GATEFREAKS

GATE/NET/PSU

COMPUTER SCIENCE

# Operating System

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# Process Scheduling

1. Match the following

| | |
|---|---|
| (a) Disk scheduling | (1) Round robin |
| (b) Batch processing | (2) Scan |
| (c) Time sharing | (3) LIFO |
| (d) Interrupt processing | (4) FIFO |

(A) a-3, b-4, c-2, d-1
(B) a-4, b-3, c-2, d-1
(C) a-2, b-4, c-1, d-3
(D) a-3, b-4, c-1, d-2
UGCNET2004-II(dec.)
Ans:c
(A) Disk Scheduling (2) SCAN
(B) Batch Processing (4) FIFO
(C) Time-sharing (1) Round robin
(D) Interrupt processing (3) LIFO .

2. In processor management, round robin method essentially uses the preemptive version of ..................
(A) FILO
(B) FIFO
(C) SJF
(D) Longest time first
UGCNET2006-II(june)
Ans:b
Round robin is pre-emptive version of FCFS, a queue is maintained which stores the input as it comes in FCFS order.

3. ...................is one of pre-emptive scheduling algorithm.
(A) Shortest-Job-first
(B) Round-robin
(C) Priority based
(D) Shortest-Job-next
UGCNET2006-II(dec.)
Ans:b
Round robin is pre-emptive version of FCFS, a queue is maintained which stores the input as it comes in FCFS order.

4. An example of a non-preemptive CPU scheduling algorithm is:
(A) Shortest job first scheduling.
(B) Round robin scheduling.
(C) Priority scheduling.
(D) Fair share scheduling
UGCNET2008-II(jun.)
Ans:a
Preemptive version of shortest job first is known as shortest remaining time first. Non-preemptive version is known as shortest job first.

5. There are $n$ processes in memory. A process spends a fraction $p$ of its time waiting for I/O to complete. The CPU utilization is given by:
(A) $p^n$
(B) $1 - p^n$
(C) $(1 - p)^n$
(D) $1 - np$
UGCNET2008-II(jun.)
Ans:b
Lets assumes that all five processes will never be waiting for I/O at the same time.With $n$ processes in memory at once, the probability that all $n$ processes are waiting for I/O is $p^n$. CPU utilization $= 1 - p^n$.

6. N processes are waiting for I/O. A process spends a fraction p of its time in I/O wait state. The CPU utilization is given by:
(A) $1 - p^{-N}$
(B) $1 - p^N$
(C) $p^N$
(D) $p^{-N}$
UGCNET2008-II(dec.)
Ans:b
Lets assumes that all five processes will never be waiting for I/O at the same time.With $N$ processes in memory at once, the probability that all $N$ processes are waiting for I/O is $p^N$. CPU utilization $= 1 - p^N$.

7. An example of a non preemptive scheduling algorithm is:
(A) Round Robin
(B) Priority Scheduling
(C) Shortest job first
(D) 2 level scheduling
UGCNET2008-II(dec.)
Ans:c
Preemptive version of shortest job first is known as shortest remaining time first. Non-preemptive version is known as shortest job first.

8. With a four programs in memory and with 80% average I/O wait, the CPU utilization is ?
(A) 60%
(B) 70%
(C) 90%
(D) 100%
UGCNET2009-II(jun.)
Ans:a
Let $n$ is number of process and $P$ is the time waiting for I/O.
CPU utilization $= 1 - p^n$
Here $n = 4$ and $p = 0.80$
CPU Utilization $= 1 - 0.8^4 = 0.6$.

9. In the process management Round-robin method is essentially the pre-emptive version of .........
(A) FILO
(B) FIFO
(C) SSF
(D) Longest time first
UGCNET2009-II(dec.)
Ans:b
Round robin is pre-emptive version of FCFS, a queue is maintained which stores the input as it comes in FCFS order.

10. is one of pre-emptive scheduling algorithm.
(A) RR

(B) SSN
(C) SSF
(D) Priority based

UGCNET2010-II(Jun)

Ans:a
Round robin is pre-emptive version of FCFS, a queue is maintained which stores the input as it comes in FCFS order .

11. Pre-emptive scheduling is the strategy of temporarily suspending a gunning process
(A) before the CPU time slice expires
(B) to allow starving processes to run
(C) when it requests I/O
(D) to avoid collision

UGCNET2012-II(JUN)

Ans:a
In non-preemptive scheduling, a running task is executed till completion. It cannot be interrupted.
In Preemptive scheduling ,the running task is interrupted for some time,OS takes the cpu from the process before its completion completion and resumed later .

12. In round robin CPU scheduling as time quantum is increased the average turn around time
(A) increases
(B) decreases
(C) remains constant
(D) varies irregularly

UGCNET2012-II(JUN)

Ans:d
If the time quantum is increased, the average turn around time varies irregularly, it's totally depend on the execution time of given processes.

13. The problem of indefinite blockage of low-priority jobs in general priority scheduling algorithm can be solved using :
(A) Parity bit
(B) Aging
(C) Compaction
(D) Timer

UGCNET2012-II(Dec)

Ans:b
In priority-based scheduling algorithms, a major problem is indefinite block, or starvation. A process that is ready to run but waiting for the CPU can be considered blocked. A priority scheduling algorithm can leave some low-priority processes waiting indefinitely.
Aging is used to ensure that jobs with lower priority will eventually complete their execution,where priority of a process should increase as it waits in the ready queue.

14. Consider $n$ processes sharing the CPU in a round-robin fashion. Assuming that each process switch takes $s$ seconds, what must be the quantum size $q$ such that the overhead resulting from process switching is minimized but at the same time each process is guaranteed to get its turn at the CPU at least every $t$ seconds?
(A) $q \leq \frac{t-ns}{n-1}$
(B) $q \geq \frac{t-ns}{n-1}$
(C) $q \leq \frac{t-ns}{n+1}$
(D) $q \geq \frac{t-ns}{n+1}$

UGCNET2012-III(Dec)

Ans:a
Each process has time quanta of q unit and there are n process: $p_1$, $p_2$,$p_3$,, ....., $p_n$, after first execution $p_1$ executes again after at most $(n-1)q$ time.Likewise each process gets its turn after $(n-1)q$ time. Also there is overhead of s unit for context switching.
So, we have $ns + (n-1)q \leq t$
$q \leq \frac{t-ns}{n-1}$.

