Day monday

DATE 8/7/19

4. CPU Scheduling

I) scheduling concept
II) Primitive and non Primitive scheduling
III) Types of schedulors.
IV) scheduling Criteria
V) Types of scheduling algorithm.
VI) Multi-level Queue
VII) Multi-level feedback Queue. Imp points:- 2, 3, 4, 5, 6, 7.

* what is scheduling or define the term schedulor.

In the multiprogramming environment their may be the situatn. where two or more Processes are in the ready state but only one CPU is available at that time choice has to be made which process should exicute next.

"The Part of O.S that makes the select^n of Processes for exication is called as schedulor." and "algorithm used by the CPU schedulor is called CPU schedulor algorithm."

There are many situation when scheduling is required.

1) when new Process is created then decision regarding whether the Parent or child Process should be exicuted.

ii) when Process terminates the some other Process must be selected from the set of ready states.
iii) If no Process in the ready state then System supplied ideal Process is exiccuted.
iv) When Process blocks on I/O some other reasons or for on Simaphore another process has to be selected to run.
v) when I/O interrupt occues a scheduling decision may be made.

* Differentiate bet^n Primitive & non-Primitive.

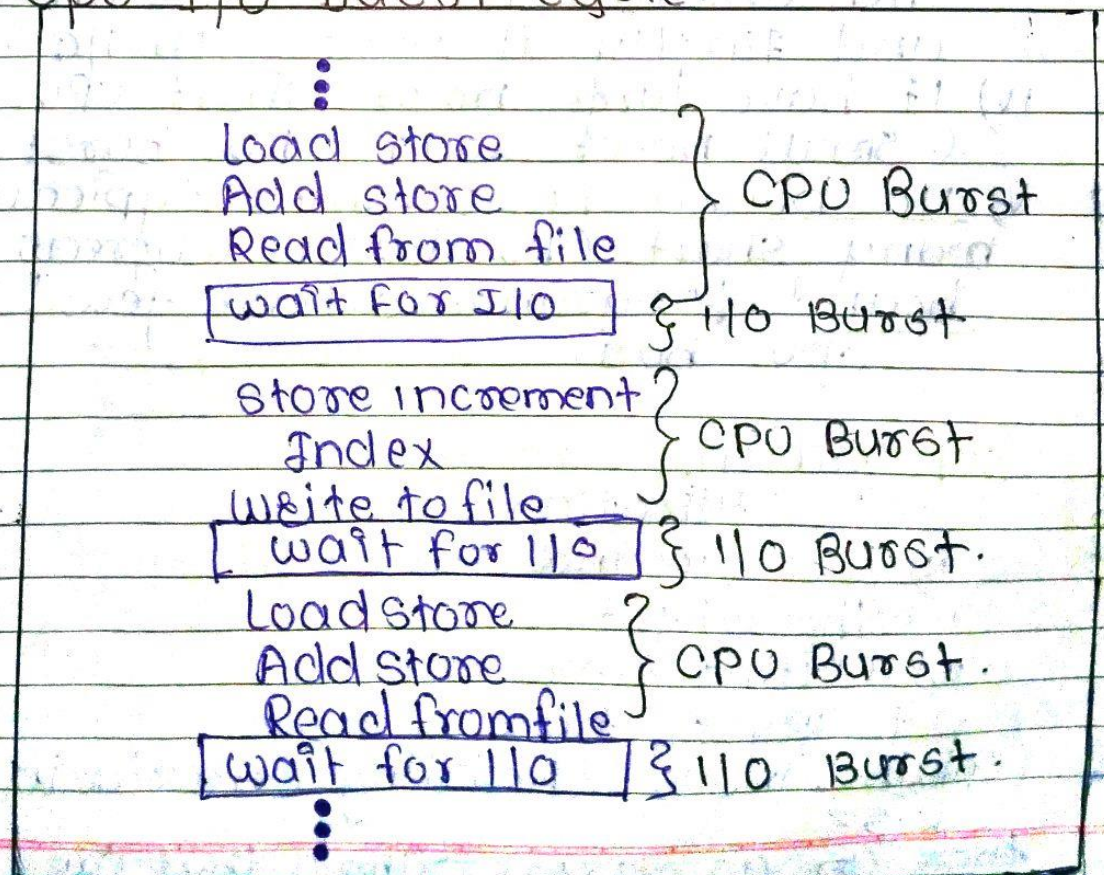
Imp

Primitive	Non-Primitive.
i) In this case one's the CPU is allocated to process it can be primited. at any time. as a result of occurance of high r priority process for an interrupt occues.	In this case one's the CPU allocated to the process it will not relased. the CPU until & unless. the task gets completed.
ii) It required by the context switching.	In the non-Primitive the context switching is not required.

