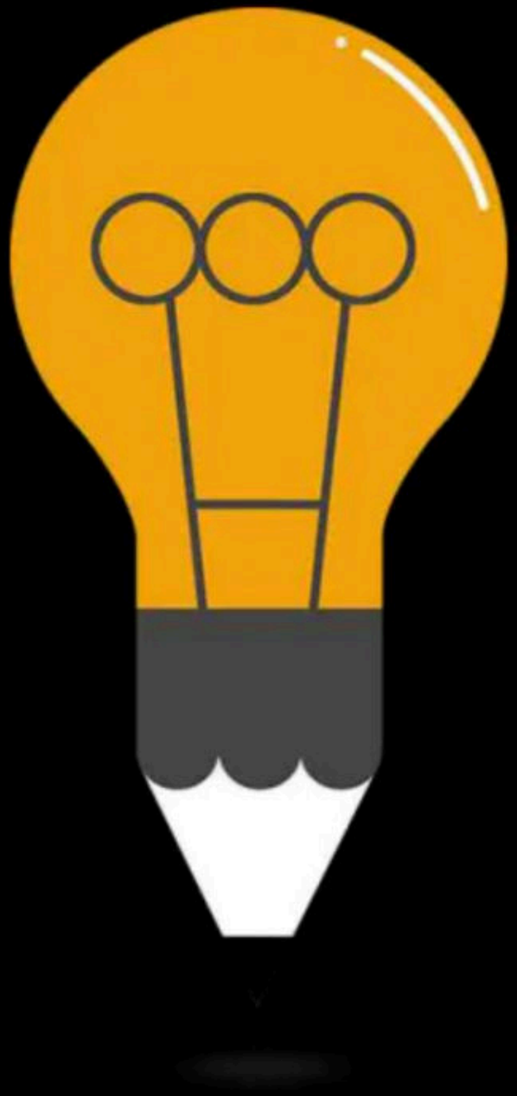
unacademy

Doubt Clearing Session

Comprehensive Course on Operating System for GATE - 2024/25

Vishvadeep Gothi • Lesson 8 • Apr 27, 2023

unacademy

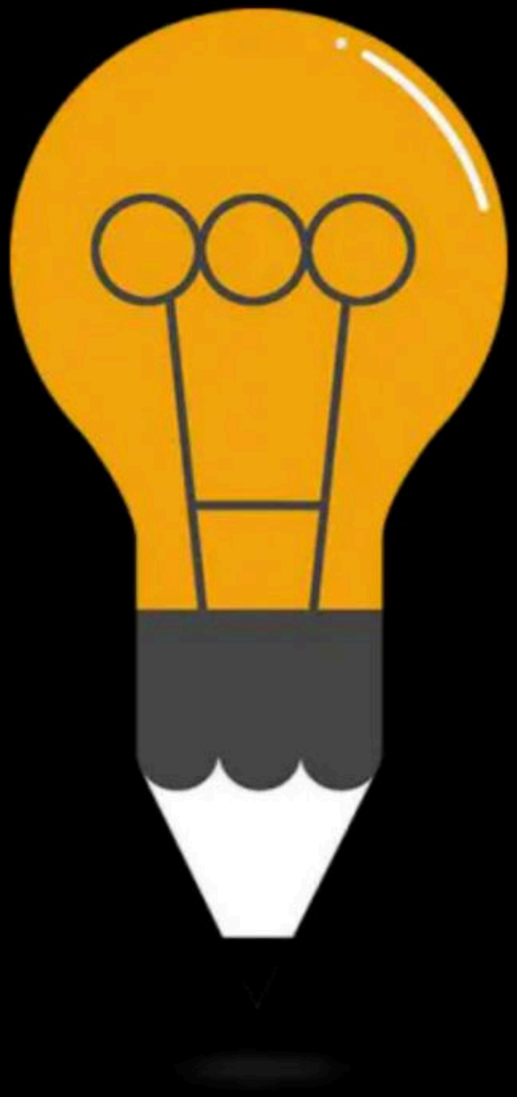


Operating System
Doubts & Scheduling Algo

By: Vishvadeep Gothi

If all processes arrive together, then SJF & SRTF will have same process execution.

unacademy



DPP

By: Vishvadeep Gothi

unacademy

Question 1

Response time of processes in non-preemptive scheduling algorithms are equal to waiting time of processes?

True or False

Justify your answer with appropriate explanation.

Question 2

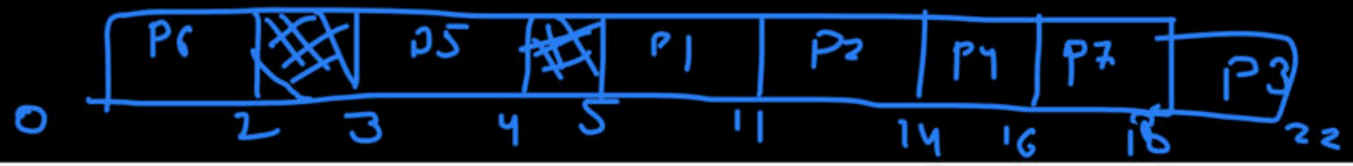
Consider the following process scenario.

