Operating System

Date

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Assignment - 01

Ques 1.

Ans. Because Os oprovides essential services that hardware alone cannot, like process scheduling, memory management, I/O handling Security, and user interface. Even with advanced hardware, an OS is needed to manage resources effient and make the system osable by applications $ users.

Ques 2.

Ans. A Real Time operating system (RTOS) is most Suitable because it provides fast and predictable response to time-critical events like hearts rate monitoring Reliability, low power usage and quick task switching are crucial in health devices.

Ques 3.

Ans. I would avoid a Layered Kernel because the strict layer hierarchy increases overhead (each request passed through multiple layers), which reduces performance. for performance critical environment

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Ques4.

Ans. Refute: OS structure affects performance, security, scalability and maintainabily for eg, a monolithic OS may be faster but harder to maintain, while a microkernel is more modular and secure but slightly slower.

Ques5.

Ans. (i) PCB stores process state, program counter, CPU registers, memory info, etc, by checking PCB values, we can detect if registers or process states were incorrectly saved or restored during context switching.

(ii) Context switching saving the current process state (registers, program counter etc) onto its PCB and loads the state of next process from its PCB, switching CPU control to the waiting process.

(iii) Use a non-blocking asynchronous system cell, because the process can continue exeution without waiting for I/O TO finish, improving performance and responsiveness.

Ques6.

Ans. Given :-

- save state = 2 ms
- load state = 3 ms
- scheduler overhead = 1 ms

(a) Total context switching Time = Save time + Load Time + Scheduler overhead

= 2 + 3 + 1 = 6 ms

(b)

- Context switching introduces overhead since CPU spend time switching instead of executing user process
- If switching takes too long or happens too frequently, CPU efficiency decreases.
- In this case, 6 ms is small compared to execution times, so the system can still multitask efficiently. But ~~with~~ many processes, frequent switching will reduce throughput.

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Ques7.

Ans· Thread Efficiency check

- Total time in single- Threaded = 40 sec
- 8 threads per process (Ideal conditions)

(a) Execution Time (with 8 threads) = $\frac{40}{8}$ = 5 sec.

(b) • Multithreading divides a process into smaller tasks (threads) that run in parallel.

• It reduces execution times by utilizing multiple CPU cores.

• Improves CPU utilization, responsiveness and throughput.

Ques8.

Ans. (a) Gantt charts

1. FCFS (First come first Serve)
   Order: P1 → P2 → P3 → P4

• Grantt chart
0-5 (P1) | 5-8 (P2) | 8-16 (P3) | 16-22 (P4)

2. Non-preemptive SJF
   Order by burst: P2(3) → P1(5) → P4(6) → P3(8)

- Gantt chart:

  0-3(P2) | 3-8 (P1) | 8-14 (P4) | 14-22(P3).

3. Round Robin
   - step 1: P1 (0-4), P2 (4-7), P3 (7-11), P4(11-15)
   - step 2: p1 (1ms left: 15-16), P3(4 ms left: 16-20), p4 (2 ms left: 20-22), P3(last 2ms:22-24)

- Gantt chart:

0-4(P1)
4-7 (P2)
7-11 (P3)
11-15 (P4)

15-16 (P1)
16-20 (P3)
20-22 (P4)
22-24 (P3.)

Ques 9.

Ans. (i) Cloud Migration

(a) • Micro Kernel architecture is best:
- Minimal Kernel reduces attack surface (more secure).
- Services run in user space (easily scalable, modular).

(b) • Provide isolation (each VM runs independently)
- Simplify management (snapshots)
- Enables resources optimization (multiple VMs on one physical server.

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(ii) Smart Home IOT System

(a) ◦ Uses process scheduling to priotize urgent tasks (eg. ~~insti~~ intrusion detection)

◦ IPC ensures fast coordination b/w process/ devices.

◦ High - priority tasks handled immediately low priority tasks scheduled efficiently.