Branch : CSE & IT Batch : Hinglish

Operating System

CPU Scheduling

DPP 04

[MSQ]

1. Which of the following statements is/are correct regarding HRRN scheduling algorithm?

(a) It reduces waiting time for longer processes.

(b) HRRN is preemptive in nature.

(c) HRRN's response ratio can be calculated as (S + W)/S, where S is the service time and W is the waiting time.

(d) HRRN favours job with shorter burst time.

[MSQ]

2. Consider the below table

Process	Arrival time	Burst time
P1	0	7
P2	2	4
P3	4	1
P4	5	4

Schedule the above processes using SRTF and SJF, and select the correct option from the following.

(a) TAT(SJF) > TAT(SRTF).

(b) Waiting time P4(SJF) > Waiting time P3 (SRTF)

(c) TAT(SRTF)> TAT(SJF)

(d) Waiting time P2(SRTF)< Waiting time P1(SJF)

[NAT]

3. How many of the following scheduling algorithms may cause starvation?

i. First-come-first-serve

ii. Priority

iii. Shortest process next

iv. Shortest remaining time first

[NAT]

4. Consider the following processes:

Process	Arrival time	Burst time
P1	0	5
P2	1	5
P3	2	5
P4	3	5

Calculate the sum of waiting time of process P4 and average turnaround time using LRTF scheduling algorithm? (if burst time of two process is same schedule the process with higher arrival time)

[NAT]

5. Consider the set of 5 processes whose arrival time and burst time are given below:

Process	Arrival time	Burst time
P0	0	4
P1	3	5
P2	4	6
P3	5	5
P4	8	3

If the CPU scheduling policy is Highest Response Ratio Next, X is response ratio of last process scheduled, Y is the average turnaround time, and Z is the average waiting time. Calculate X * Y + Z? (upto 1 decimal point)

[MCQ]

6. Match the following groups.

Group-I	Group-II
A. FCFS	1. Used in time sharing system
B. SJF	2. Used in real time system
C. Priority scheduling	3. Minimum average waiting time
	4. Convoy effect

(a) A-2, B-1, C-3

(b) A-4, B-3, C-2

(c) A-2, B-3, C-1

(d) A-4, B-2, C-3

[MCQ]

7. Consider the three processes for a particular system P1, P2, P3. The arrival time of the processes are 0ms, 5ms and 8ms respectively. And the processing times are 15ms, 12ms and 5ms respectively. The three processes

are pre-emptively scheduled on a single-CPU system using the shortest remaining processing time first scheduling policy. Which of the following shows the order in which processes are completed?

(a) P2, P1, P3 (b) P3, P1, P2

(c) P3, P2, P1 (d) P1, P2, P3

[NAT]

8. Consider the following set of processes with the arrival times and burst times. Processes are scheduled using highest response ratio next.

Process	Arrival Time	Burst Time
A	0	4
B	2	1
C	4	3
D	5	5

(All time in milliseconds)

The average waiting time of processes are _____ (ms). (Upto 1 decimal place)

Answer Key

1. **(a, c, d)**
2. **(a, b)**
3. **(3)**
4. **(26)**
5. **(34.6)**
6. **(b)**
7. **(b)**
8. **(1.5)**

Hint & Solutions

1. (a, c, d)

(a) HRRN reduces waiting time for longer processes. Correct

(b) HRRN is preemptive in nature. Incorrect- HRRN is non-preemptive in nature.

(c) HRRN's response ratio can be calculated as (S + W)/S, where S is the service time and W is the waiting time. Correct

(d) HRRN favors job with shorter burst time. Correct

Therefore, A, C, D are correct statements.

2. (a, b)

SRTF:

P1	P2	P3	P2	P4	P1

0 2 4 5 7 11 16

Process	Arrival Time	Burst Time	Completion Time	Turnaround Time	Waiting Time
P1	0	7	16	16	9
P2	2	4	7	5	1
P3	4	1	5	1	0
P4	5	4	11	6	2

Average Turn Around Time = (16 + 5 + 1 + 6)/ 4

= 28/4 = 7

SJF:

P1	P3	P2	P4

0 7 8 12 16

Process	Arrival Time	Burst Time	Completion Time	Turnaround Time	Waiting Time
P1	0	7	7	7	0
P2	2	4	12	10	6
P3	4	1	8	4	3
P4	5	4	16	11	7

Average Turn Around Time = (7 + 10 + 4 + 11)/ 4

= 32/4 = 8

Therefore, only option a, b are correct.

