OPERATING SYSTEMS

Professor: Hungwen Li

HOMEWORK 5

Name: Jeyanthh Venkatachari Ravikumar SJSU ID: 010720528

6.16

**Process Burst Time Priority**

***P*1 2 2**

***P*2 1 1**

***P*3 8 4**

***P*4 4 2**

***P*5 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**

6.17

|  |  |  |  |
| --- | --- | --- | --- |
| 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 %

6.19

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.**

6.24

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 |

1. 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.**