Calculate the average waiting time and average TAT for processes for FCFS?

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

Avg tat = 7.42

Avg wt = 4.57



unacademy

Question 3

Consider the following process scenario.

Calculate the average waiting time and average TAT for processes for SJF algo?

Process	Arrival Time	Burst Time
P1	5	6
P2	3	3
P3	1	4
P4	2	2
P5	4	1
P6	0	5
P7	1	2

Avg tat = 9.42

Avg wt = 6.14

unacademy

Question 4

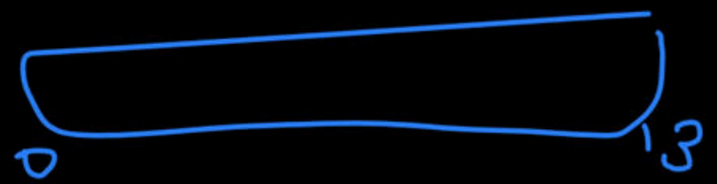
Consider a CPU performance metric *throughput* which is calculated as:

$$Throughput = \frac{Number\ of\ processes\ executed}{Total\ scheduling\ duration}$$

For the following process scenario calculate the throughput if process execution is done using:

1. FCFS algorithm $\frac{4}{13}$
2. SJ algorithm $\frac{4}{13}$

Process	Arrival Time	Burst Time
P1	0	4
P2	0	3
P3	0	1
P4	0	5



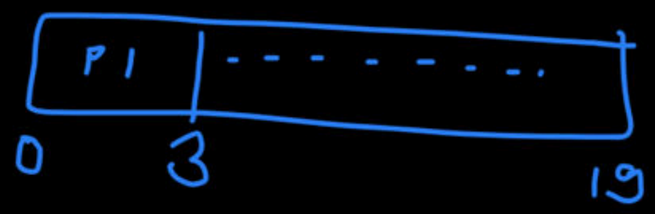
Question 5

Consider a CPU performance metric *throughput* which is calculated as:

$$Throughput = \frac{Number\ of\ processes\ executed}{Total\ scheduling\ duration} = \frac{6}{19}$$

For the following process scenario calculate the throughput if process execution is done using:

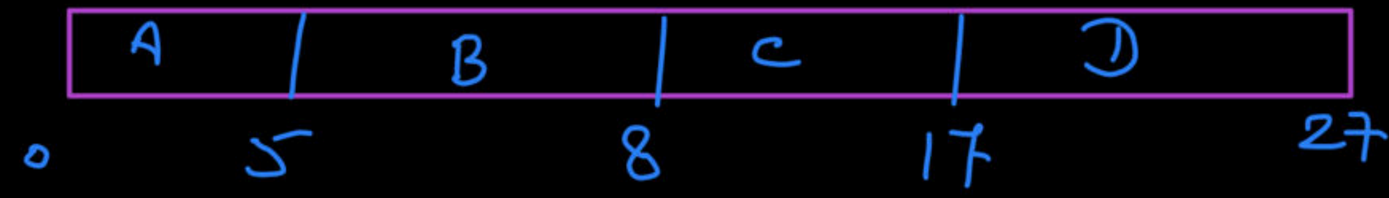
1. FCFS algorithm
2. SJ algorithm



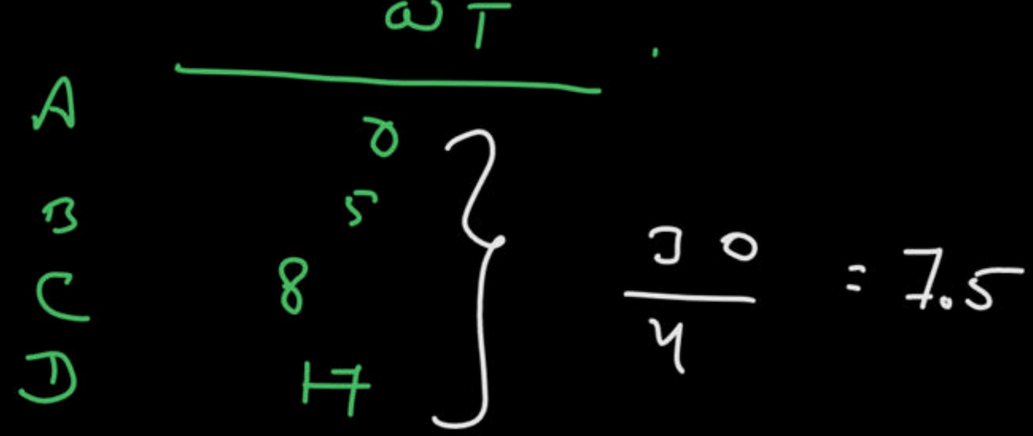
Process	Arrival Time	Burst Time
P1	0	3
P2	3	6
P3	4	4
P4	5	2
P5	6	1
P6	3	3

Question 6

Consider 4 processes A, B, C and D. All arrived at time 0 in the given order. The processes needed 5ns, 3ns, 9ns and 10ns respectively for their CPU burst to complete. What is the average waiting time of processes if executed in FCFS order?



7.5



unacademy

Question 7

Consider the following process scenario.

How much average waiting time can be saved using SRTF execution as compared to SJF execution?

