Operating systems

Sheet 10

(EED)

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1-Most round-robin schedulers use a fixed size quantum. Give an argument in favor of a small quantum. Now give an argument in favor of a large quantum. Compare and contrast the types of systems and jobs to which the arguments apply. Are there any for which both are reasonable?

Small quantum: favor short processes, as they decrease switch context if process ended in one quantum.

Disadvantages

Low efficiency as processor spends most time in context switching.

large quantum: favor long processes which will cause less context switching.

Disadvantages

Low responsiveness and Cause starvation for low priority processes.

2-Which type of process is generally favored by a multilevel feedback queuing scheduler, a processor-bound process or an I/O-bound process? Briefly explain why.

i/o bound process are generally favored by multilevel feedback queuing as they require small processor time so processor can finish them quickly and be free to execute other processes which need processor for long time.

3-What advantage is there in having different time quantum sizes at different levels of multilevel scheduling (feedback)?

having different time quantum sizes at different levels of multilevel scheduling allows the scheduler to diverse needs of processes, leading to improved system responsiveness, fairness, and resource utilization. And this helps to avoid starvation.

4. Answer each of the following questions about HRRN strategy

a. How does it prevent starvation?

HRRN prevent starvation by choosing process with high request ratio ($\frac{waiting\ time+service\ time}{service\ time}$) due to this relation as waiting time increases process priority increases.

b. How does it decrease the favoritism shown by other strategies to short new processes?

Shortest Job First strategy which always favors the shortest upcoming process, HRRN reduces this bias by considering both the service time and the waiting time.

c. Suppose two processes have been waiting for about the same time. Are their priorities about the same? Explain your answer.

If two processes waiting for the same time, it's not necessary to have the same priority as their priority will be depending on service time if their have the same service time, they will have the same priority.

5. Show how multilevel queues accomplish each of the following scheduling goals

a. Favor short processes?

By creating priority queues due to processes execution time and the short process take high priority and will be executed first.

b. Favor I/O-bound processes to improve I/O device utilization.

Multilevel queues favor i/o bound processes as they need less time from CPU so i/o devices takes high priority.

c. Determine the nature of a process as quickly as possible and schedule the process accordingly.

Feedback Mechanism: The scheduler observes process behavior during execution.

Dynamic Queue Movement: Based on observed behavior, processes move between queues.

Q6)

a-

i-Shortest Remaining Time

P1	P1	P2	P2	P1	P1	P1	P4	P4	P4	P4	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

ii-Non-preemptive Priority

P1	P1	P1	P1	P1	P2	P2	P4	P4	P4	P4	P3	P3	P3	P3	P3	P3	P3	P3	P3	P3

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

ii- Round Robin with quantum of 30 ms

P1	P1	P1	P2	P2	P1	P1	P3	P3	P3	P4	P4	P4	P3	P3	P3	P4	P3	P3	P3	P3

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

b-average waiting time

Shortest Remaining Time $\frac{20+0+10+70}{4}$ =25ms

Non-preemptive Priority $\frac{0+30+10+70}{4}$ =27.5ms

Round Robin $\frac{20+10+70+70}{4}$ = 42.5ms

Q7)

a. FIFO: optimal for workloads where all jobs have similar execution times and arrive in the order of their completion time.

Pessimal: when there is high variance in processes execution times. So when long processes come first other processes starve.

b. round robin: optimal for workloads with a mix of short and long jobs where fairness and responsiveness are important.

pessimal for workloads where most jobs are long-running and have similar execution times.

c. shortest time to completion first with preemption

optimal for workloads with a mix of short and long jobs, where short jobs arrive frequently.

pessimal for workloads where long jobs arrive frequently, and short jobs are rare.

d. multilevel feedback

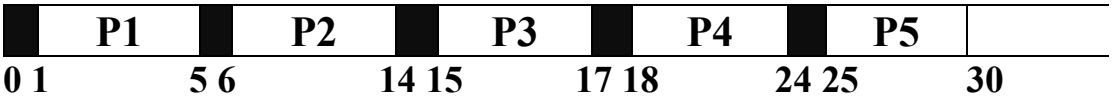
optimal for workloads with a mix of CPU-bound and I/O-bound jobs.

pessimal for workloads with a large number of short, CPU-bound jobs.