15. Consider the following processes with time slice of 4 milliseconds (I/O requests are ignored) :

| Process | A | B | C | D |
|---|---|---|---|---|
| Arrival time | 0 | 1 | 2 | 3 |
| CPU cycle | 8 | 4 | 9 | 5 |

The average turn around time of these processes will be
(A) 19.25 milliseconds
(B) 18.25 milliseconds
(C) 19.5 milliseconds
(D) 18.5 milliseconds

UGCNET2013-III(JUN)

Ans:b

| A | B | C | D | A | C | D | C | |
|---|---|---|---|---|---|---|---|---|
| 0 | 4 | 8 | 12 | 16 | 20 | 24 | 25 | 26 |

Average turn around time = $\sum_{P_1}$(Finished time-start time)/ no of processes.
$= \frac{(20-0)+(8-1)+(26-2)+(25-3)}{4} = 18.25$ ms.

16. Consider a preemptive priority based scheduling algorithm based on dynamically changing priority. Larger priority number implies higher priority. When the process is waiting for CPU in the ready queue (but not yet started execution), its priority changes at a rate a = 2. When it starts running, its priority changes at a rate b = 1. All the processes are assigned priority value 0 when they enter ready queue. Assume that the following processes want to execute :

| Process ID | Arrival Time | Service Time |
|---|---|---|
| P1 | 0 | 4 |
| P2 | 1 | 1 |
| P3 | 2 | 2 |
| P4 | 3 | 1 |

The time quantum q = 1. When two processes want to join ready queue simultaneously, the process which has not executed recently is given priority.

The finish time of processes P1, P2, P3 and P4 will respectively be
(A) 4, 5, 7 and 8
(B) 8, 2, 7 and 5
(C) 2, 5, 7 and 8
(D) 8, 2, 5 and 7
UGCNET2013-II(Dec.)

Ans:
.

17. Linux operating system uses
(A) Affinity Scheduling
(B) Fair Preemptive Scheduling
(C) Hand Shaking
(D) Highest Penalty Ratio Next
UGCNET2013-II(Dec.)

Ans:b
Linux uses completely fair preemptive scheduling while windows uses multi-level feedback queue.

18. Match the following:

| | List-I | | List-II |
|---|---|---|---|
| a. | Multilevel feedback queue | i. | Time-slicing |
| b. | FCFS | ii. | Criteria to move processes between queues |
| c. | Shortest process next | iii. | Batch processing |
| d. | Round robin scheduling | iv. | Exponential smoothening |

(A) a-i; b-iii; c-ii; d-iv
(B) a-iv; b-iii; c-ii; d-i
(C) a-iii; b-i; c-iv; d-ii
(D) a-ii; b-iii; c-i; d-i
UGCNET2014-II(Jun)

Ans:d
a. Multilevel feedback queue : ii. Criteria to move processes between queues
b. FCFS : iii. Batch processing
c. Shortest process next : iv. Exponential smoothening
d. Round robin scheduling : i. Time-slicing.

19. Consider the following justifications for commonly using the two-level CPU scheduling :
I. It is used when memory is too small to hold all the ready processes.
II. Because its performance is same as that of the FIFO.
III. Because it facilitates putting some set of processes into memory and a choice is made from that.
IV. Because it does not allow to adjust the set of in-core processes.
Which of the following is true ?
(A) I, III and IV
(B) I and II
(C) III and IV
(D) I and III
UGCNET2014-II(DEC)

Ans:d
Two-level scheduling uses two different schedulers, one lower-level scheduler which can only select among those processes in memory to run. That scheduler could be a Round-robin scheduler. The other scheduler is the higher-level scheduler whose only concern is to swap in and swap out processes from memory. It does its scheduling much less often than the lower-level scheduler since swapping takes so much time.
Thus, the higher-level scheduler selects among those processes in memory that have run for a long time and swaps them out. They are replaced with processes on disk that have not run for a long time.It is generally used when memory is too small to hold all the ready processes.Statement I and III are correct.

20. Which of the following statements is not true for Multi Level Feedback Queue processor scheduling algorithm ?
(A) Queues have different priorities
(B) Each queue may have different scheduling algorithm
(C) Processes are permanently assigned to a queue
(D) This algorithm can be configured to match a specific system under design
UGCNET2015-III(jun)

Ans:c
In multilevel queue scheduling algorithm processes are permanently assigned to a queue, whereas multilevel feedback queue scheduling allows a process to move between queues. This movement is facilitated by the characteristic of the CPU burst of the process. If a process uses too much CPU time, it will be moved to a lower-priority queue.Hence statement in option c is false.

21. In an operating system, indivisibility of operation means :
(A) Operation is interruptable
(B) Race - condition may occur
(C) Processor can not be pre-empted
(D) All of the above
UGCNET2015-III(dec.)

Ans:c
An indivisible operation is an atomic operation that is performed entirely or not performed at all.

22. Five jobs $A, B, C, D$ and $E$ are waiting in Ready Queue. Their expected runtimes are $9, 6, 3, 5$ and $x$ respectively. All jobs entered in Ready queue at time zero. They must run in ......... order to minimize average response time if $3 < x < 5$.
(A) $B, A, D, E, C$

(B) $C, E, D, B, A$
(C) $E, D, C, B, A$
(D) $C, B, A, E, D$

UGCNET2016-II(aug.)

Ans:b
To minimize the average response time , processes should be executed in the increasing order of running time . Required order is C,E,D,B,A. Option b is correct.

23. Consider three CPU intensive processes $P1, P2, P3$ which require $20, 10$ and $30$ units of time, arrive at times $1, 3$ and $7$ respectively. Suppose operating system is implementing Shortest Remaining Time first (preemptive scheduling) algorithm, then....... context switches are required (suppose context switch at the beginning of Ready queue and at the end of Ready queue are not counted).
(A) 3 (B) 2 (C) 4 (D) 5

UGCNET2016-II(aug.)

Ans:a
There will be 3 context switches , P1− >P2− >P1− >P3, as shown below

| | | | | |
|---|---|---|---|---|
| | P1 | P2 | P1 | P3 |

0 1 3 13 31 61 .

