agrees with the time quantum –turn around time relationship

g. Time Quantum 7

P1	P2	P3	P4	
0	6	9	10	17

Process	Waiting Time	Turnaround Time
P1	0	0+6=6
P2	6	6+3=9
P3	9	9+1=10
P4	10	10+7=17

Average Turnaround Time=6+9+10+17/4=10.5
The average turnaround time for the given processes when time quantum is 7 is
10.5 which agrees with the time quantum –turn around time relationship

The Average Turn Around Values matches with the Graph mentioned in the slide.

- **Turnaround time also depends on the size of the time quantum. As we can see from the above calculations, the average turnaround time of a set of processes does not necessarily improve as the time-quantum size increases. the average turnaround time can be improved if most processes finish their next CPU burst in a single time quantum.**

- **If context-switch time is added in, the average turnaround time increases even more for a smaller time quantum, since more context switches are required.**