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Subject :- Operating System
Course:- B.Tech CSE-D

Assignment-1

Qu1 Despite the evolution of hardware, why do modern system still rely heavily on operating system?

sol. Even though hardware has advanced, users and applications can't directly interact with it. The OS provides abstraction, resource management, process scheduling, security and multitasking system, making usable and efficient. Without an O.S. programming and running application would be extremely complex.

Qu2 sol A Real-Time operating system (RTOS) is most suitable. Such devices needs quick and predictable response (e.g. detecting abnormal heartbeat instantly). RTOS ensures low latency, reliability and time-bound execution, which are critical for health monitoring.

Qu3 I would avoid a ~~non~~ monolithic kernel. Although fast it lack modularity has poor fault isolation, and debugging errors is harder. A crash in one service can bring ~~is~~ down the whole system which is not acceptable in performance-critical environment. Micro kernel or layered design is more secure and maintainable.

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Que 4 sol

This claim is false. OS structure affects security, reliability, efficiency and scalability. A poorly structured OS may run processes but will face performance issue, debugging difficulties, and weak security.

For eg - microkernel, improves modularity and fault isolation compared to monolithic.

Que 5 sol

(i) PCB Analysis:- PCB stores registers, program counter and process state. If registers stated are mins intialized, error during context switch can be traced here.

(ii) Context switching:- Involves saving CPU state (registers, program counter, memory mapping) of running process and loading the state of next process.

(iii) System call type - for I/O allocation mid-execution, non-blocking asynchronous system call are preferred. They allow the process to continue without waiting for I/O completion, improving efficiency.

Que 6

Save = 2ms, Load = 3ms, Schedule = 1ms
Total = 6 ms

Impact → Frequent switching increases CPU overhead, reduces time available for actual execution, and may degrade multitasking performance.

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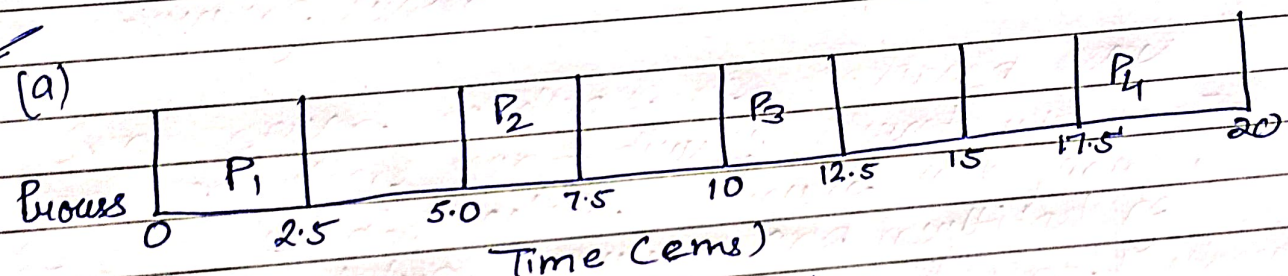
Qu7 Thread Efficiency Chart

- Single-threaded = 40 sec
  with 4 threads → Execution time = 40/4 = 10s

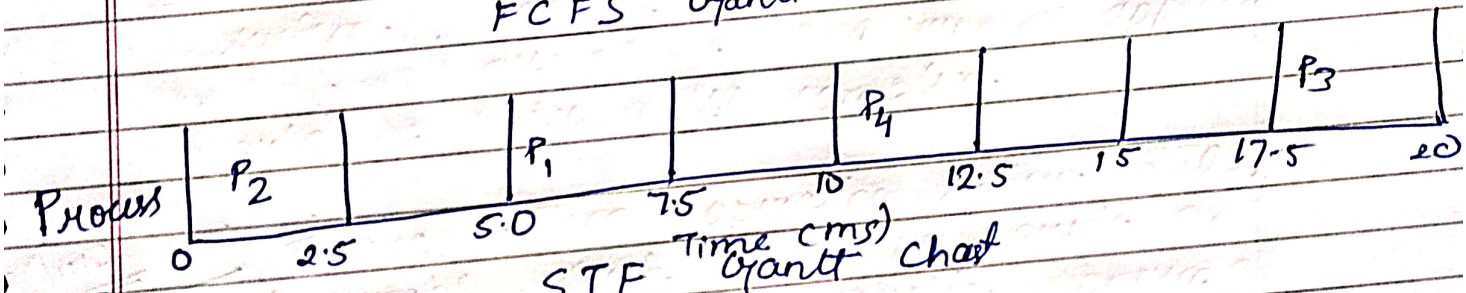
→ Multithreading allows parallel execution on multiple cores, reduces idle CPU time during I/O waits, and increases throughput.