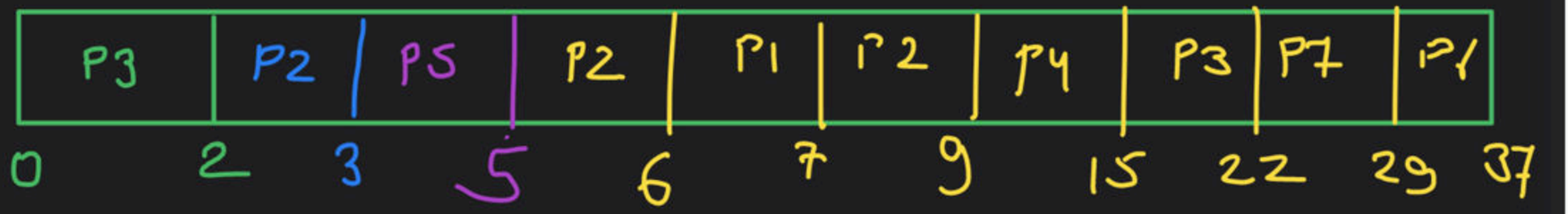
Process	Arrival Time	Burst Time
P1	6	1
P2	2	4
P3	0	9
P4	5	6
P5	3	2
P6	1	8
P7	4	7

Avg wt SJF = 11

Avg wt SRTF = 9.43

1.57

P1	5	1	—
P2	2	4	~~4~~
P3	0	9	~~9~~
P4	5	~~6~~	
P5	3	~~2~~	
P6	1	~~8~~	
P7	4	~~7~~	



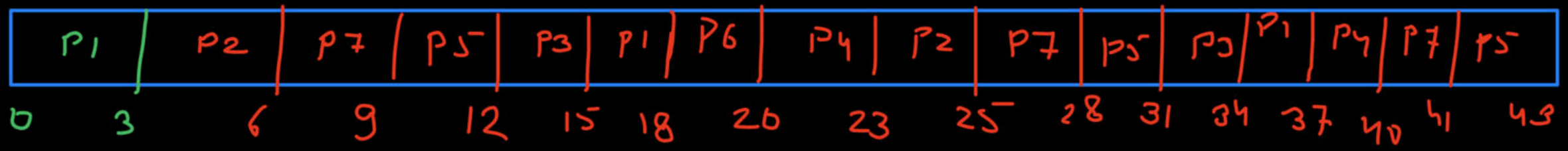
CT	TAT	WT
7	1	0
5	7	3
22	22	13
15	10	4
5	2	0
37	36	28
29	25	18

avg $WT = \frac{66}{7}$

P3 (7)
P6 (8)
P2 (4) 3
P1 (7)

P4 (6)

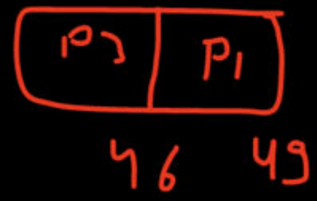
Round Robin (RR)



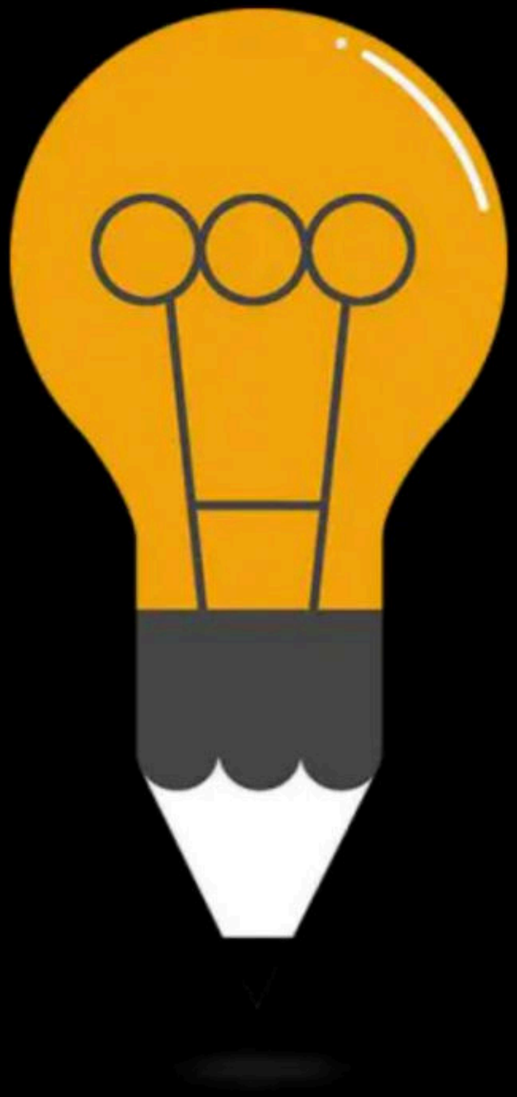
Q=3

Process	Arrival Time	Burst Time
P1	0	12
P2	0	5
P3	3	9
P4	5	6
P5	2	8
P6	4	2
P7	1	7

