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Operating System Assignment - 1

Part A

Ques 1. Despite ---------- Systems?

Ans :- Modern Systems still rely heavily on operating Systems because :-

- Resource management :- The OS efficiently manages hardware resources (CPU, memory, storage, I/O devices) and allocates them to different programs.
- User & Application Interface :- The OS Provides a Convinent interface between hardware and users/applications, enabling, Portability, multitasking and Security.

Ques (2) You ---------- why?

Ans :- Real time operating System (RTOS)
RTOS :- ensures timely, Predictable and reliable response to inputs like heart rate signals Processes data with low latency efficient resource management on Small, low - power hardware - Critical for health monitoring devices.

Ques (3) Given ---------- why?

Ans :- Avoid a monolythic kernal, while it give fast System Calls they lack

modularity and are harder to main tain/ debug. A bug in one Service can Crash the Whole System, making them Unrealable for Critical Systems.

Qus(4) A developer _____ reasoning.
Refute the Claim, because Os Structure directly impacts performance, readiability, Scalibality and Security.
for ex.:- Microkernel isolates Servies for fault tolerance, while a layered Str. improves maintainability. Just "running Processes" isn't enough if the System is low, Unsecure or Unstable.

Qus(5)
(i) Explain _____ States.
The PCB Stores CPU registers, Program Counter, State and memory info. By examining it, we can detect misinitialized register, wrong State flags, or incorrect Program Counter values that Cause faulty Switching.

(ii) If a _____ involve?
When a task unexpectedly moves from running to waiting, Content switching Saves the Current Process State (registers, Program Counter, PCB Updates and load the State of the State of the next Process. It ensures execution resumes Correctly later.

(iii) The ------ and why?
Use an asynchronous, non-blocking System Call because this allows the process to continue execution while the I/O is allocated in the background, preventing the CPU from idling.

Part-B

Qus (6) Content _____ Performance.

(a) Total Content Switching time,
Save State = 2ms
load State = 3ms
Schedular Overhead = 1ms

Total time = 2+3+1 = 6ms

(b) Explain _____ Performance.

- Content Switching is Pure overhead (no useful work is done during this time).
- Higher Switching time reducing CPU efficiency, as more time is Spent Switching then exciting Processes.
- In Multitasking, frequent Content Switches with high overhead can Slow down throughput and increase response time.

Qus (7)

Given:- excecution time (signal - threaded) = 40sec
Multithreading is used with n threads per process

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Execution time estimate:-
In ideal Conditions (Perfect parallelism, no overhead):

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

Example:-

if $n=2 \rightarrow 20$ sec
if $n=4 \rightarrow 10$ sec
if $n=8 \rightarrow 5$ sec

How multithreading improves performance.

- It improves performance by running tasks in parallel, reducing executing time.
- It keeps the CPU busy even during I/O waits, avoiding idle time.
- Threads share resources, making execution faster and more efficient.

Qus (8) Given _____ times.

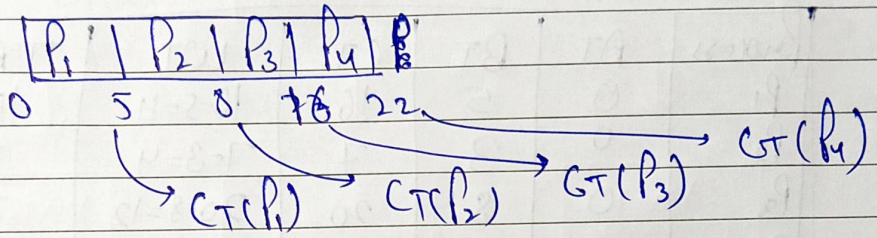
Process:	P_1	P_2	P_3	P_4
Burst time:	5	3	8	6

(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



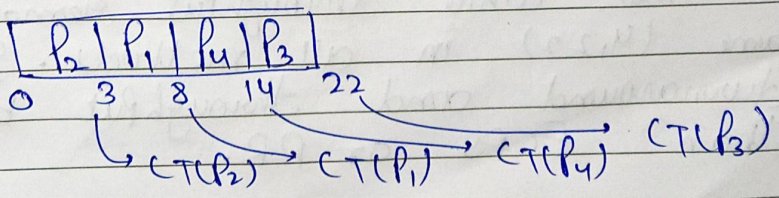
Avg. waiting time = (0+5+8+16) / 4 = 7.25 ms
Avg. turnaround time = (5+8+16+22) / 4 = 12.75 ms