24. A scheduling Algorithm assigns priority proportional to the waiting time of a process. Every process starts with priority zero (lowest priority). The scheduler re-evaluates the process priority for every 'T' time units and decides next process to be scheduled. If the process have no I/O operations and all arrive at time zero, then the scheduler implements .............. criteria.
(A) Priority scheduling
(B) Round Robin Scheduling
(C) Shortest Job First
(D) FCFS

UGCNET2016-II(jun.)

Ans:b
Given algorithms works like round robin with time quanta of T units .Once a process is scheduled it gets executed for T time units and waiting time becomes least and it again gets chance when every other process has completed T time units.

25. Which of the following scheduling algorithms may cause starvation ?
a. First-come-first-served
b. Round Robin
c. Priority
d. Shortest process next
e. Shortest remaining time first
(A) a, c and e
(B) c, d and e
(C) b, d and e
(D) b, c and d

UGCNET2016-II(dec.)

Ans:b
First-come-first-served- No starvation
Round Robin- No starvation
Priority- starvation
Shortest process next -starvation
Shortest remaining time first -starvation possible.

26. Some of the criteria for calculation of priority of a process are :
a. Processor utilization by an individual process.
b. Weight assigned to a user or group of users.
c. Processor utilization by a user or group of processes
In fair share scheduler, priority is calculated based on :
(A) only (a) and (b)
(B) only (a) and (c)
(C) (a), (b) and (c)
(D) only (b) and (c)

UGCNET2016-III(dec.)

Ans:d
Fair-share scheduling is a scheduling algorithm for computer operating systems in which the CPU usage is equally distributed among system users or groups, as opposed to equal distribution among processes.Hence statement a is incorrect..

27. Which module gives control of the CPU to the process selected by the short - term schedular ?
(A) Dispatcher
(B) Interrupt
(C) Schedular
(D) Threading

UGCNET2017-II(Nov.)

Ans:a
The dispatcher is the module that gives control of the CPU to the process selected by the short-time scheduler(selects from among the processes that are ready to execute).
The function involves :
Switching context
Switching to user mode
Jumping to the proper location in the user program to restart that program.

28. Consider the following four processes with the arrival time and length of CPU burst given in milliseconds :

| Process | Arrival Time | Burst Time |
|---|---|---|
| P1 | 0 | 8 |
| P2 | 1 | 4 |
| P3 | 2 | 9 |
| P4 | 3 | 5 |

The average waiting time for preemptive SJF scheduling algorithm is ..........
(A) 6.5 ms

(B) 7.5 ms
(C) 6.75 ms
(D) 7.75 ms

UGCNET2017-III(Nov.)

Ans:a
Gantt chart for the given scenario:

| P1 | P2 | P4 | P1 | P3 | |
|---|---|---|---|---|---|
| 0 | 1 | 5 | 10 | 17 | 26 |

Waiting time for :
P1=0+9=9ms
P2=0
P3=17-2=15ms
P4=5-3=2ms
Average waiting time $= \frac{9+0+15+2}{4} = 6.5$ms.

29. Consider the following three processes with the arrival time and CPU burst time given in milliseconds:

| Process | Arrival Time | Burst Time |
|---|---|---|
| P1 | 0 | 7 |
| P2 | 1 | 4 |
| P3 | 2 | 8 |

The Gantt Chart for preemptive SJF scheduling algorithm is

(A)

| $P_1$ | $P_2$ | $P_3$ | |
|---|---|---|---|
| 0 | 7 | 13 | 21 |

(B)

| $P_1$ | $P_2$ | $P_1$ | $P_3$ | |
|---|---|---|---|---|
| 0 | 1 | 5 | 11 | 19 |

(C)

| $P_1$ | $P_2$ | $P_3$ | |
|---|---|---|---|
| 0 | 7 | 11 | 19 |

(D)

| $P_2$ | $P_3$ | $P_1$ | |
|---|---|---|---|
| 0 | 4 | 12 | 19 |

UGCNET2018(July)

Ans:b
.

30. In which of the following scheduling criteria, context switching will never take place ?
(A) ROUND ROBIN
(B) Preemptive SJF
(C) Non-preemptive SJF
(D) Preemptive priority

UGCNET2018(July)

Ans:c
.

31. The term aging refers to
(A) booting up the priority of the process in multi-level of queue without feedback.
(B) gradually increasing the priority of jobs that wait in the system for a long time to remedy infinite blocking
(C) keeping track of the following a page has been in memory for the purpose of LRU replacement
(D) letting job reside in memory for a certain amount of time so that the number of pages required can be estimated accurately.

ISRO 2007

Ans:b
In priority-based scheduling algorithms, a major problem is indefinite block, or starvation. A process that is ready to run but waiting for the CPU can be considered blocked. A priority scheduling algorithm can leave some low-priority processes waiting indefinitely.
Aging is used to ensure that jobs with lower priority will eventually complete their execution,where priority of a process should increase as it waits in the ready queue.

32. Consider a set of n tasks with known runtimes $r_1, r_2, \ldots r_n$ to be run on a uniprocessor machine. Which of the following processor scheduling algorithms will result in the maximum throughput?
(A) Round Robin
(B) Shortest job first
(C) Highest response ratio next
(D) first come first served

ISRO 2007

Ans:b
Shortest Job First has maximum throughput because in this scheduling technique shortest jobs are executed first hence it minimize the average waiting time and maximize throughput .

33. Round Robin schedule is essentially the pre-emptive version of
(A) FIFO
(B) Shortest job first
(C) Shortest remaining time
(D) Longest remaining time

ISRO 2007

Ans:a
Round robin is pre-emptive version of FCFS, a queue is maintained which stores the input as it comes in FCFS order .

34. A task in a blocked state
(A) is executable
(B) is running
(C) must still be placed in the run queues
(D) is waiting for some temporarily unavailable resources

ISRO 2007

Ans:d
A process that is blocked is one that is waiting for some event, such as a resource becoming available or the completion of an I/O operation.

35. On a system using non-preemptive scheduling, processes with expected run times of 5, 18, 9 and 12 are in the ready queue. In what order should they be run to minimize wait time?
(A) 5, 12, 9, 18
(B) 5, 9, 12, 18
(C) 12, 18, 9, 5
(D) 9, 12, 18, 5

ISRO 2007

Ans:b
Shortest job first leads to minimum average waiting time, hence execution sequence must be 5, 9, 12, 18 .