	RQ
0	P1, P2
3	P2, P7, P5, P3, P1
6	P7, P5, P3, P1, P6, P4, P2



unacademy



DPP

By: Vishvadeep Gothi

Question 1

Consider the following set of processes:

Process	Arrival Time	Burst Time	FCFS	RR
P1	0	~~10ms~~	0	6
P2	0	~~29ms~~ 19	10	32
P3	0	~~3ms~~	33	26
P4	0	~~7ms~~	42	23
P5	0	12~~ms~~ 2	49	40

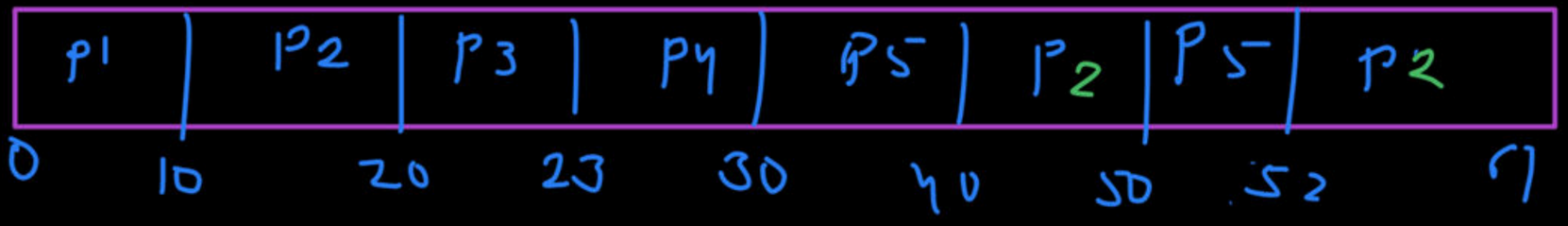
FCFS = 28

SJF =13

SRTF =13

RR =23

Calculate average waiting time for:
FCFS, Non-preemptive SJF, SRTF and Round-robin (quantum = 10ms)



unacademy

Question 2

Four processes to be executed on a single processor system arrives at time 0+ in the order A, B, C and D. Their CPU burst time requirements are 4, 1, 8, 1 time units respectively. The average waiting time of processes under Round-Robin scheduling with time slice of one time unit is?

3.75

unacademy

Question 3

Three processes with their respective process IDs given by P1, P2 and P3, having estimated burst time of 8ms, 4ms and 2ms respectively, enter a ready queue together in the order P1, P2 and P3. What is the average turn around time in Round Robin scheduling algorithm with time slice 2ms?

10

Question 4

Consider a scheduling algorithm to select one of the ready processes for execution as follows:

1. If only one process is available in ready queue, then select is without any condition
2. If more than one processes are available in ready queue, then calculate waiting time of each process and select the process with maximum waiting time

The given algorithm is used on a system where a new process arrives every A nanoseconds after the first process arriving at time 0. Each process takes B nanoseconds to run on CPU. If A>=B then the given algorithm works as:

(A) FCFS
(B) SJF
(C) Non-preemptive Priority based algo with priority of process is inversely proportional to waiting time
(D) Non-preemptive Priority based algo with priority of process is proportional to waiting time

unacademy

Question 5

Consider a scheduling algorithm to select one of the ready processes for execution as follows:

1. If only one process is available in ready queue, then select is without any condition
2. If more than one processes are available in ready queue, then calculate waiting time of each process and select the process with minimum waiting time

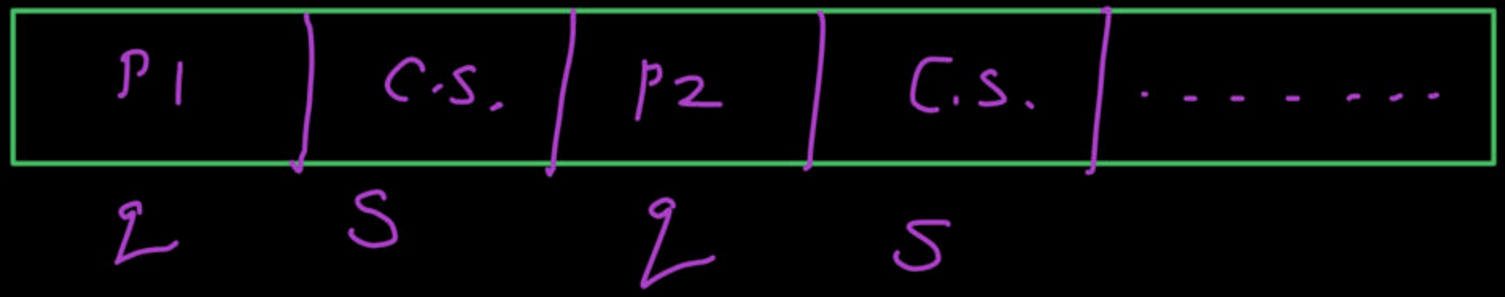
The given algorithm is used on a system where a new process arrives every A nanoseconds after the first process arriving at time 0. Each process takes B nanoseconds to run on CPU. If A>=B then the given algorithm works as:

(A) FCFS
(B) FJF
(C) Non-preemptive Priority based algo with priority of process is inversely proportional to waiting time
(D) Non-preemptive Priority based algo with priority of process is proportional to waiting time

Question 6

On a system using round robin CPU scheduling, context-switch overhead is given by ‘s’. Time quantum is ‘q’. The CPU efficiency, if q=s is?

