Name → Suyash Jain
Course → BTech CSE
Roll No. → 2301010249

Operating System Assignment 01

Q1.

Ans → Even with advanced hardware, OS is essential for resource management (CPU, memory, I/O). It provides abstraction, multitasking; security and ensure programs can run safely and efficiency.

Q2.

Ans → A real-time embedded OS is best because the device needs quick and predictable response, low power usage, and small footprint.

Q3

Ans → Avoid microkernel, as frequent inter-process comminication adds overhead. Monolithic or layered gives better raw performance.

Q4 →

Ans → Yes, Structure impacts perfomance, maintainability, and fault isolation. For example, micro-kernal is secure but slower, monolithic is faster but less reliable.

Q5.

Ans → If PCB stores registers, PC and state → errors show misinitialized values.

(ii) Content switch = saving current process state, updating PCB, loading new state.

(iii) Mid-execution I/O allocation usually needs non-blocking call so process continues running.

Part - B

Que 6.

Ans a) Total content switching time;

save state = 2ms
Load State = 3 ms
Schedular overhead = 1ms

Total time = 2+3+1 = 6ms.

b)

- ★ Content switching is pure overhead (no useful work is done during this time).
- ★ Higher switching time reduces CPU efficiency, as more time is spent switching than executing process.

Que 7

Ans. Execution time estimate:

In ideal conditions (perfect parallelism, no overhead):

$$T_{multi} = \frac{T_{single}}{n} = \frac{40}{n} \text{ second.}$$

Single-thread = 40 sec.
With 2 threads under ideal condⁿ = $\frac{40}{2}$ = 20 sec.

* Multithreading allows overlapping of I/O and computation, untilizing multiple cores and reducing waiting time, though in practice overhead reduces perfect gains.

Que 8.

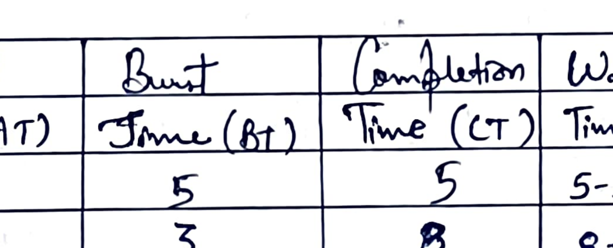
Process :	P1	P2	P3	P4
Burst time :	5	3	8	6

a) FCFS

Process	Arrival time (AT)	Burst Time (BT)	Completion Time (CT)	Waiting Time (WT)	TAT
P_1	0	5	5	5-5 = 0	5-0 = 5
P_2	0	3	8	8-3 = 5	8-0 = 8
P_3	0	8	16	16-8 = 8	16-0 = 16
P_4	0	6	22	22-6 = 16	22-0 = 22

WT = Turnaround - Burst (TAT - BT)
TAT = Completion - Arrival (CT - AT)

Grantt Chart

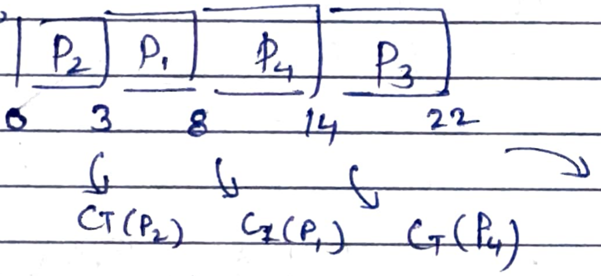


Avg waiting time = (0+5+8+16)/4 = 7.25 ms
Avg turnaround time = (5+8+16+22)/4 = 12.75 ms

(b) Non-premptive SJf

Process	AT	BT	CT	WT	TAT
P_1	0	5	8	8-5 = 3	8 = 8-0
P_2	0	3	3	3-3 - 0	3 = 3-0
P_3	0	8	22	22-8 = 14	22 = 22-0
P_4	0	6	14	14-6 = 8	14 = 14-0

Gantt Chart,

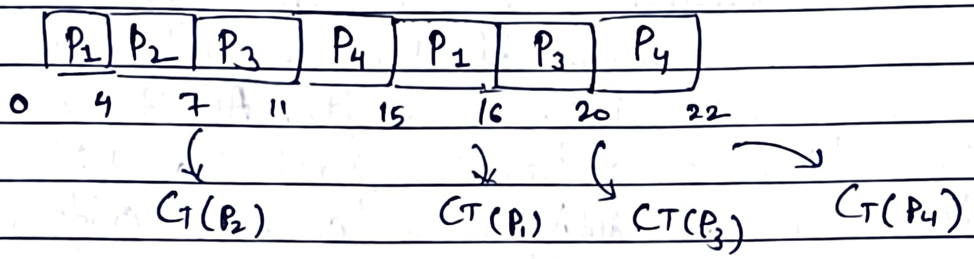


Avg waiting time = (3+0+14+8)/4 = 6.25 ms
Avg turnaround time = (8+3+22+14)/4 = 11.75 ms

(c) Round Robin (quantum = 4ms)

Process	AT	BT	CT	WT	TAT
P_1	0	5	16	16-5 = 11	16-0 = 16
P_2	0	3	7	7-3 = 4	7-0 = 7
P_3	0	8	20	20-8 = 12	20-0 = 20
P_4	0	6	22	22-6 = 16	22-0 = 22

Grant Chart,



Avg waiting time = (11 + 4 + 12 + 16) / 4 = 10.75 ms
Avg turn around = (16 + 7 + 20 + 22) / 4 = 16.25 ms

⇒ SJF gives lowest waiting and turnaround times, while RR improves fairness for interactive takes.

Que 9.

Ans. → (i) Cloud migration:

For a virtualized cloud, a microkernel is suitable since it separates core services and provides better Security and scalability. Virtual machies (VMs) add isolation by running multiple OS instance on the same hardware They also support resource sharing, load balance and living migration.

(ii) Smart home system:

Her, many IOT devices run together. The OS uses priority scheduling and IPC so urgent tasks like intrusing detection get

CPU immediately, while low-priority scheduling and IPC so urgent takes like intrusion detection get CPU immediately, which low-priority tasks like lighting wait. Algorithms such as EDF (Earliest Deadline first) or RMS (Rate Monotonic Scheduling) can ensure critical tasks meets their deadlines without starving background process.