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Ans-1 Modern system still rely heavily on OS because they manage and coordinate hardware resources like CPU, memory & I/O devices, ensuring efficient performance. They also provide a user friendly interface and overhall can interact with hardware easily without needing to handle low level details.

Ans-2 Real-Time operating system :
RTOS ensure timely, Predictable, and reliable response to inputs like heart rate signals process data with low latency, provide efficient resource management on small for health monitoring devices.

Ans 3 Avoid a monolithic kernal, while it give fast system calls, they lack ~~mostly~~ modularity and are harder to maintain. A bug in one service can crash the whole system, making them unreliable for critical system.

Ans 4 Refute the claim, because OS structure directly impacts performance, reliability, scability and security
For ex -> microkernel isolate services for fault tolerance, while or layered structure improves maintainability.

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Ans 5 (i) The PCB store CPU registers, program counter, state, and memory info. By examining it, we can direct misinitialized register, wrong state flags that causes

(ii) when a task unexpectedly moves from running to waiting. context switching saves the current process state and loads the state of the next process.

(iii) use an asynchronous, non-blocking system call because this allow the process to continue execution while the I/O is allocated in the background, preventing the CPU from idling.

Ans 6 • ~~Context~~ Higher switching time reduce CPU efficiency, as more time is spent switching than executing processes

• context switching is pure overhead (no useful work is done during time)

• In multitasking, frequent context switches with high overhead can slow down through put and increases response time.

Ans 7 Execution time (single-threaded) = 40 sec
multithreading is use with n threads per

Execution time estimate:
In ideal condition:

$$T_{multi} = \frac{T_{single}}{n} = \frac{40}{2} \text{ sec.}$$

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Example
if n=2 -> 20 sec
if n=4 -> 10 sec
if n=8 -> 5 sec

Ans 9 (i) cloud migration
a) OS architecture
-> Microkernel - Secure, scalable, modular
b) VMs Help:
-> Provide isolation, easy management and resources optimization.
(ii) smart Home system
(a) OS use:
-> scheduling for priorities, IPC for first communication
(b) Algorithms:
-> RMS, ~~DES~~, EDF, multilevel Queue -> real-times, efficient task handling.