Date

CPU SCHEDULING

(Process Scheduling)

→ Process Scheduling refers to a set of policies & mechanism built into the Operating System that govern the order in which the work has to be done in a computer system is Completed.

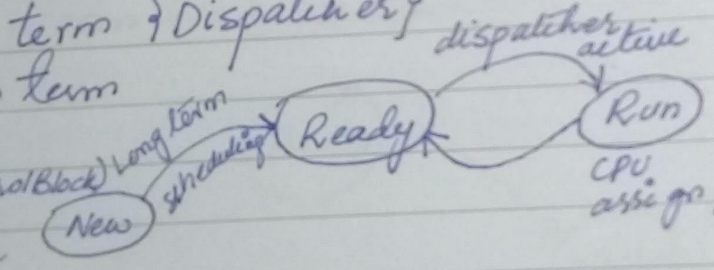
→ Program in Execution is a Process
Process wants resources

PROCESS

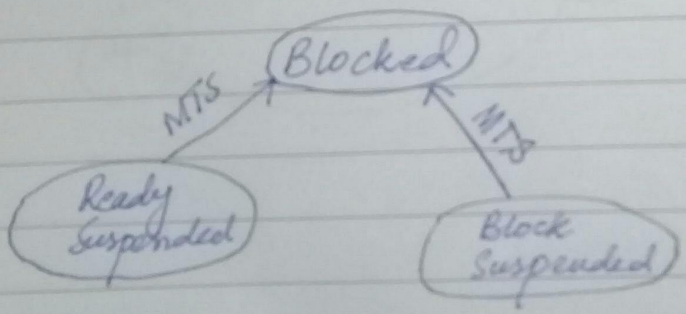
C.P.U bound — CPU Burst

I/O bound — I/O Burst

- There are three types of Schedulers
1- Long term
2- Short term {Dispatcher}
3- Medium term



PCB (Program Control Block)
waiting stage
CPU assign ہونے کے بعد



- Swapping In وہ Process جو آتا ہے Virtual Memory میں
- Swapping Out وہ Process جو جاتا ہے Virtual Memory سے

Date

* Long term

SCHEDULING CRITERIA'S

1- CPU UTILIZATION:

→ We want to keep the CPU as busy as possible
→ We want to maximize the working of CPU

2- THROUGHPUT:

→ Number of processes that are completed per unit time.
→ It must be maximum.

3- TURNAROUND TIME:

The time b/w the submission of the job & completion of the job
Time should be minimum

4- WAITING TIME:

The time of the process in which the process is in the ready queue for execution, time should be minimum

5- RESPONSE TIME:

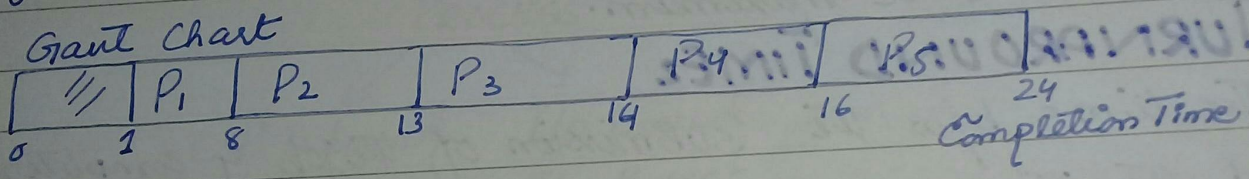
The time b/w the submission of job & first response of the job is called Response time.
Time should be minimum.

Date _____ Criteria: Arrival Time, Decission Mode

FCFS (FIRST COME FIRST SERVE)

Program PNO	Arrival AT	Burst BT	Completion CT	Turnaround CT-AT TAT	Waiting TAT-BT WT
1	1	7	8	7	0
2	2	5	13	11	6
3	3	1	14	11	10
4	4	2	16	12	10
5	5	8	24	19	11

Gant Chart



PRE-EMPTION:

Agr ak resource/CPU day diya to process ki completion tk wapis nahi layskty.

TAT = Completion time - Arrival Time

WT = Turnaround time - Burst time

Avg = $\frac{\Sigma}{5}$

MERIT:

Simple to understand, Easy to understand

DEMERIT:

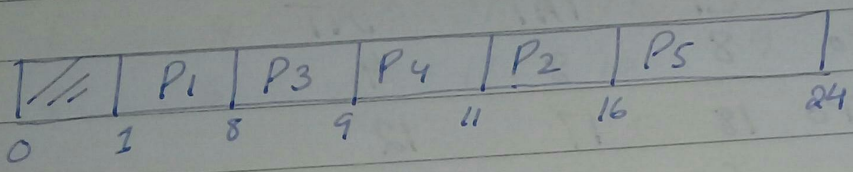
When there is larger effect of 2 processes then other process has to wait.

- If arrival time is same of 2 processes then see subscript.

Date

SHORTEST JOB FIRST: (SJF)

PNo	AT	BT	CT	TAT	WT
1	1	7	8	7	
2	2	5	16	14	
3	3	1	9	6	
4	4	2	11	7	
5	5	8	24	19	



Criteria Burst Time

Decission Mode: Non pre-emptive

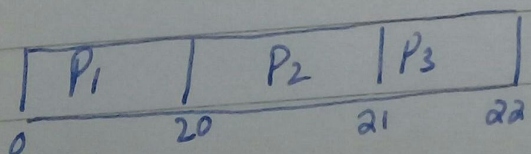
Merit: Solution of the convey effect

Demerit: It is basically ideal algorithm, Worst time calculation is difficult.

PNo	AT	BT	CT	TAT	WT
1	0	20	20	20	0
2	1	1	21	20	19
3	2	1	22	20	19

$$\text{Avg } \Sigma_1 = \frac{60}{3}$$

$$\Sigma_1 = 20$$



Date ______

ROUND ROBIN:

TQ = Time Quantum

→ Pre-empt → Resource sirf 1 maksoos time tk diya jyga or phir wapis lay liya jyga

تھوڑی تھوڑی دیر بعد ہر پروسس کو ٹائم دیا جائے گا -

→ Switching is through Dispatcher

→ Context Switch → Save & resume Back

TQ = 2

PNo	AT	BT	CT	TAT	WT
1	0	~~4~~ ~~2~~ 0	8	8	4
2	1	~~5~~ ~~3~~ ~~1~~ 0	18	17	12
3	2	~~2~~ 0	6	4	2
4	3	~~1~~ 0	9	6	5
5	4	~~6~~ ~~4~~ ~~2~~ 0	21	17	11
6	6	~~3~~ ~~1~~ 0	19	13	10

Gantt chart + Queue is maintained

First in First out

Queue | ~~P1~~ ~~P2~~ ~~P3~~ ~~P1~~ ~~P4~~ ~~P5~~ ~~P2~~ ~~P6~~ ~~P5~~ ~~P2~~ ~~P6~~ ~~P5~~ |

← right to left scan

P1	P2	P3	P1	P4	P5	P2	P6	P5	P2	P6	P5

TQ ↓

CS ↑

Date

Round Robin

TQ = 4

PNo	AT	BT	CT	TAT	WT
1	0	~~4~~ 0	4	4	0
2	1	~~5~~ ~~1~~ 0	19	18	13
3	2	~~2~~ 0	10	8	6
4	3	~~1~~ 0	11	8	7
5	4	~~6~~ ~~2~~ 0	21	17	11
6	6	~~3~~ 0	18	12	9

circular Queue

P1	P2	P3	P4	P5	P6	P2	P5

Gantt chart

P1	P2	P3	P4	P5	P6	P2	P5

0 4 8 10 11 15 18 19 21

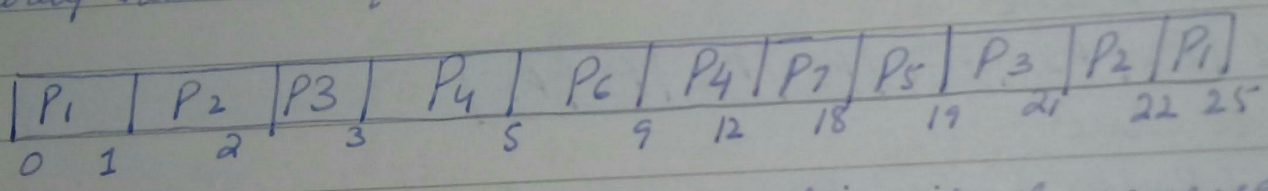
→ If time Quantum is too large then it will become FCFS

Date

PREEMPTIVE PRIORITY. ALGORITHM:

PNo	Priority	AT	BT
1	2	0	4 3
2	4	1	2 1
3	6	2	5 2
4	10	3	6 4 3
5	8	4	X
6	12 Highest Priority	5	4 0
7	9	6	6

Priority Queues = Heap



Pre-emptive become non-preemptive if all processes is in ready queue

Starvation: Problem.

Aging (Pre-emptive Counter)

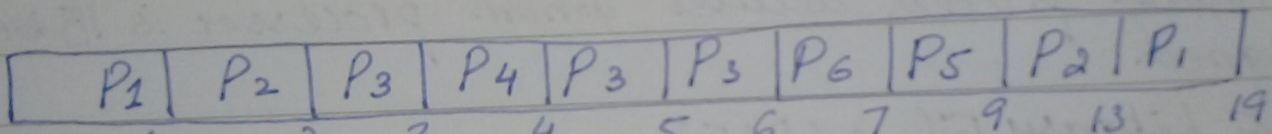
Date

SHORTEST REMAINING TIME FIRST (SRTF)

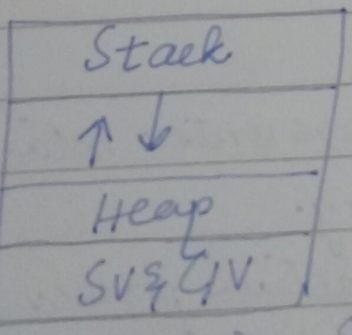
Pre emptive version of SJF

P No	AT	BT
1	0	~~7~~ 6
2	1	~~5~~ 4
3	2	~~3~~ ~~2~~ 1
4	3	~~1~~ 0
5	4	2
6	5	~~1~~

When all the process are in the ready Queue it will become SJF



A Process is THREADS



Address Space → Same
Register's are different
but Stack is different
Thread is unit of work