3. (3)

(i) First-come-first-served- No starvation

(ii) Priority- Starvation

(iii) Shortest process next- Starvation

(iv) Shortest remaining time first- Starvation

4. (26)

Gantt Chart:

P1	P2	P3	P4	P3	P2	P1	P4	P3

0 1 2 3 5 6 7 8 9 10

P2	P1	P4	P3	P2	P1	P4	P3	P2	P1

10 11 12 13 14 15 16 17 18 19 20

Process	Arrival Time	Burst Time	Completion Time	Turnaround Time	Waiting Time
P1	0	5	20	20	15
P2	1	5	19	18	13
P3	2	5	18	16	11
P4	3	5	17	14	9

Waiting time of P4 = 9

Average TAT = (20 + 18 + 16 + 14)/ 4 = 17

Waiting time of P4 + Average TAT = 26

5. (49.2)

Gantt Chart:

P0

0 4

At time 4, process P1 and P2 arrived, calculating response ratio for P1 and P2.

P1 = (W + S)/ S = (1 + 5)/5 = 6/5 = 1.2

P2 = (W + S)/ S = (0 + 6)/6 = 6/6 = 1

So, P1 will be scheduled next.

P0	P1

0 4 9

At time 9, process P3 and P4 arrived and P2 was already waiting, calculating response ratio for P2, P3, and P4.

P2 = (W + S)/ S = (5 + 6)/6 = 11/6 = 1.8

P3 = (W + S)/ S = (4 + 5)/5 = 9/5 = 1.8

P4 = (W + S)/ S = (1 + 3)/3 = 4/3 = 1.3

So, P2 will be scheduled next.

P0	P1	P2

0 4 9 15

At time 15, calculating response ratio for P3, and P4.

P3 = (W + S)/ S = (10 + 5)/5 = 15/5 = 3

P4 = (W + S)/ S = (7 + 3)/3 = 10/3 = 3.3

Now, P4 will be scheduled and then P3 will be scheduled

P0	P1	P2	P4	P3

0 4 9 15 18 23

Process	Arrival Time	Burst Time	Completion Time	Turnaround Time	Waiting Time
P0	0	4	4	4	0
P1	3	5	9	6	1
P2	4	6	15	11	5
P3	5	5	23	18	13
P4	8	3	18	10	7

Response ratio of last process scheduled, last process scheduled was P3, its response ratio was 3, so X = 3.

Average waiting time = (0 + 1 + 5 + 13 + 7)/ 5

= 26/5 = 5.2

Average Turnaround time = (4 + 6 + 11 + 18 + 10)/5

= 49/5 = 9.8

So, X * Y + Z = 34.6

6. (b)

FCFS: Suffers from Convoy effect.

SJF: Minimum average waiting time

Priority scheduling: Used in real time system.

7. (b)

Gantt Chart:

P1	P3	P1	P2

0 8 13 20 32

Process completion order: P3, P1, P2. So, option b is correct answer.

8. (1.5)

Gantt Chart:

A

0 4

At time 4, process B and C are in the system, calculating response ratio

B = (2 + 1)/1 = 3

C = (0 + 3)/ 3 = 1

So, B will be scheduled next

A	B

0 4 5

At time 5, process C and D are in the system, calculating response ratio

C = (1 + 3)/3 = 1.333

D = (0 + 5)/ 5 = 1

So, C will be scheduled next, and after that D will be scheduled.

A	B	C	D

0 4 5 8 13

Process	Arrival Time	Burst Time	Completion Time	Turnaround Time	Waiting Time
A	0	4	4	4	0
B	2	1	5	3	2
C	4	3	8	4	1
D	5	5	13	8	3

Average waiting time = (0 + 2 + 1 + 3)/ 4 = 1.5