III	It supported by the multi-programming.	It always supports from the single programming.
IV	It suffer from starvation.	it suffer from the deadloc.
V	The waiting time of Primitive is more than non-Primitive	The waiting time of non-primitive is less
VI	e.g:- windows 95	e.g:- windows 7, latest version of windows

* CPU I/O Burst cycle.

Imp



Q Define term CPU scheduler & explain CPU I/O Bus cycle with diagram.

Ans "The Part of O.S that makes the selectn the processes for exicution is called scheduler".

i) Process exicution cycle consist of cycle of CPU Burst (i.e CPU exicution) & I/O Burst (i.e I/O wait)
ii) Process alternate betn this two states is CPU Burst & I/O Burst.
iii) Process exicution starts withs CPU Bursts. that is followed byan I/O bus, then another CPU Burst, then another I/O bust & so on. and finally it ends with I/O burst.
iv) It have large no. of short CPU Burst & small no. of long CPU burst.
v) I/O bound Programmes typically many short CPU Burst. whereas CPU bound programmes. have few long cpu bus.

* Imp Scheduling Criteria :-
i) CPU Utilization
ii) Turn Around Time
iii) Throughput
iv) waiting time.
v) Response time.

Q Explain various scheduling criteria in O.S ?
there are as several criteria that can given below:

1) Cpu Utilization :-
i) this is the Percentage of time that Processor is busy.
ii) in CPU utilization you want to keep CPU busy as much as possible.
iii) for Normal Processes CPU utilization ranges from 0 to 100 %. & for real time process it should range for 40 to 90 %.

(2) Turn Around Time-
def :-
i) "the time interval from submission of process to completion of process is known as turnaround time."
ii) turn around time should be minimum
iii) turn around time can be calculated by using following formula.

Turn around time = waiting time + Burst time

(3) ThroughPut-
i) def :-
"The no. of Processes Completed Per unit time is called as throughput."
ii) throughput should be always maximum
iii) for the long process throughput may be one Process per hr.
iv) for the short Process it may be 10 Process Per Second.

④ waiting time :-

1) def^n :-

"It is Some of period Spent waiting in the readyqueue."

ii) waiting time should be minimum.

iii) The amount of time the process Spents waiting in the readyqueue is known as waiting time.

⑤ Response Time ⇒

def^n :-

i) It is time form the Submission of request until the 1st response is produced.

(or)

the time taken by Process to starts responding is known as response time

* Define the term Burst time :-

1 marks

"the time taken by the Process for it's exicution."

(or)

"the time required by the CPU to Exicute a Process is called buest time."

* Define the term Dispatcher :-

2 marks

i) "Dispatcher can be defined as the Dispatcher is module that gives the Control of CPU to the Process selected by the short term Scheduler."

ii) Dispatcher is responsible for Contex Switching i.e is dispatcher monitor Processes & decide when to switch from

one Process to another.

iii) follow. functn of dispatcher.
   i) Contex Switching.
   ii) Switching to User mode.
   iii) Jumping to the Proper locatn in the User Programm to restart that Programs.

def^n 2marks

iv) Dispatch latency time ⇒

"The time Required by the dispatcher to stop one Process and start execution of another Process is known as dispatch lentency time".

* Problems on scheduling algorithm.

4m

I) fcfs → first come first serve.
II) SJF → shortest Job first.
III) Priority
IV) Round Robin.

I] fcfs :- first Come first Serve.

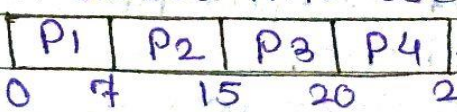
Q. Consider the following Processes P_1, P_2, P_3, P_4 and burst time is given in the following chart.

Process	Burst time
P_1	7
P2	8
P3	5
P4	6

Calculate the average waiting time & average turnaround time by using fcfs

scheduling algorithm.

Ans from above info. we can draw Gantt chart



← Gantt chart.

waiting time for P1 = 0 ms
waiting time for P2 = 7 ms
waiting time for P3 = 15 ms
waiting time for P4 = 20 ms.

i) ∴ Average waiting time = $\frac{\text{sum of waiting time}}{\text{No. of Process}}$

$= \frac{0+7+15+20}{4}$

$\therefore AWT = \frac{42}{4}$

$\boxed{\therefore AWT = 10.5 ms}$

ii) Turn around Time = waiting + Burst time.
turn around time for P1 = 0+7 = 7
P2 = 7+8 = 15
P3 = 15+5 = 20
P4 = 20+6 = 26.

Average turn around time = $\frac{7+15+20+26}{4}$

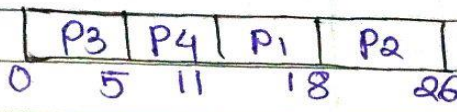
$= \frac{68}{4}$

$= 17 ms$

$\boxed{\therefore ATT = 17ms}$

II) SJF → shortest Job first.

Gantt Chart.



waiting time for $P_1 = 18$

$P_2 = 18$

$P_3 = 0$

$P_4 = 5$

$\therefore AWT = \frac{0+5+18+18}{4}$

$= \frac{34}{4}$

$\therefore AWT = 8.5 ms$

turn around time = waiting time + Burst time

$P_1 = 11+7 = 18$

$P_2 = 18+8 = 26$

$P_3 = 0+5 = 5$

$P_4 = 5+6 = 11$

average TAT $= \frac{18+26+5+11}{4}$

$= \frac{60}{4}$ 15

$\therefore AWT = 15 ms$

①

Process	Burst time
P1	4
P2	1
P3	9
P4	1

Calculate AWT & ATT using SJF, fcfs.

fcfs

P1	P2	P3	P4	→ Gantt chart.

0 4 5 14 15

waiting time for P1 = 0 ms

P2 = 4 ms

P3 = 5 ms

P4 = 14 ms

1) AWT = $\frac{0+4+1+9}{4}$

$= \frac{14}{4} = 3.5$ $\quad \frac{23}{4} =$

AWT = 3.75 ms

2) Turn around Time = WT + BT

P1 = 0 + 4 = 4

P2 = 4 + 1 = 5

P3 = 5 + 9 = 14

P4 = 14 + 1 = 15

∴ ATT = $\frac{4+5+14+15}{4}$

$= \frac{38}{4} = 9.5$ $\quad \frac{38}{4} = 14.5$

∴ ATT = 14.75 ms

iii] SJF ⇒

P2	P4	P1	P3
0	1	2	6	15

waiting for P1 = 2 ms
—11— P2 = 0 ms
—11— P3 = 6 ms
—11— P4 = 1 ms

∴ AWT ⇒ $\frac{0+1+2+6}{4}$

⇒ $\frac{9}{4}$ 2.25 4.5

∴ AWT ⇒ 2.25

Turn around time = WT + BT

P1 = 2 + 4 = 6
P2 = 0 + 1 = 1
P3 = 6 + 9 = 15
P4 = 1 + 1 = 2

ATT = $\frac{6+1+15+2}{4}$

= $\frac{15+9}{4}$

= $\frac{24}{4}$ 12 6

ATT = 6 ms.

* Priority scheduling algorithm :-

Process	Burst time	Priority
P1	3	5
P2	5	1
P3	4	0
P4	7	2

calculate the AWT and ATT by using priority scheduling algorithm.

P3	P2	P4	P1
0	4	9	16	19

— Gantt chart

waiting time for P1 = 16
P2 = 04
P3 = 00
P4 = 09

$$AWT = \frac{16 + 4 + 0 + 09}{4}$$

$$= \frac{29}{4}$$

$$\boxed{AWT = 7.25 \text{ ms}}$$

Turn around time = WT + BT

P1 = 16 + 3 = 19
P2 = 04 + 5 = 09
P3 = 00 + 4 = 04
P4 = 09 + 7 = 16

$$ATT = \frac{19 + 09 + 04 + 16}{4} = \frac{48}{4} = \underline{12 \text{ ms}}$$

* Round Robin Scheduling algorithm.

Process	Burst time.	time quantum = 4ms
P1	24	24-4=20
P2	3	
P3	3	

P1	P2	P3	P1	P1	P1	P1	A
0	4	7	10	14	18	22	26 30

WT for P1 = 18-4=6

P2 = 4

P3 = 7

$AWT = \frac{6+4+7}{3} = \frac{17}{3}$ 5.67

∴ AWT = 5.67 ms

Turn around time = WT + BT

P1 = 6+24 = 30

P2 = 4+3 = 7

P3 = 7+3 = 10

$\therefore ATT = \frac{30+7+10}{3}$

$= \frac{47}{3}$ 15.67

∴ ATT = 15.67 ms

iij

Process	burst time
P1	30
P2	6
P3	8

time quantum = 5ms

30 - 5 = 25

6 - 5 = 1

8 - 5 = 3

P1	P2	P3	P1	P2	P3	P1	P1	P1	P1

0 5 10 15 20 21 24 29 34 39 44

waiting time for P1 = 0 + (15-5) + (24-20) = 14

P2 = 5 + (20-10) = 15

P3 = 10 + (21-15) = 16

$AWT = \frac{14+15+16}{3}$

$= \frac{45}{3}$

∴ AWT = 15 ms.

ATT = WT + BT

Turn around time P1 = 14 + 30 = 44

P2 = 15 + 6 = 21

P3 = 16 + 8 = 24

$ATT = \frac{44+21+24}{3}$

∴ ATT = [illegible] ms

iii)

Process	burst time	time quantam = 4ms
P1	28	28-4 = 24
P2	7	7-4 = 3
P3	9	9-4 = 5

P1	P2	P3	P1	P2	P3	P1	P3	P1	P1	P1	P1
0	4	8	12	16	19	23	27	28	32	36	40	44

waiting time for P1 = 0 + (32-4) + (18-16) + (28-7)
= 16

P2 = 4 + (16-8)
= 4+8
P2 = 12.

P3 = 8 + (19-12) + (27-23)
= 19

AWT = $\frac{16+12+19}{3}$

AWT = 84.34

Turn around time = WT + burst time

P1 = 16 + 28 = 44
P2 = 12 + 7 = 19
P3 = 19 + 9 = 28

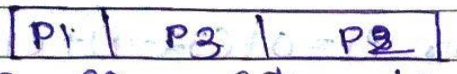
ATT = $\frac{44+19+28}{3}$

ATT = 30.84 ms

iv] Process BT Priority

P1	28	0
P2	7	5
P3	9	2

Using a Priority scheduling algorithms.



waiting time for P1 = 0 ms
P2 = 37 ms
P3 = 28 ms.

$$AWT = \frac{0+28+37}{3}$$

$\therefore$ AWT = 21.66 ms.

ATT = WT + BT
P1 = 0 + 28 = 28
P2 = 37 + 7 = 44
P3 = 28 + 9 = 37

$$ATT = \frac{28+44+37}{3}$$

$\therefore$ ATT = 36.33 ms.

* Explain the various types of algorithm in CPU sheduling.

i) fcfs ⇒
1) It is the simplest form of CPU schedulin g algorithm.
2) In this skim Process that request CPU first is allocated to the CPU first.
3) The average waiting time under fcfs policy is quite long.
4) fcfs is non Primitive & implimentation of fcfs is manged with the help of fifo (first in first out).
5) fcfs scheduling is simple to write.
6) main

ii) SJF
i) this algo. is related to length of next CPU bus.
ii) when CPU is available it is assign to the process that has smaller CPU bus time.
iii) If two Processes have the same length at that time fcfs scheduling is used bet^n two processes.
iv) SJF algo. may be either Primitive or non-Primitive.
v) Primptive SJF some time called as shortest remaining time bus first (SRTF

iii) Priority ⇒

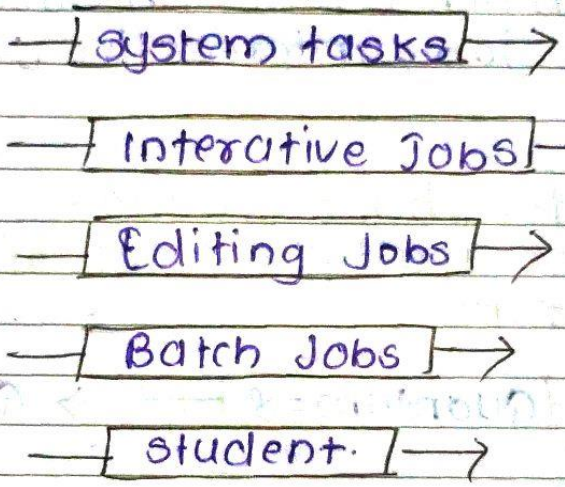
1) In this scheme Priority is assigned to each Process.
2) CPU is allocated to Process that has the highest Priority. (lowest no shows the highest Priority.)
3) equal Priority processes are schedual in fcfs order.
4) A major Problem with Priority, scheduling algo. is indefinite blockage of processes.
5) ie Process is ready to run but lacking the CPU.

iv) Round Robin scheduling algorithm-

i) RR algo. is similiar to fcfs scheduling but Primptive is added to switch bet^n the processes.
ii) a small unit of time is given for the exicution is called as time Quantum & slice.
iii) The readyque is treated as Circular queue a new Process are added to the tail of the readyqueue.
iv) One of the follow.. two things will happens if interupts occures
① the Process may have the CPU burst time less than the time quantum in this case Process itself relased the voluntarily.

(2) If the CPU Burst of currently running process is longer than the time quantum. the timer will go off & will caused the interrupts.

* Multi-level Queue ⇒



Q Explain multi-level queue scheduling in detail with diagram. [4M]

1. In multilevel queue scheduling multiple levels of queues are present.
2. It classified into two ways are as follows:
   1) Background Jobs (Batch Jobs).
   2) foreground Jobs (Interactive Jobs).
3. In multilevel queue scheduling Partition the readyqueue in separate queues.
4. Jobs are permantely assign to one queue base on the properties like memory size, job type, it depends on assignment of jobs.
5. foreground queues may have absolute Priority over background queues.

6. A multilevel Ques scheduling have follow. Queue
   1] system tasks.
   2] interactive jobs.
   3] Editing jobs.
   4] Batch jobs.
   5] student.

7. no job in Batch Queue can exicute unless Queue for system job, interactive job, editing job are empty.

4m * Multilevel feedback Queue ⇒
Explain the multiple level of feedback Queue with diagram.

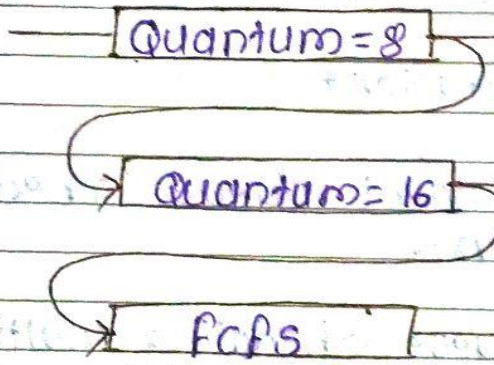


fig:- multilevel feedback Queue.

1. normally in multilevel Queue scheduling jobs are permanely assign to Queue. depends on the entry to system
2. Jobs are do not moves bet^n the Queues.
3. multilevel Queue it allows jobs to move bet^n the Queues.
4. The idea is that if job uses toomuch CPU time it will move to the lower priority Queue.

5. Similarly, jobs which waits longs time in the lower Queue may be move to the higher priority queue.
6. Consider the multilevel feedback queue no.ed from Queue0, Queue 2.
7. The scheduler first exicutes all jobs in the Queue0.
8. a job in the Queue0 is given time Quantum is equal to 8ms.
9. If it doesnot finished within time it moves to the tail of readQueue1.
10. If Queue0 is empty then add jobs at the head of Queue1.
11) and Queue1 given a time quantum of 16 ms.
12. If it doesnot completed within this time then it moves to the Queue2.
13. Jobs in a Queue2 are executed. In the order first come first serve (FCFS).
14. Jobs in the Queue2 to are exicuted.
15. if and only if Queue0 & Queue1 is ~~foot~~ empty.

* Define the Term agenging :-
"A sol^n to the Problem of indefinite blockage. Of loss of Priority of Process is called as agening".

OR

"Agening is techinque of gradually increasing the Priority of Process that wait in system in long time."

Q what is scheduler? explain types of scheduler

there are three basic type of scheduler.

1) long term scheduler
2) medium term
3) short term

1) long term scheduler →

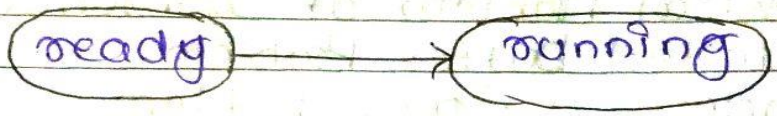
i) It is also known as job scheduler.
ii) LTS is responsible for creating new process & bringing them into system.
iii) It select the processes from 2ndry storage & load into the readyqueue i.e main memory.
iv) It increases the degree of multiprogramming.
v) LTS decides which jobs are to be admitted to the readyqueue in the main memory.

2) medium term scheduler ⇒

i) It is responsible for suspending & resuming the processes.
ii) MTS is also called as swapper.
iii) MTS temporarely removes the processes from main memory & places them into the 2ndry memory or viceversa.
iv) this is commonly known as swapping out or swapping in.
v) MTS may decides to swap out a process which has not been active for sometimes & process which has lower priority or process which is taking large

amount memory

3) Short term scheduler →
i) It is also known as CPU schedular.
ii) It is responsible for scheduling one of Process from ready state to running state.



iii) It is responsible to select only one Process & assign it to the CPU.
iv) It is very frequent & enhance the CPU performance.
v) It is increases the exicution speed of CPU.
vi) this schedular can be Primitive.