36. Feedback queues
(A) are very simple to implement
(B) dispatch tasks according to execution characteristics
(C) are used to favour real time tasks
(D) require manual intervention to implement properly

ISRO 2007

Ans:b
In multilevel queue scheduling algorithm processes are permanently assigned to a queue, whereas multilevel feedback queue scheduling allows a process to move between queues. This movement is facilitated by the characteristic of the CPU burst of the process. If a process uses too much CPU time, it will be moved to a lower-priority queue



37. Four jobs to be executed on a single processor system arrive at time 0 in the order $A, B, C, D$. Their burst CPU time requirements are $4, 1, 8, 1$ time units respectively. The completion time of $A$ under round robin scheduling with time slice of one time unit is
(A) 10
(B) 4
(C) 8
(D) 9

ISRO 2008

Ans:d
Gantt chart:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| A | B | C | D | A | C | A | C | A |

0 1 2 3 4 5 6 7 8 9

Completion time of A is 9.

38. Feedback queues
(A) are very simple to implement
(B) dispatch tasks according to execution characteristics
(C) are used to favour real time tasks
(D) require manual intervention to implement properly

ISRO 2008

Ans:b
In multilevel queue scheduling algorithm processes are permanently assigned to a queue, whereas multilevel feedback queue scheduling allows a process to move between queues. This movement is facilitated by the characteristic of the CPU burst of the process. If a process uses too much CPU time, it will be moved to a lower-priority queue .

39. With Round-Robin CPU scheduling in a time shared system
(A) using very large time slices (quantas) degenerates into First-Come First served (FCFS) algorithm.
(B) using extremely small time slices improves performance
(C) using very small time slices degenerates into Last-In First-Out (LIFO) algorithm.
(D) using medium sized times slices leads to shortest Request time First (SRTF) algorithm

ISRO 2008

Ans:a
Round robin is pre-emptive version of FCFS, a queue is maintained which stores the input as it comes in FCFS order. If time quanta is very large then all the processes will complete its within the time quanta in FCFS order.

40. What is the name of the operating system that reads and reacts in terms of operating system?
(A) Batch system
(B) Quick response time
(C) real time system
(D) Time sharing system

ISRO 2008

Ans:c
.

41. Checkpointing a job
(A) allows it to be completed successfully
(B) allows it to continue executing later
(C) prepares it for finishing
(D) occurs only when there is an error in it

ISRO 2008

Ans:b
Checkpointing is a method of periodically saving the state of a job so that, if for some reason, the job does not complete, it can be restarted from the saved state. Checkpoints can be taken either under

the control of the user application or external to the application.

42. The performance of Round Robin algorithm depends heavily on
(A) size of the process
(B) the I/O bursts of the process
(C) the CPU bursts of the process
(D) the size of the time quantum

ISRO 2008

Ans:d
Round robin is pre-emptive version of FCFS, a queue is maintained which stores the input as it comes in FCFS order. If time quanta is very large then all the processes will complete its within the time quanta in FCFS order. If time quantum is too small, overhead increases due to amount of context switching needed.So the performance of Round Robin algorithm depends heavily on the size of the time quantum.

43. Which is the correct definition of a valid process transition in an operating system?
(A) Wake up: ready → running
(B) Dispatch: ready → running
(C) Block: ready → running
(D) Timer runout: → ready → running

ISRO 2009

Ans:b
a) WakeUp : waiting− >ready
b) Dispatch : Ready− > Running
c) Block : Waiting/Blocked − >Ready
d) Timerout : Running− >Blocked.

44. The correct matching of the following pairs is

| | |
|---|---|
| (A) Disk check | (1) Round robin |
| (B) Batch processing | (2) Scan |
| (C) Time sharing | (3) LIFO |
| (D) Stack operation | (4) FIFO |

| | A | B | C | D |
|---|---|---|---|---|
| a | 3 | 4 | 2 | 1 |
| b | 4 | 3 | 2 | 1 |
| c | 3 | 4 | 1 | 2 |
| d | 2 | 4 | 1 | 3 |

ISRO 2009

Ans:d
Disk check : Scan Algorithms
Batch processing : jobs should process in First in First out manner
Time sharing : Round robin based on time slice time sharing will happen
Stack operation : Last In Last Out.

45. Consider three CPU-intensive processes, which require 10, 20 and 30 time units and arrive at times 0, 2 and 6, respectively. How many context switches are needed if the operating system implements a shortest remaining time first scheduling algorithm? Do not count the context switches at time zero and at the end.
(A) 1
(B) 2
(C) 3
(D) 4

ISRO 2009

Ans:b
Gantt chart for the given scenario:

| P1 | P2 | P3 |
|---|---|---|

0 10 30 60 .

46. The performance of Round Robin algorithm depends heavily on
(A) size of the process
(B) the I/O bursts of the process
(C) the CPU bursts of the process
(D) the size of the time quantum

ISRO 2009

Ans:d
Round robin is pre-emptive version of FCFS, a queue is maintained which stores the input as it comes in FCFS order. If time quanta is very large then all the processes will complete its within the time quanta in FCFS order. If time quantum is too small, overhead increases due to amount of context switching needed.So the performance of Round Robin algorithm depends heavily on the size of the time quantum.

47. Consider a set of 5 processes whose arrival time, CPU time needed and the priority are given below:

| Process Priority | Arrival Time (in ms) | CPU Time Needed | Priority |
|---|---|---|---|
| P1 | 0 | 10 | 5 |
| P2 | 0 | 5 | 2 |
| P3 | 2 | 3 | 1 |
| P4 | 5 | 20 | 4 |
| P5 | 10 | 2 | 3 |

(smaller the number, higher the priority) If the CPU scheduling policy is priority scheduling without pre-emption, the average waiting time will be
(A) 12.8 ms
(B) 11.8 ms
(C) 10.8 ms
(D) 09,8 ms

ISRO 2009

Ans:c
Gantt chart:

| P2 | P3 | P4 | P5 | P1 |
|---|---|---|---|---|

0 5 8 28 30 40

Waiting time for:

P1=30
P2=0
P3=5-2=3
P4=8-5=3
P5=28-10=18
Average waiting time=$\frac{30+0+3+3+18}{5}$=10.8ms.