(b) Non- Premitive SJF :-

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

TAT = CT-AT
WT = TAT - BT

Grantt Chart,



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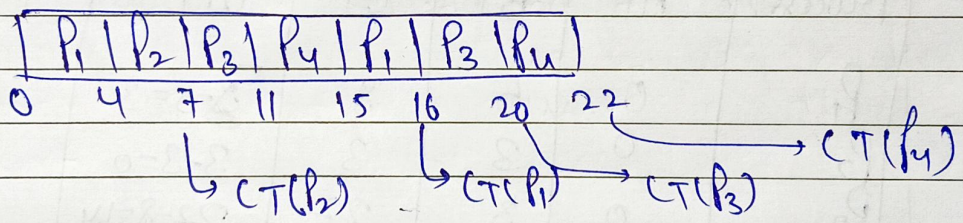
Avg. waiting time = (3+0+14+8)/4 = 6.25ms
Avg. turnaround time = (8+3+22+14)/4 = 11.75ms

(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

WT = TAT − BT
TAT = CT − AT

Grantt Chart



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

* Non-Primitive SJF is best because it gives the lowest avg waiting time (11.75ms) while throughput remains the same (4,22) in all methods. It balances turnaround and throughput better than FCFS or RR.

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Qus ⑨ (i) Virtualized Cloud Migration.

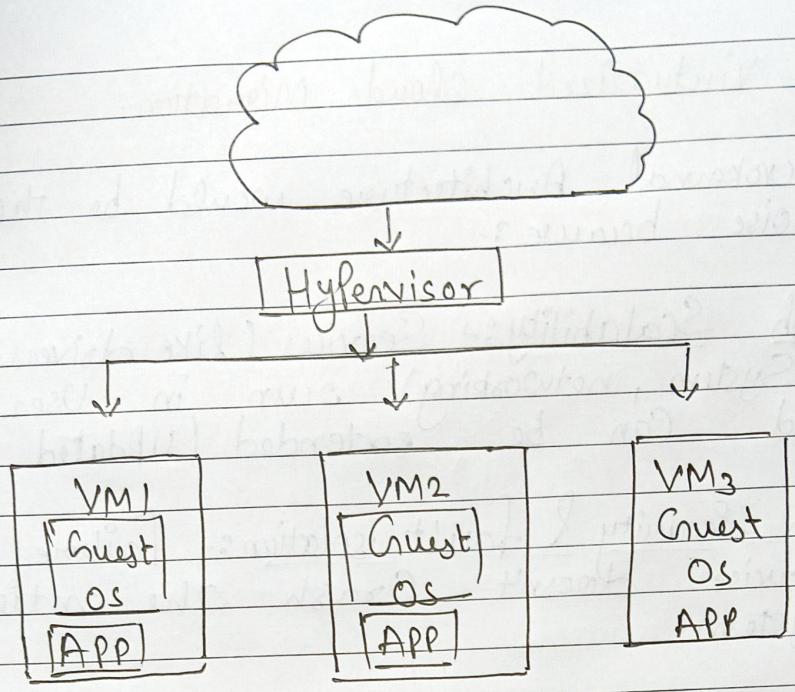
(a) Microkernal Architecture would be the best Choise because :-

High Scalability :- Services (like drivers, File System, networking) run in User Space and Can be extended / updated easily.

High Security & fault isolation :- failure in one Service doesn't Crash the entier System.

(b) Role of Virtual Machines in Migration

- Isolation :- Each VM run its own OS, preventing one Service failure or attack from affecting others.
- Management :- VMs Can be created paused, or migrated dynimacally across Services for load balancing.
- Resource Optimization :- Hypervisor allocates, CPU, Memory, and I/O efficiently among VMs, ensuring better utilization and reducing wastage.



(ii) Smart Home System (IoT devices)

(a) OS role with Scheduling + IPC

- Process Scheduling → The OS assign higher priority to critical tasks. So they preemt less urgent ones (like lighting).

- Inter-Process Communication (IPC):- Enables devices and Controller Processes to exchange data quicky (eg: Camera, Seeds motion.
  alert → Controller Process reacts immediately)