(A)50%
(B)Zero
(C)100%
(D)Not predictable



$$\frac{q}{q+s} = \frac{q}{2q} = \frac{1}{2} = 0.5 = 50\%$$

Question 7

Consider the following set of processes:

Process	Arrival Time	Burst Time
P1	0	12
P2	1	8
P3	2	7
P4	3	2
P5	7	3

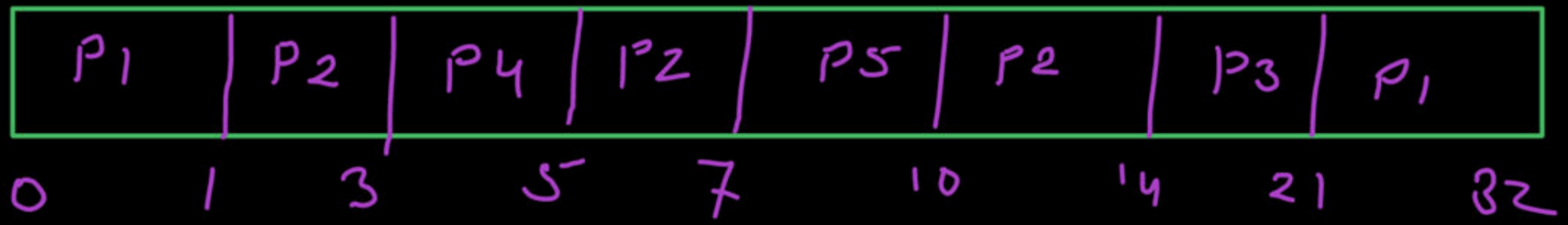
WT

20
5
12
0
0

avg WT : $\frac{37}{5}$

= 7.4

Calculate average waiting time for: SRTF



unacademy

Question 8

Consider the following set of processes:

Process	Arrival Time	Burst Time
P1	0	8
P2	1	4
P3	2	1
P4	3	5
P5	4	4

10.8 Ans.

Calculate average waiting time for: RR, Q=3

unacademy

Question 9

Consider the following set of processes:

Process	Arrival Time	Burst Time
P1	2	2
P2	4	3
P3	1	6
P4	0	5

3.5

Calculate average waiting time for: SRTF

unacademy

Question 10

Consider the following set of processes:

Process	Arrival Time	Burst Time
P1	0	12
P2	1	9
P3	2	10
P4	7	4

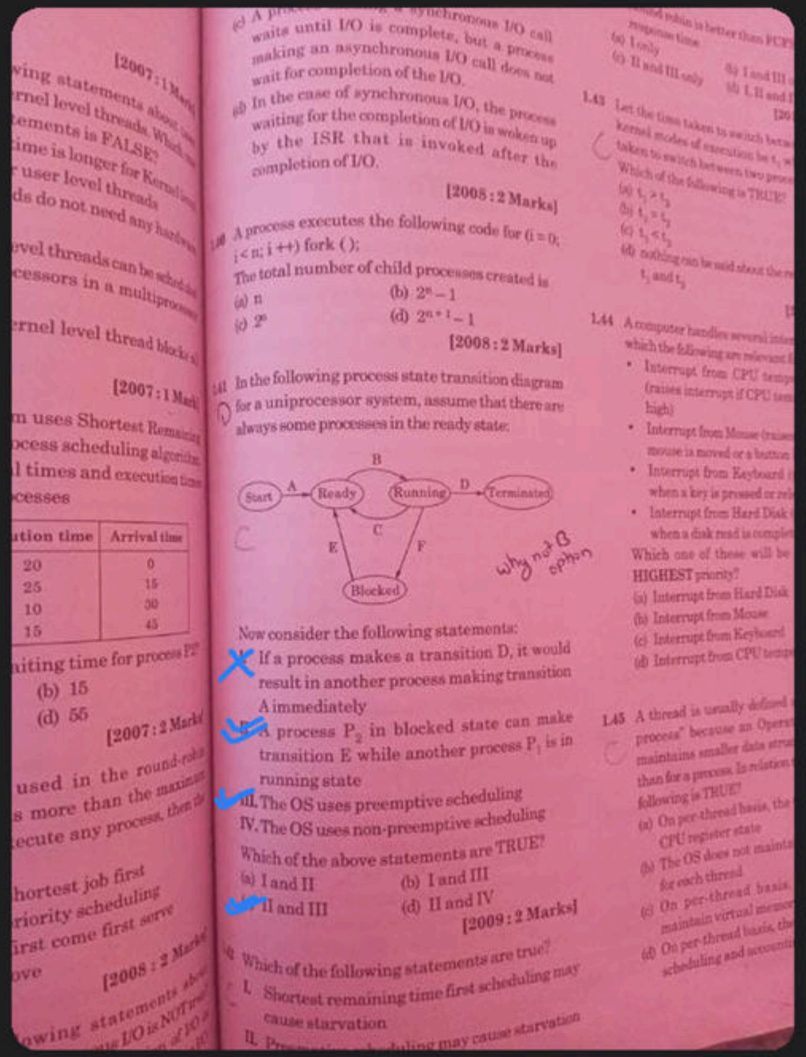
Ans = 19

Calculate average waiting time for: RR, Q=2

unacademy

▲ 1 • Asked by Sagar

Q41



waits until I/O is complete, but a process making an asynchronous I/O call does not wait for completion of the I/O.

(d) In the case of synchronous I/O, the process waiting for the completion of I/O is woken up by the ISR that is invoked after the completion of I/O.

[2008 : 2 Marks]

1.40 A process executes the following code for (i = 0; i < n; i ++) fork ( );
The total number of child processes created is
(a) n (b) $2^n - 1$
(c) 2^n (d) $2^{n+1} - 1$

[2008 : 2 Marks]

1.41 In the following process state transition diagram for a uniprocessor system, assume that there are always some processes in the ready state:

Now consider the following statements:
I. If a process makes a transition D, it would result in another process making transition A immediately
II. A process P_2 in blocked state can make transition E while another process P_1 is in running state
III. The OS uses preemptive scheduling
IV. The OS uses non-preemptive scheduling
Which of the above statements are TRUE?
(a) I and II (b) I and III
(c) II and III (d) II and IV

[2009 : 2 Marks]

1.42 Which of the following statements are true?
I. Shortest remaining time first scheduling may cause starvation
II. Preemptive scheduling may cause starvation

(a) I only (b) I and III
(c) II and III only (d) I, II and III

1.43 Let the time taken to switch between user and kernel modes of execution be t_1 while the time taken to switch between two processes is t_2. Which of the following is TRUE?
(a) $t_1 > t_2$
(b) $t_1 = t_2$
(c) $t_1 < t_2$
(d) nothing can be said about the relation between t_1 and t_2

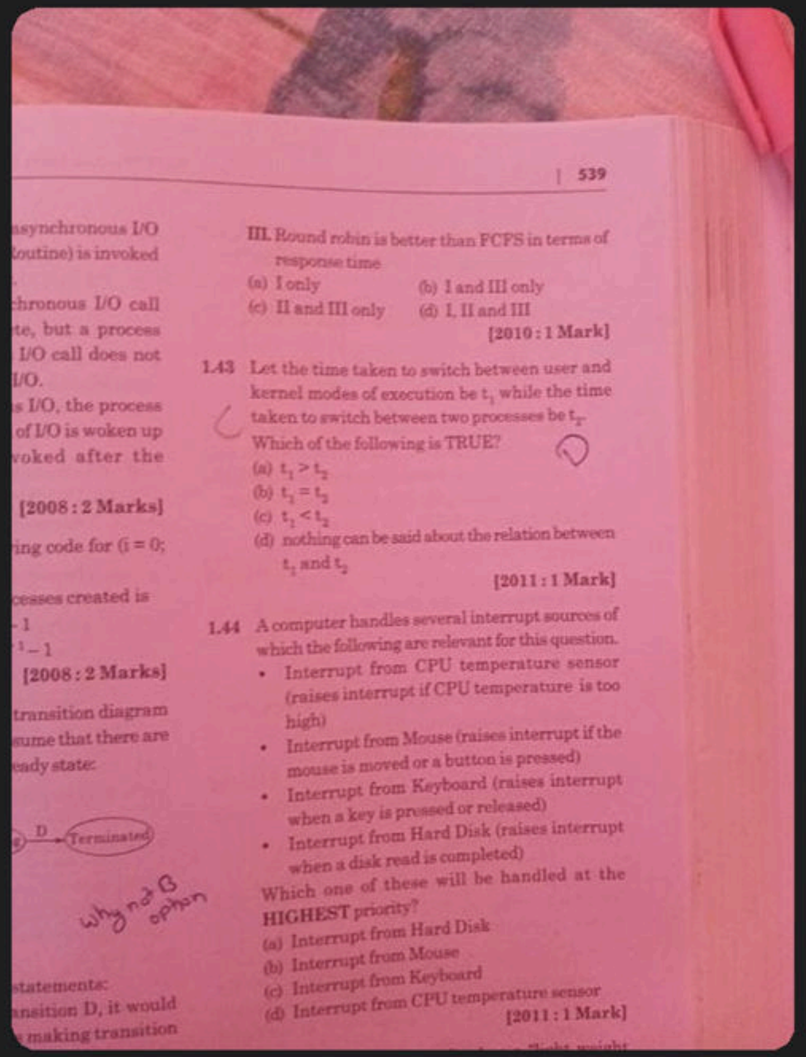
1.44 A computer handles several interrupt sources of which the following are relevant:
- Interrupt from CPU temperature sensor (raises interrupt if CPU temperature is too high)
- Interrupt from Mouse (raised when a mouse is moved or a button is pressed)
- Interrupt from Keyboard (raised when a key is pressed or released)
- Interrupt from Hard Disk (raised when a disk read is complete)

Which one of these will be assigned the HIGHEST priority?
(a) Interrupt from Hard Disk
(b) Interrupt from Mouse
(c) Interrupt from Keyboard
(d) Interrupt from CPU temperature sensor