48. The following table shows the processes in the ready queue and time required for each process for completing its job.

| Process | Time |
|---|---|
| $P_1$ | 10 |
| $P_2$ | 5 |
| $P_3$ | 20 |
| $P_4$ | 8 |
| $P_5$ | 15 |

If round-robin scheduling with 5 ms is used what is the average waiting time of the processes in the queue?
(A) 27 ms
(B) 26.2 ms
(C) 27.5 ms
(D) 27.2 ms

ISRO 2011

Ans:b
.

49. There are three processes in the ready queue. When the currently running process requests for I/O how many process switches take place?
(A) 1
(B) 2
(C) 3
(D) 4

ISRO 2011

Ans:b
In the first switch, the process to be switched is taken out and the scheduler starts executing. Then the next process is brought to execution. So there are two process switches.

50. In a system using single processor, a new process arrives at the rate of six processes per minute and each such process requires seven seconds of service time. What is the CPU utilization?
(A) 70%
(B) 30%
(C) 60%
(D) 64%

ISRO 2011

Ans:a
Given that there are on an average 6 processes per minute.
So the arrival rate = 6 process/min.
i.e. every 10 seconds a new process arrives on an average.
Or we can say that every process stays for 10 seconds with the CPU Service time = 7 sec.
Hence the fraction of time CPU is busy = service time / staying time
=7/ 10
=0.7
So the CPU is busy for 70% of the time.

51. Consider the following set of processes, with arrival times and the required CPU-burst times given in milliseconds.

| Process | Arrival Time | Burst Time |
|---|---|---|
| P1 | 0 | 4 |
| P2 | 2 | 2 |
| P3 | 3 | 1 |

What is the sequence in which the processes are completed? Assume round robin scheduling with a time quantum of 2 milliseconds.
(A) $P1, P2, P3$
(B) $P2, P1, P3$
(C) $P3, P2, P1$
(D) $P2, P3, P1$

ISRO 2013

Ans:b
Gantt chart for the given scenario:

| P1 | P2 | P1 | P3 |
|---|---|---|---|

0 2 4 6 7

At time t=2, process P2 starts execution and P1 is transferred to queue, At time t=3 , process p3 arrives, hence put into the queue . As round robin is pre-emptive version of FCFS, So at time t=4 , P1 will gets CPU over P3.

52. A CPU scheduling algorithm determines an order for the execution of its scheduled processes. Given 'n' processes to be scheduled on one processor, how many possible different schedules are there?
(A) $n$
(B) $n^2$
(C) $n!$
(D) $2^n$

ISRO 2013

Ans:c
.

53. A starvation free job scheduling policy guarantees that no job indefinitely waits for a service. Which of the following job scheduling policies is starvation free?
(A) Priority queing
(B) Shortest job first
(C) Youngest job first
(D) Round robin

ISRO 2013

Ans:d
Round Robin gives all processes equal access to the

processor.After fixed time interval every process gets CPU.

54. The state of a process after it encounters an $I/O$ instruction is?
(A) Ready
(B) Blocked
(C) Idle
(D) Running

ISRO 2013

Ans:b
The State of a process after it encounter I/O instruction is blocked state . It has nothing to do with CPU after it encounter I/O instruction.

55. A particular parallel program computation requires 100 seconds when executed on a single CPU. If 20% of this computation is strictly sequential, then theoretically the best possible elapsed times for this program running on 2 CPUs and 4 CPUs respectively are
(A) 55 and 45 seconds
(B) 80 and 20 seconds
(C) 75 and 25 seconds
(D) 60 and 40 seconds

ISRO 2013

Ans:d
2CPU: First 20% is sequential and next 80% work, 2 CPUs can work simultaneously hence total time required 20+40=60 unit.
4 CPU: First 20% is sequential and for next 80% work, 4 CPUs can work simultaneously hence total time required 20+20=40 unit.

56. Which of the following strategy is employed for overcoming the priority inversion problem?
(A) Temporarily raise the priority of lower priority level process
(B) Have a fixed priority level scheme.
(C) Implement Kernel pre-emption scheme.
(D) Allow lower priority process to complete its job.

ISRO 2013

Ans:a
Priority Inversion problem: Sometimes a lower priority task may indirectly preempt a higher priority task, This is called "priority inversion", and usually occurs when resource sharing is involved.
Solution:
Temporarily Increase priority of a lower priority thread that acquires a lock to ensure that it will complete its execution, and release its lock, as quickly as possible.

57. Which of the following is not an optimization criterion in the design of a CPU scheduling algorithm?
(A) Minimum CPU utilization
(B) Maximum throughput
(C) Minimum turnaround time
(D) Minimum waiting time

ISRO 2014

Ans:a
Criteria in designing a scheduling algorithm is :
Maximum CPU Utilization
Minimum TAT(Turn Around Time)
Minimum WT(Waiting Time)
Minimum RT(Response Time)
Maximum Throughput.

58. In a lottery scheduler with 40 tickets, how we will distribute the tickets among 4 processes $P_1, P_2, P_3$ and $P_4$ such that each process gets 10%, 5%, 60% and 25% respectively?

| | $P_1$ | $P_2$ | $P_3$ | $P_4$ |
|---|---|---|---|---|
| A | 12 | 4 | 70 | 30 |
| B | 7 | 5 | 20 | 10 |
| C | 4 | 2 | 24 | 10 |
| D | 8 | 5 | 30 | 40 |

ISRO 2015

Ans:c
40*10 / 100 = 4
40*5 / 100 =2
40*60 / 100 =24
40*25 / 100 = 10 .

59. Suppose a system contains $n$ processes and system uses the round-robin algorithm for CPU scheduling then which data structure is best suited ready queue of the process
(A) stack
(B) queue
(C) circular queue
(D) tree

ISRO 2015

Ans:c
The ready queue in round robin works like circular queue. All processes are kept in the circular queue also known as ready queue. Each New process is added to the tail of the ready/circular queue. When all processes have had a turn, then the scheduler gives the first process another turn, and so on.

60. Suppose two jobs, each of which needs 10 minutes of CPU time, start simultaneously. Assume 50% I/O wait time. How long will it take for both to complete, if they run sequentially?
(A) 10
(B) 20
(C) 30
(D) 40

ISRO 2015

Ans:d
A process has 50% CPU time(10ms) and 50% I/O time (10ms). Total time allotted to a process =20ms.

