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Assignment-1

A-1 Modern systems use operating systems for core functions - managing hardware, providing a software interface, ensuring security and supporting multitasking.

A-2 A real-time operating system (RTOS) would be ideal as it guarantees timely, predictable responses critical for health monitoring. It ensures low power consumption.

A-3 I would avoid using a monolithic kernel. Although its fast, its lack of modularity risks system crashes due to bugs in any single component making it harder to maintain.

A-4 I refute this claim, OS structure does matter. Modularity and abstraction enhance stability, maintainability and performance. Poor structuring can cause system wide crashes, increase overhead and impact scalability.

A-5 (i) Analysing the PCB checks registers, states and pointers revealing misinitialized values and context switch bugs.

(ii) When a process moves unexpectedly, context switching saves the running state and loads the waiting process state and loads the waiting process state.

(iii) For mid-allocation execution allocation of I/O resources, non blocking synchronous system calls will allow the process ~~will allow~~ without stalling the scheduler.

A-6)

a) Total context switching time = 2+3+1 = 6 ms

b) Frequent context switching increases overhead, reduces effective CPU time and degrades multitasking performance.

A-7) Single threaded time = 40 s

Execution time = $\frac{40}{n}$

For max efficiency, maximum threads

$\frac{40}{2} = 20$ s, $\frac{40}{4} = 10$ s, $\frac{40}{10} = 4$ s, $\frac{40}{20} = 2$ s, $\frac{40}{40} = 1$ s

Multithreading improves CPU utilization, parallelizes independent tasks, hides IO latency which boosts overall throughput.

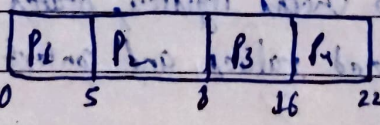
A-8

a) b)

Process	AT	BT	CT	TAT	WT
P_1	0	5	5	5	0
P_2	0	3	8	8	5
P_3	0	8	16	16	8
P_4	0	6	22	22	16

FCFS

FCFS ⇒



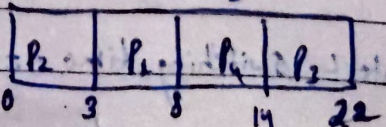
Avg TAT = $\frac{5+8+16+22}{4} = \frac{41}{4} = 10.25$ s

Avg WT = $\frac{0+5+8+16}{4} = \frac{29}{4} = 7.25$ s

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

SJF

SJF ⇒



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Avg TAT = $\frac{8+3+22+14}{4} = \frac{47}{4}$ 11.75

Avg WT = $\frac{3+0+14+8}{4} = \frac{25}{4}$ 6.25

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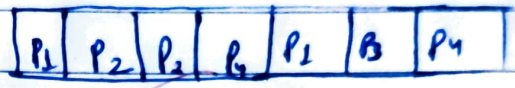
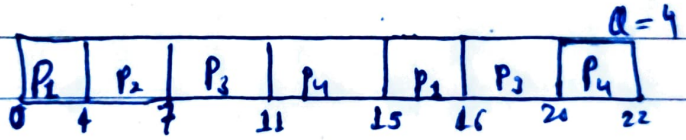
Processes	AT	BT	CT	TAT	WT
P_1	0	5	16	16	11
P_2	0	3	7	7	4
P_3	0	8	20	20	12
P_4	0	6	22	22	16

Round Robin => Ready Queue



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



Avg TAT = $\frac{16+7+20+22}{4} = \frac{65}{4} = 16.25$ s

Avg WT = $\frac{11+4+12+16}{4} = \frac{43}{4} = 10.75$ s

c) Non preemitive SJF best balances throughput & turnaround by minimizing average waiting and turnaround times due to optimal ordering of burst times.

Q9.

Ans. (a) We will use a microkernel or layered OS architecture. Microkernel isolates core functions, securing critical services while layered modularizes services management for cloud environments.

b) ~~Frequent context switching~~

b) Virtual Machines provide isolation, better resource control and enable flexible service deployment and scaling during migration.

(ii)
Ans.

a) OS ensures high priority tasks preempt lower priority tasks, uses priority or preemptive scheduling.

b) Algorithms like priority scheduling can be suitable for this scenario.