1.45 A thread is usually defined as a "light weight process" because an Operating System (OS) maintains smaller data structures for a thread than for a process. In relation to this, which of the following is TRUE?
(a) On per-thread basis, the OS maintains only CPU register state
(b) The OS does not maintain a separate stack for each thread
(c) On per-thread basis, the OS does not maintain virtual memory state
(d) On per-thread basis, the OS maintains only scheduling and accounting information

▲ 1 • Asked by Sagar

Q43



asynchronous I/O
routine) is invoked

chronous I/O call
te, but a process
I/O call does not
I/O.
s I/O, the process
of I/O is woken up
voked after the

[2008 : 2 Marks]

ing code for (i = 0;

cesses created is
- 1
^{1} – 1

[2008 : 2 Marks]

transition diagram
sume that there are
eady state:

D → Terminated

why not B option

statements:
ansition D, it would
making transition

III. Round robin is better than FCFS in terms of response time

(a) I only (b) I and III only
(c) II and III only (d) I, II and III

[2010 : 1 Mark]

1.43 Let the time taken to switch between user and kernel modes of execution be t_1 while the time taken to switch between two processes be t_2. Which of the following is TRUE?

(a) $t_1 > t_2$
(b) $t_1 = t_2$
(c) $t_1 < t_2$
(d) nothing can be said about the relation between t_1 and t_2

[2011 : 1 Mark]

1.44 A computer handles several interrupt sources of which the following are relevant for this question.

- Interrupt from CPU temperature sensor (raises interrupt if CPU temperature is too high)
- Interrupt from Mouse (raises interrupt if the mouse is moved or a button is pressed)
- Interrupt from Keyboard (raises interrupt when a key is pressed or released)
- Interrupt from Hard Disk (raises interrupt when a disk read is completed)

Which one of these will be handled at the **HIGHEST** priority?

(a) Interrupt from Hard Disk
(b) Interrupt from Mouse
(c) Interrupt from Keyboard
(d) Interrupt from CPU temperature sensor

[2011 : 1 Mark]

▲ 2 • Asked by Srishti

Please help me with this doubt

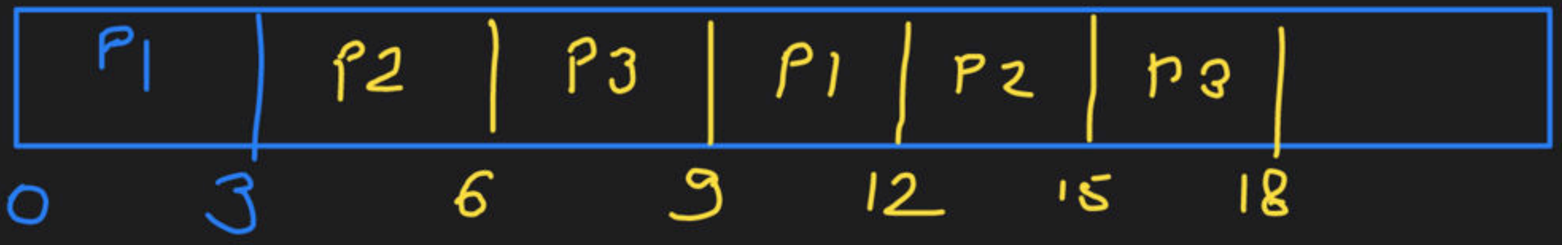
Question GATE-2013

A scheduling algorithm assigns priority proportional to the waiting time of a process. Every process starts with priority zero (the lowest priority). The scheduler re-evaluates the process priorities every T time units and decides the next process to schedule. Which one of the following is TRUE if the processes have no I/O operations and all arrive at time zero?

a) This algorithm is equivalent to the first-come-first-serve algorithm
b) This algorithm is equivalent to the round-robin algorithm. Q = T
c) This algorithm is equivalent to the shortest-job-first algorithm
d) This algorithm is equivalent to the shortest-remaining-time-first algorithm

T = 3

	AT	Priority
P1	0	0 3 6 9 12
P2	0	0 3 6 9 12
P3	0	0 3 6 9 12



→ If all processes arrive together

- SJF, SRTF same to same
- Preemptive & non-preemptive priority algo same to same

Because in SRTF & preemptive priority algo preemption occurs only when later arriving process has better criteria (Priority, BT)

SRTF & SJF are also Priority based algo.

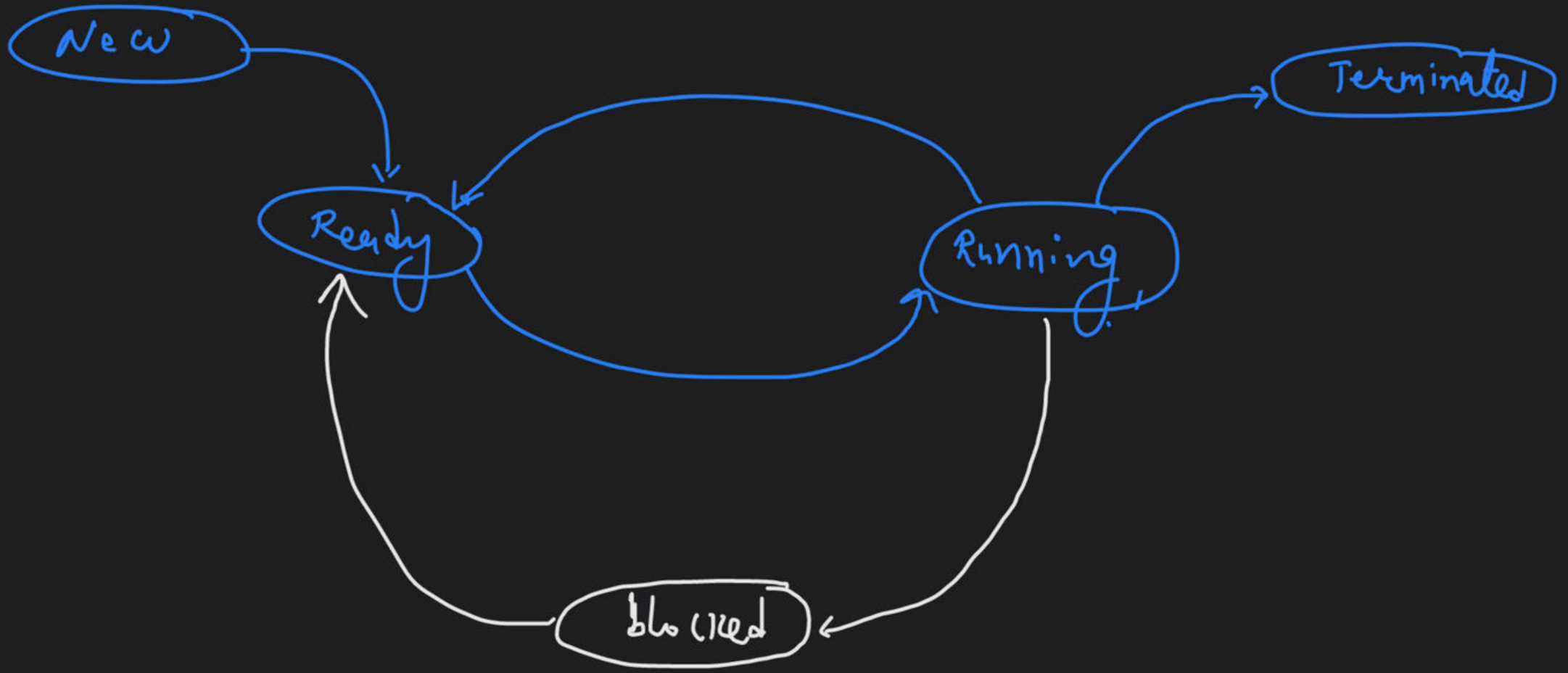
where priority $\propto \frac{1}{BT}$

Algo	NO preemptn case
SRTF	① All processes arrive together ② BT of later arriving process $\geq$ Remaining time of running process ③ Process arrive with nondecreasing BT
Preemptive Priority algo	① All process arrive together ② Priority of later arriving process is always lesser than current running process. ③ Process arrive with decreasing order of priority.

algo	no preempt case
RR	$Q >= max(BT)$
LRTF	when all process have $BT = 1$

unacademy

Process states



Execution if IO is also included

Consider a process scenario in which each process executes first in CPU then goes for IO operation, then once again process needs a CPU bursts and then terminates. Following is given a process scenario in which for CPU execution system uses non preemptive SJF algorithm. Consider system has enough number of resources to carry out IO operations for all processes in parallel. What is the average waiting time for the execution for the processes?

Process	Arrival Time	CPU Burst Time	IO Burst Time	CPU Burst Time	CT	TAT	WT
P1	0	3	9	4	18	18	2
P2	0	6	4	7	36	36	19
P3	0	4	1	2	14	14	7
P4	0	5	3	1	19	19	10

$WT = TAT - [CPU\ BT + I/O\ BT + CPU\ BT]$

(In Ready State)

P3 I/O
7+1=8

P1 I/O
12+3=15

P1 in I/O
3+9 = 12

CPU utilization = $\frac{32}{36}$

CPU idle = $\frac{4}{36}$

R.Q.	At 0	3	7	12	18
	P1, P2, P3, P4	P2, P3, P4	P2, P4	P2 (1st)	P1, P3 (2nd Burst)
				P1, P3 (2nd)	P2 first, P4 (2nd Burst)

Question GATE-2006

The arrival time, priority, and duration of the CPU and I/O bursts for each of three processes P1,P2 and P3 are given in the table below. Each process has a CPU burst followed by an I/O burst followed by another CPU burst. Assume that each process has its own I/O resource. The multi-programmed operating system uses preemptive priority scheduling. What are the finish times of the processes P1, P2 and P3 ?

Process	Arrival Time	Priority	CPU, IO, CPU Bursts
P1	0	2	1, 5, 3
P2	2	3 (Lowest)	3, 3, 1
P3	3	1 (Highest)	2, 3, 1

unacademy

Question

If the waiting for a process is p for IO and there are n processes in the memory, then the CPU utilization is?

unacademy

Happy Learning.!

→ I/O CPU Questns

→ CPU utilizatn

→ MLQ & MLFQ scheduling