As both processes are executing sequentially , hence total time=$2 \times 20 = 40$ms.

61. For the real time operating system, which of the following is the most suitable scheduling scheme?
(A) Round robin
(B) First come first serve
(C) Pre-emptive
(D) Random scheduling

ISRO 2016

Ans:c
Preemptive Scheduling is suitable for Real-Time Programming, as it will allow a real-time process to preempt a process currently running in the Kernel.

62. Assume that the following jobs are to be executed on a single processor system

| Job Id | CPU Burst Time |
|---|---|
| p | 4 |
| q | 1 |
| r | 8 |
| s | 1 |
| t | 2 |

The jobs are assumed to have arrived at time $0^+$ and in the order p,q,r,s,t. Calculate the departure time (completion time) for job p if scheduling is round robin with time slice 11
(A) 4
(B) 10
(C) 11
(D) 12
(E) None of the above

GATE 1993,2 MARKS

Ans:c
Gantt chart:

| p | q | r | s | t | p | r | t | p | r | p |
|---|---|---|---|---|---|---|---|---|---|---|

0 1 2 3 4 5 6 7 8 9 10 11 .

63. Which scheduling policy is most suitable for a time shared operating system?
(A)Shortest Job First
(B)Round Robin
(C)First Come First Serve
(D)Elevator

GATE 1995,1 MARK

Ans:b
.

64. The sequence ......... is an optimal non-preemptive scheduling sequence for the following jobs which leaves the CPU idle for ........ unit(s) of time.

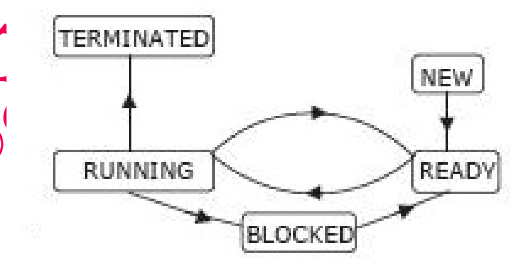
| Job | Arrival Time | Burst Time |
|---|---|---|
| 1 | 0.0 | 9 |
| 2 | 0.6 | 5 |
| 3 | 1.0 | 1 |

(A)$\{3, 2, 1\}, 1$
(B)$\{2, 1, 3\}, 0$
(C)$\{3, 2, 1\}, 0$
(D)$\{1, 2, 3\}, 5$

GATE 1995,2 MARKS

Ans:a
B: Not possible , because sequence is starting with Job 2 so CPU will be idle for at-least 0.6 unit of time .
C:Not possible , because sequence is starting with Job 3 so CPU will be idle for at-least 1 unit of time .
D: not possible , as CPU will execute all three jobs in sequence , starting from job 1. hence CPU will not be Idle.
A:Possible , As Shortest job first will minimize the waiting time , hence sequence will be {3,2,1} , and CPU will be idle for 1 Unit of time.

65. The process state transition diagram in the below figure is representative of




(A)a batch operating system
(B)an operating system with a preemptive scheduler
(C)an operating system with a non-preemptive scheduler
(D)a uni-programmed operating system

GATE 1996,2 MARKS

Ans:b
Due to the transition from running to ready state, process in the running state can be preempted and brought back to ready state. Hence Operating system have pre-emptive scheduler.

66. The correct matching for the following pairs is

| | | | |
|---|---|---|---|
| (A) | Activation record | (1) | Linking loader |
| (B) | Location counter | (2) | Garbage collection |
| (C) | Reference counts | (3) | Subroutine call |
| (D) | Address relocation | (4) | Assembler |

(A)A-3 B-4 C-1 D-2
(B)A-4 B-3 C-1 D-2
(C)A-4 B-3 C-2 D-1
(D)A-3 B-4 C-2 D-1

GATE 1996,2 MARKS

Ans:d
Activation record is created when a sub routine is called
A linker combines one or more object files and possible some library code into either some executable.A loader reads the executable code into memory, does some address translation and tries to run the program resulting in a running program. Thus it needs to do relocation of the object codes.
An assembler uses location counter value to give address to each instruction which is needed for relative addressing as well as for jump labels.
garbage collector uses reference count to clear the memory having reference count= 0.

67. Four jobs to be executed on a single processor system arrive at time 00 in the order A,B,C,D. Their burst CPU time requirements are 4,1,8,1 time units respectively. The completion time of A under round robin scheduling with time slice of one time unit is
(A)10
(B)4
(C)8
(D)9

GATE 1996,2 MARKS

Ans:d
Gantt chart:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| A | B | C | D | A | C | A | C | A |

0 1 2 3 4 5 6 7 8 9

Completion time of A is 9.

68. Consider $n$ processes sharing the CPU in a round-robin fashion. Assuming that each process switch takes $s$ seconds, what must be the quantum size $q$ such that the overhead resulting from process switching is minimized but at the same time each process is guaranteed to get its turn at the CPU at least every $t$ seconds?
(A) $q \leq \frac{t-ns}{n-1}$
(B) $q \geq \frac{t-ns}{n-1}$
(C) $q \leq \frac{t-ns}{n+1}$
(D) $q \geq \frac{t-ns}{n+1}$

GATE 1998,2 MARKS

Ans:a
Each process has time quanta of q unit and there are n process: $p_1$, $p_2$,$p_3$,, ....., $p_n$, after first execution $p_1$ executes again after at most $(n-1)q$ time.Likewise each process gets its turn after $(n-1)q$ time. Also there is overhead of s unit for context switching.
So, we have $ns + (n-1)q \leq t$
$q \leq \frac{t-ns}{n-1}$.

69. Consider a set of n tasks with known runtimes r1, r2,.... rn to be run on a uniprocessor machine. Which of the following processor scheduling algorithms will result in the maximum throughput?
(A) Round-Robin
(B) Shortest-Job-First
(C) Highest-Response-Ratio-Next
(D) First-Come-First-Served

GATE 2001,1 MARK

Ans:b
Shortest Job First has maximum throughput because in this scheduling technique shortest jobs are executed first hence it minimize the average waiting time and maximize throughput.