Q8)

a-FCFS

i-timing chart



ii-average job turnaround time=[5-0+14-1+17-3+24-10+30-12]/5=12.8

iii-the normalized turnaround time for each job

job1=5/4=1.25

job2=13/8=1.625

job3=14/2=7

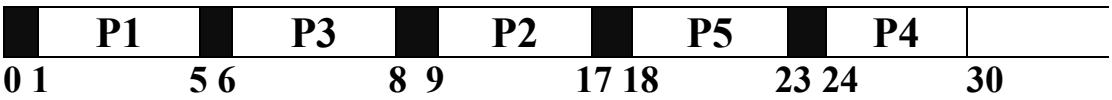
job4=14/6=2.33

job5=18/5=3.6

iv- the processor efficiency=25/30=83.33%

b-SPN

i-timing chart



ii-average job turnaround time=[5-0+8-3+17-1+23-12+30-10]/5=11.4

iii-the normalized turnaround time for each job

job1=5/4=1.25

job2=16/8=2

job3=5/2=2.5

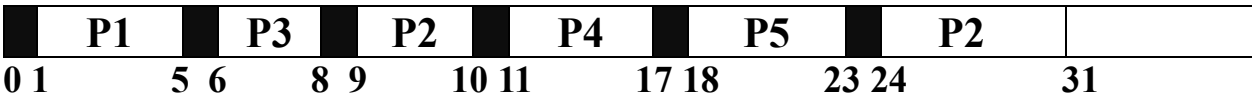
job4=20/6=3.33

job5=11/5=2.2

iv- the processor efficiency=25/30=83.33%

C-STRN

i-timing chart



ii-average job turnaround time=[5-0+31-1+8-3+17-10+23-12]/5=11.6

iii-the normalized turnaround time for each job

job1=5/4=1.25

job2=30/8=3.75

job3=5/2=2.5

job4=7/6=1.166

job5=11/5=2.2

iv- the processor efficiency=25/31=80.6%

d-RR

i-timing chart

ii-average job turnaround time=[13-0+28-1+11-3+32-10+35-12]/5=18.6

iii-the normalized turnaround time for each job

job1=13/4=3.25

job2=27/8=3.375

job3=8/2=4

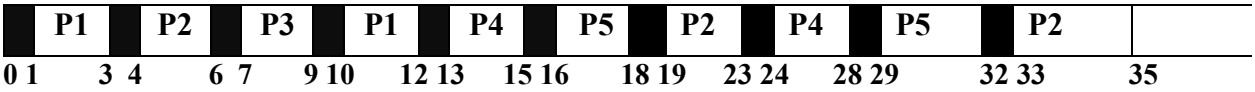
job4=22/6=3.66

job5=23/5=4.6

iv- the processor efficiency=25/35=71.42%

e-multilevel feedback queue

i-timing chart



ii-average job turnaround time=[12-0+35-1+9-3+28-10+32-12]/5=18

iii-the normalized turnaround time for each job

job1=12/4=3

job2=34/8=4.25

job3=6/2=3

job4=18/6=3

job5=20/5=4

iv- the processor efficiency=25/35=71.42%

Q9)

Job	Running time	priority
A	15	6
B	9	3
C	3	7
D	6	9
E	12	4

a- Round robin with a time quantum of 1 minute

jobs go in this sequence one minute foe each job any job finished erased from the sequence

A->B->C->D->E

At minute15

A->B->D->E

At minute 27

A->B->E

At minute 36

A->E

At minute 42

A

Turnaround times:

A: 45

B: 36

C: 15

D: 27

E: 42

Average = (45+36+15+27+42)/5=33

b. Priority scheduling

B->E->A->C->D

Turnaround times:

A: 36

B: 9

C: 39

D: 45

E: 21

Average = (36+9+39+45+21)/5=30

C. FCFS

A->B->C->D->E

Turnaround times:

A: 15

B: 24

C: 27

D: 33

E: 45

Average = (15+24+27+33+45)/5=28.8

D. Shortest job first

C->D->B->E->A

Turnaround times:

A: 45

B: 18

C: 3

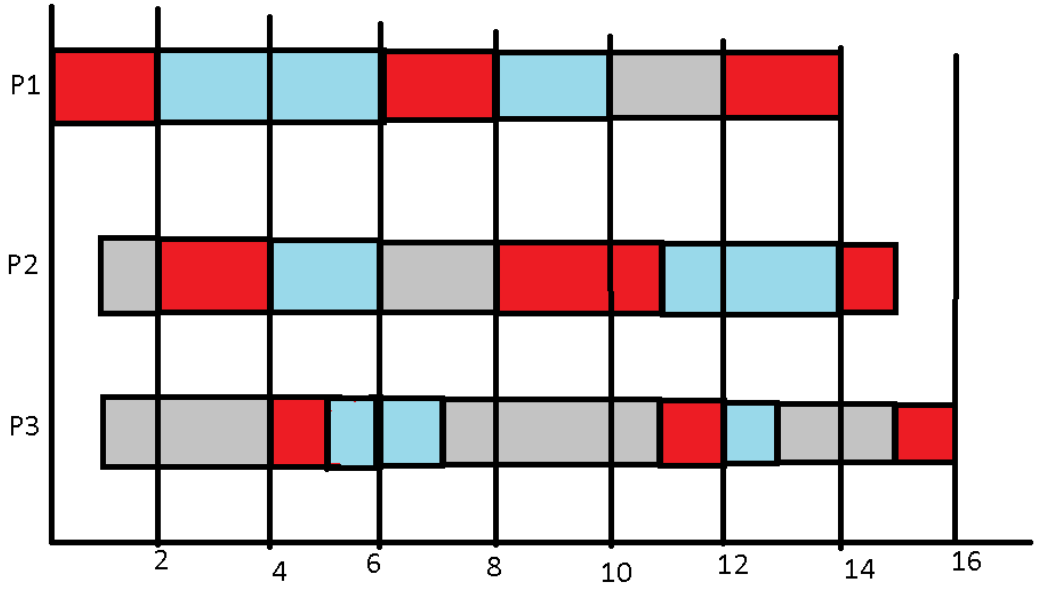
D: 9

E: 30

Average = (45+18+3+9+30)/5=21

Q10) CPU (red) I/O(blue) waiting(gray)

a. The first come first served (FCFS) algorithm



a-Waiting time

P1: 2

P2: 3

P3: 9

b-Average = 14/3 =4.6667

Turnaround:

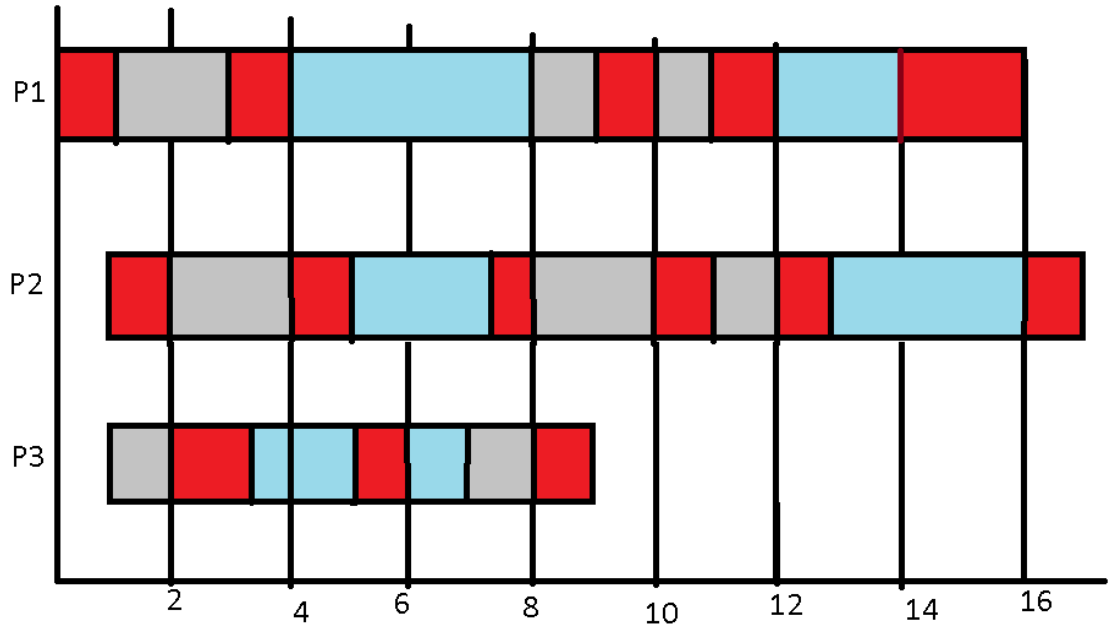
P1: 14-0=14

P2: 15-1=14

P3: 16-1=15

Average = 43/3=14.333c-priority is not considered in FCFS as it takes longest waiting time first (priority independent)

b. The round robin (RR) scheduling algorithm with quantum = 1



a-Waiting time

P1: 4

P2: 5

P3: 2

Average = 11/3=3.666

b-Turnaround:

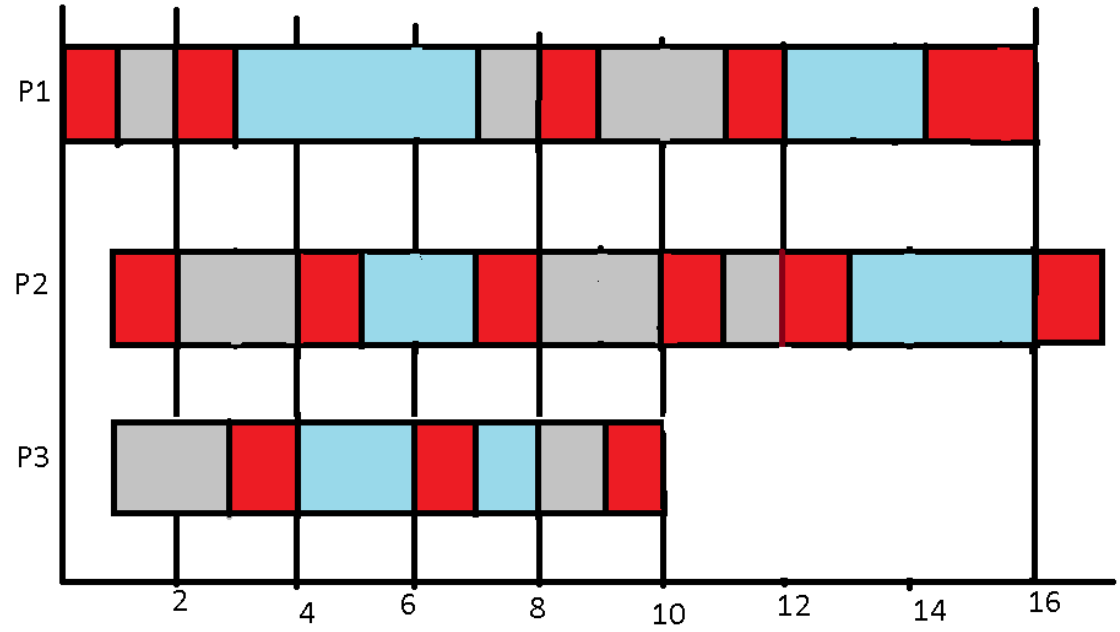
P1: 16-0=16

P2: 17-1=16

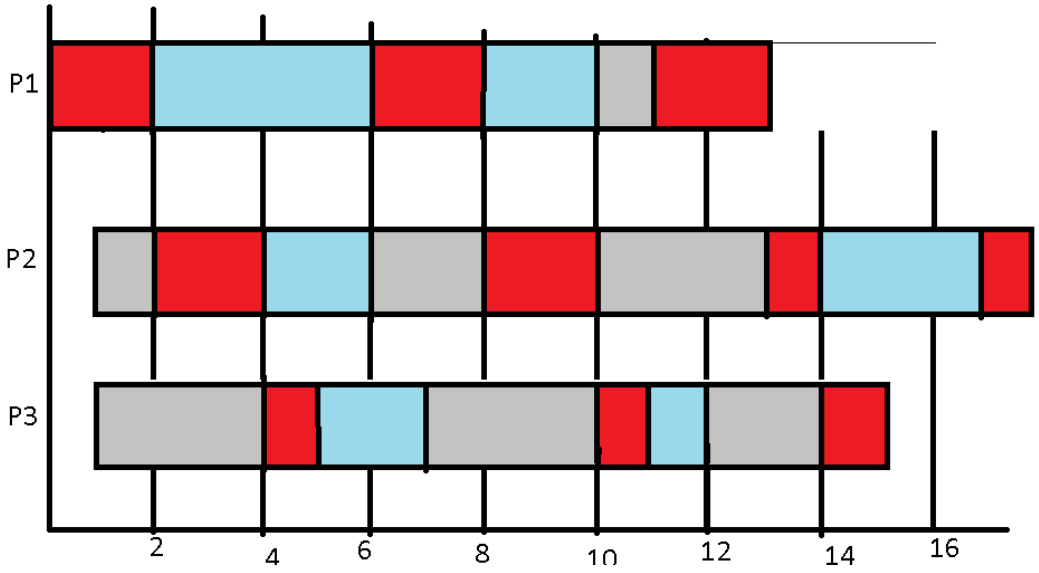
P3: 9-1=8

Average = (16+16+8)/3=13.3333

c-if p2 has higher priority than p1and p3. where quantum=1



c. The round robin (RR) scheduling algorithm with quantum = 2.



a-Waiting time

P1: 1

P2: 6

P3: 8

Average = 15/3=5

b-Turnaround:

P1: 13

P2: 17

P3: 14

Average =44/3= 14.666

c-if p2 has higher priority than p1and p3. where quantum=3