Qu8

(a)



FCFS Gantt Chart



SJF Gantt Chart

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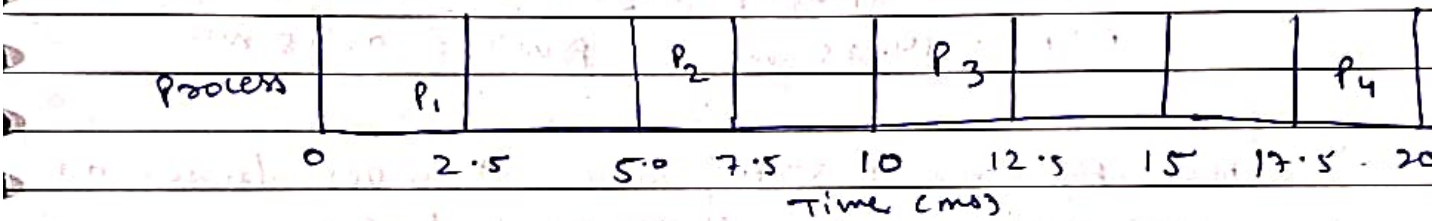
Q-7 Thread Efficiency Check

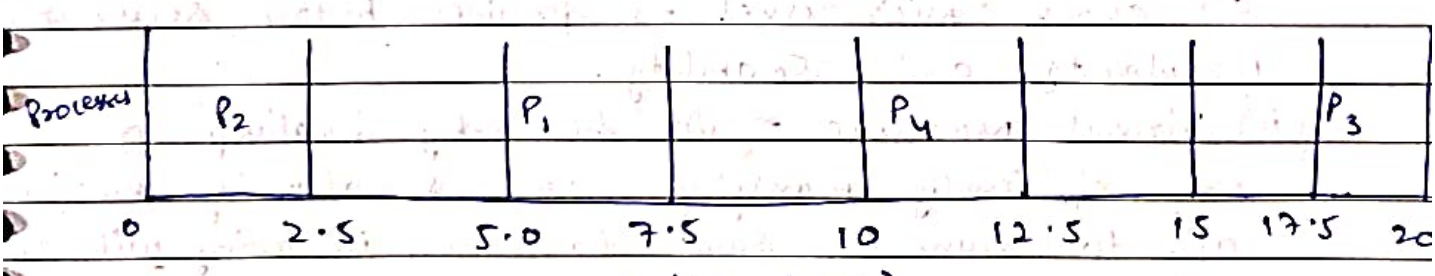
- Single - threaded = 40 sec
  with 4 threads → Execution time ≈ 40/4 = 10s

→ Multithreading allows parallel execution on multiple cores, reduces idle CPU time during I/O wait, and increases throughput.

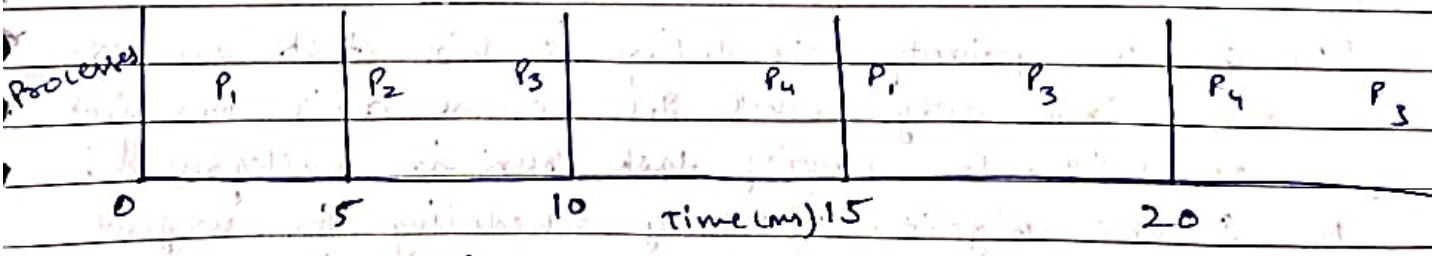
Q-8 (a)



FCFS Gantt Chart



SJF Gantt chart



Round Robin (Q = 4) Gantt Chart

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(b) FCFS

Order : $P_1 \rightarrow P_2 \rightarrow P_3 \rightarrow P_4$

ATAT = 13 ms, AWT = 7.75 ms

SJF (Non-preemptive)

Order : $P_2 \rightarrow P_1 \rightarrow P_4 \rightarrow P_3$

ATAT = 12 ms AWT = 6.5 ms

Round Robin (Q=4) ms

Order : $P_1 \rightarrow P_2 \rightarrow P_3 \rightarrow P_4 \rightarrow P_1 \rightarrow P_3 \rightarrow P_4 \rightarrow P_3$

ATAT = 14.25 ms AWT = 9.25 ms.

(c) Best Algorithm : SJF, since it gives lowest average waiting and Turnaround time.

Q-9 (i) Cloud Migration.

(a) choose microkernel → provides better security, modularity and scability.

(b) Virtual machine – It help by isolating applications, efficiently managing resources, allowing multiple O.S. to run on same hardware, improving utilization tolerance.

(ii) Smart Home System.

(a) OS use priority Scheduling so high task are executed immediately while IPC ensure device communicate efficiently. Low priority task run in background.

(b) Suitable Algorithm : Priority Scheduling for urgent tasks, combined with Round Robin for fair CPU sharing among less critical task. This ensure responsiveness and efficiency.