70. Which of the following scheduling algorithms is non-preemptive?
(A) Round Robin
(B) First-In First-Out
(C) Multilevel Queue Scheduling
(D) Multilevel Queue Scheduling with Feedback

GATE 2002,1 MARK

Ans:b
FCFS is non-preemptive scheduling algorithm , while round robin is pre-emptive version of FCFS, a queue is maintained which stores the input as it comes in FCFS order.



71. Consider the following set of processes, with the arrival times and the CPU-burst times given in milliseconds.

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

What is the average turnaround time for these processes with the preemptive shortest remaining processing time first (SRPT) algorithm?
(A) 5.50
(B) 5.75
(C) 6.00
(D) 6.25

GATE 2004,2 MARKS

Ans:a
Gantt chart:

| | | | | |
|---|---|---|---|---|
| P1 | P2 | P4 | P3 | P1 |

0 1 4 5 8 12

Turnaround time for :
P1:12ms
P2:3ms
P3:6ms
P4:1ms
Average turnaround time=$\frac{12+3+6+1}{4} = 5.5$ms.

72. Group 1 contains some CPU scheduling algorithms and Group 2 contains some applications. Match entries in Group 1 to entries in Group 2.

| Group I | Group II |
|---|---|
| (P) Gang Scheduling | (1) Guaranteed Scheduling |
| (Q) Rate Monotonic Scheduling | (2) Real-time Scheduling |
| (R) Fair Share Scheduling | (3) Thread Scheduling |

(A) P - 3 Q - 2 R - 1
(B) P - 1 Q - 2 R - 3
(C) P - 2 Q - 3 R - 1
(D) P - 1 Q - 3 R - 2

GATE 2007,1 MARK

Ans:a
.

73. An operating system uses Shortest Remaining Time first (SRT) process scheduling algorithm. Consider the arrival times and execution times for the following processes:

| Process | Execution time | Arrival time |
|---|---|---|
| P1 | 20 | 0 |
| P2 | 25 | 15 |
| P3 | 10 | 30 |
| P4 | 15 | 45 |

What is the total waiting time for process P2?
(A) 5
(B) 15
(C) 40
(D) 55

GATE 2007,2 MARKS

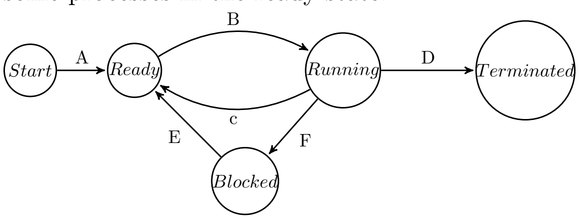
Ans:b
Gantt chart:

| P1 | P2 | P3 | P2 | P4 |
|---|---|---|---|---|

0 20 30 40 55 70

Waiting time for process P2= Completion time Arrival time burst time =551525=15.

74. 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

GATE 2009,2 MARKS

Ans:c
I:False,Given statement could be true in some scenario but it is not necessarily true always . Transition A depends on availability of process to run & Long term Scheduler.
II:True, There is no dependency between the states of process $P_1$ and $P_2$.
III;True, because of transition C, it uses preemptive scheduling. IV:False, because of transition C.

75. Which of the following statements are true?
I. Shortest remaining time first scheduling may cause starvation
II. Preemptive scheduling may cause starvation
III. Round robin is better than FCFS in terms of response time

(A) I only
(B) I and II only
(C) II and III only
(D) I, II and III

GATE 2010,1 MARK

Ans:d
I:True, in SRTF ,process with large CPU burst may suffer from starvation
II:true,Let process P1 is executing and after some time process P2 with high priority arrive then p1 is preempted and p2 will brought into CPU for execution. In this way if process which is arriving in ready queue is of higher prioirity then p1, then p1 is always preempted. So P1 will suffer from starvation.
III:True,Round robin is pre-emptive version of FCFS, a queue is maintained which stores the input as it comes in FCFS order. But every process is assigned a fixed optimized time quantum, So response time in RR is better than FCFS.

76. Consider the following table of arrival time and burst time for three processes P0, P1 and P2.

| Process | Arrival time | Burst Time |
|---|---|---|
| P0 | 0 ms | 9 ms |
| P1 | 1 ms | 4 ms |
| P2 | 2 ms | 9 ms |

The pre-emptive shortest job first scheduling algorithm is used. Scheduling is carried out only at arrival or completion of processes. What is the average waiting time for the three processes?
(A) 5.0 ms
(B) 4.33 ms

(C) 6.33 ms
(D) 7.33 ms

GATE 2011,2 MARKS

Ans:a
Gantt chart:

| P0 | P1 | P0 | P2 |
|---|---|---|---|

0 1 5 13 22

Waiting time of:
P0=0+4
P1=0
P2=11
Average waiting time=$\frac{4+0+11}{5}$=5ms.

77. Consider the 3 processes, $P_1$, $P_2$ and $p_3$ shown in the table.

| Process | Arrival time | Time Units Required |
|---|---|---|
| P1 | 0 | 5 |
| P2 | 1 | 7 |
| P3 | 3 | 4 |

The completion order of the 3 processes under the policies FCFS and RR2 (round robin scheduling with CPU quantum of 2 time units) are
(A)FCFS: $P_1, P_2, P_3$,RR2: $P_1, P_2, P_3$
(B) FCFS: $P_1$, $P_3$, $P_2$,RR2: $P_1, P_3, P_2$
(C)FCFS: $P_1, P_2, P_3$,RR2: $P_1, P_3, P_2$
(D) FCFS:$P_1, P_3, P_2$,RR2: $P_1, P_2, P_3$

GATE 2012,2 MARKS

Ans:c
Gantt chart for FCFS:

| P1 | P2 | P3 |
|---|---|---|

0 5 12 16

Gantt chart for RR2:

| P1 | P2 | P1 | P3 | P2 | P1 | P3 | P2 |
|---|---|---|---|---|---|---|---|

0 2 4 6 8 10 12 14 16

At time t=2,
P1 finishes its time quanta and put into the ready queue
P2 sent for execution
At time t=3
Process P3 arrive and put into the ready queue.
As round robin is pre-emptive version of FCFS, so execution sequence at this point will be P1 P3.....

78. Consider the following set of processes that need to be scheduled on a single CPU. All the times are given in milliseconds

| Process Name | Arrival Time | Execution Time |
|---|---|---|
| A | 0 | 6 |
| B | 3 | 2 |
| C | 5 | 4 |
| D | 7 | 6 |
| E | 10 | 3 |

Using the *shortest remaining time first* scheduling algorithm, the average process turnaround time (in msec) is__________ .

GATE 2014-I,2 MARKS

Ans:7.2
Gantt chart :

| A | B | A | C | E | D |
|---|---|---|---|---|---|

0 3 5 8 12 15 21

Turn Around time of process
A=8-0=8ms
B=5-3=2ms
C=12-5=7ms
D=21-7=15ms
E=15-10=5ms
Average turn Around time = $\frac{36}{5}$=7.2ms.

79. Three processes A, B and C each execute a loop of 100 iterations. In each iteration of the loop, a process performs a single computation that requires $t_c$ CPU milliseconds and then initiates a single I/O operation that lasts for $t_{io}$ milliseconds. It is assumed that the computer where the processes execute has sufficient number of I/O devices and the OS of the computer assigns different I/O devices to each process. Also, the scheduling overhead of the OS is negligible. The processes have the following characteristics:

| Process id | $t_c$ | $t_{io}$ |
|---|---|---|
| A | 100 ms | 500 ms |
| B | 350 ms | 500 ms |
| C | 200 ms | 500 ms |

The processes A, B, and C are started at times 0, 5 and 10 milliseconds respectively, in a pure time sharing system (round robin scheduling) that uses a time slice of 50 milliseconds. The time in milliseconds at which process C would complete its first I/O operation is ______

GATE 2014-II,2 MARKS

Ans:1000
Gantt chart :

| A | B | C | A | B | C | B | C | B | C |
|---|---|---|---|---|---|---|---|---|---|

0 50 100 150 200 250 300 350 400 450 500

C completes its CPU burst at=500 ms.
IO time for C=500 ms.
C completes 1st IO burst at =500+500=1000ms.

80. Consider a uniprocessor system executing three tasks $T_1$, $T_2$ and $T_3$, each of which is composed of an infinite sequence of jobs (or instances) which arrive periodically at intervals of 3, 7 and 20 milliseconds, respectively. The priority of each task is the inverse of its period and the available tasks are scheduled in order of priority, with the highest priority task

scheduled first. Each instance of $T_1$, $T_2$ and $T_3$ requires an execution time of 1, 2 and 4 milliseconds, respectively. Given that all tasks initially arrive at the beginning of the 1st millisecond and task preemptions are allowed, the first instance of $T_3$ completes its execution at the end of ______ milliseconds.

GATE 2015-I,2 MARKS

Ans:12
$T_1 : 1, 4, 7, 10, \ldots \infty$ ($T_1$ repeats every 3 ms)
$T_2 : 1, 8, 15, 22, \ldots \infty$ ($T_2$ repeats every 7 ms)
$T_3 : 1, 21, 41, 61, \ldots \infty$ ($T_3$ repeats every 20 ms)
Priority of $T_1 = \frac{1}{3}$
Priority of $T_2 = \frac{1}{7}$
Priority of $T_3 = \frac{1}{20}$

| $T_1$ | $T_2$ | $T_2$ | $T_1$ | $T_3$ | $T_3$ | $T_2$ | $T_2$ | $T_1$ | $T_3$ | $T_3$ |
|---|---|---|---|---|---|---|---|---|---|---|

1 2 3 4 5 6 7 8 9 10 11 12 .

81. The maximum number of processes that can be in Ready state for a computer system with n CPUs is
(A)n
(B)$n^2$
(C)$2^n$
(D)Independent of n

GATE 2015-III,1 MARK

Ans:d
The number of processes that can be in READY state depends on the size of Ready Queue not on the number of processors .Hence it will be independent of $n$.

82. For the processes listed in the following table, which of the following scheduling schemes will the lowest average turnaround time ?

| Process | Arrival Time | Processing Time |
|---|---|---|
| A | 0 | 3 |
| B | 1 | 6 |
| C | 4 | 4 |
| D | 8 | 2 |

(A) First Come First Serve
(B) Non-preemptive Shortest Job First
(C) Shortest Remaining Time
(D) Round Robin with Quantum value two

GATE 2015-III,2 MARKS

Ans:c
Turn Around Time(TAT)=Completion time of process - Arrival time of process
Gantt chart for FCFS:

| A | B | C | D |
|---|---|---|---|

0 3 9 13 15

Average TAT=$\frac{(3-0)+(9-1)+(13-4)+(15-6)}{4}$=7.25ms
Gantt chart for RR:

| A | B | A | C | B | D | C | B |
|---|---|---|---|---|---|---|---|

0 2 4 5 7 9 11 13 15

Average TAT=$\frac{(3-0)+(15-1)+(8-4)+(10-6)}{4}$=6.25ms
Gantt chart for SJF:

| A | B | D | C |
|---|---|---|---|

0 3 9 11 15

Average TAT=$\frac{(3-0)+(9-1)+(15-4)+(11-6)}{4}$=6.75ms.

83. Consider an arbitrary set of CPU-bound processes with unequal CPU burst lengths submitted at the same time to a computer system. Which one of the following process scheduling algorithms would minimize the average waiting time in the ready queue?
(A) Shortest remaining time first
(B) Round-robin with time quantum less than the shortest CPU burst
(C) Uniform random
(D) Highest priority first with priority proportional to CPU burst length

GATE 2016-I,1 MARKS

Ans:a
When all processes arrive at the same time then Shortest remaining time scheduling works like shortest job first . Shortest job first minimize the average waiting time.

84. Consider the following processes, with the arrival time and the length of the CPU burst given in milliseconds. The scheduling algorithm used is preemptive shortest remaining-time first.

| Process | Arrival Time | Burst Time |
|---|---|---|
| $P_1$ | 0 | 10 |
| $P_2$ | 3 | 6 |
| $P_3$ | 7 | 1 |
| $P_4$ | 8 | 3 |

The average turn around time of these processes is______________. milliseconds

GATE 2016-II,2 MARKS

Ans:8.25
Gantt chart :

| P1 | P2 | P3 | P2 | P4 | P1 |
|---|---|---|---|---|---|

0 3 7 8 13 10 20

Average TAT= $\frac{20+7+1+5}{4}$=8.25ms.

85. Consider the following CPU processes with arrival times (in milliseconds) and length of CPU bursts (in milliseconds) as given below: