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B.Tech CSE - D

Operating System Assignment 01

(Q.1) Despite ---- Systems?

(Ans.1) 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 & Applications Interface :- The OS provides a convenient interface b/w hardware and users/applications, enabling portability multitasking and security

(Q2) You ----- why?

Real time operating System (RTOS)

RTOS ensures timely, predictable and reliable response to inputs like heart rate signals processes data with low latency, provide efficient resource management on small, low-power

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hardware critical for health monitoring devices

(Qs) Given ---- why?

Avoid a monolithic kernal, while it give fast System calls, they lack modularity and are harder to maintain /debug. A bug is one service can crash the whole system, making them unreliable for critical systems

(Or) A developer ---- reasoning

Ans Refute the claim, because as structure directly impacts performance, mediability, scability and security.

for eg:- microkernal isolates services for fault tolerance, while a layred structure improves maintainability, Just "running"

(Qs)

i) Explain ---- states.

The PCB stores CPU registers, program counter, state, and memory info.. By examining it, we can detect misinitialized registers, wrong state flags, incorrect program counter values that cause fault switching

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(ii) (a) A of a ---- involves

When a task unexpectedly moves from running to waiting, context switching saves saves the current process state (registers, program counter, PCB updates) and loads the state of the next process.

(b) Context ---- ~~prog~~ performance

a) Total context switching time,
Save state = 2ms
Load state = 3ms
Schedulen overhead = 1ms

Total time = 2+3+1 = 6ms

b) Explain ---- performance

- context switching is pure overhead (no useful work is done durning this time)
- Higher switching time reduces CPU efficiency as more time is spent switching then executing process
- In multi tasking, frequent conduct switches with high overhead can slow down throughput and increase response time

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(Q7) execution time (single - threaded) = 40 sec
multi threading is used with n threads per process

Execution time estimate:
In idol condition (perfect parall time, no overhead):

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

Example:

if n = 2 → 20 sec
n = 4 → 10 sec
n = 8 → 5 sec

How multi threading improves performance

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

(or) Given - - - - times

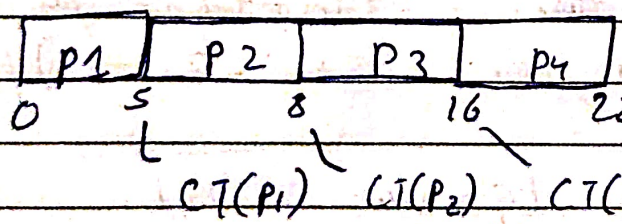
Process :	P1	P2	P3	P4
Burst time :	5	3	8	6

a) FCFS

Process	Arrival time (AT)	Burst time (BT)	completion time (CT)	Waiting time (WT)	TAT
P1	0	5	5	5-5=0	5-0=5
P2	0	3	8	8-3=5	8-0=8
P3	0	8	16	16-8=8	16-0=16
P4	0	6	22	22-6=16	22-0=22

WT = Turnaround - Burst (TAT - BT)
TAT = completion - Arrival (CT - AT)

Gantt chart



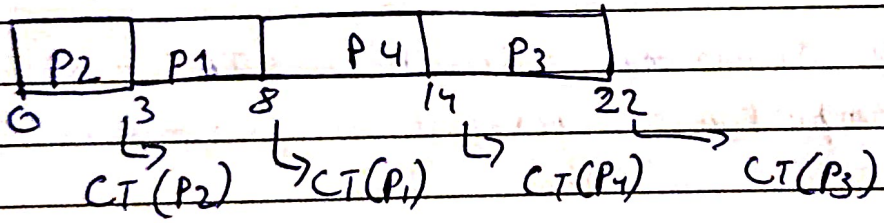
Avg waiting time = (0+5+8+16)/4 = 7.25ms
Avg turnaround time = (5+8+16+22)/4 = 12.7ms

(b) Non-preemptive SJF

Process	AT	BT	CT	WT	TAT
P1	0	5	8	8-5=3	8=8-0
P2	0	3	3	3-3=0	3=3-0
P3	0	8	22	22-8=14	22=22-0
P4	0	6	14	14-6=8	14=14-0

TAT = CT - AT
WT = TAT - BT

Grantt chart,



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
P1	0	5	16	16-5=11	16-0=16
P2	0	3	7	7-3=4	7-0=7
P3	0	8	20	20-8=12	20-0=20
P4	0	6	22	22-16=16	22-0=22

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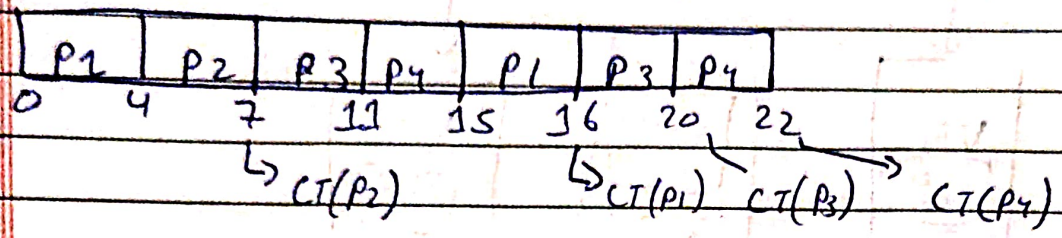
$WT = TAT - BT$
$TAT = CT - AT$

Gantt chart,

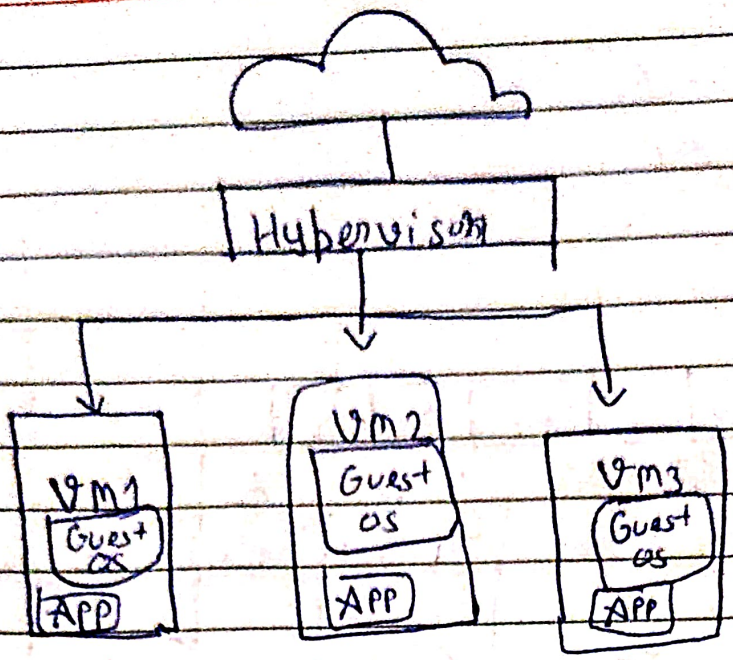


Avg waiting time = $(11 + 4 + 12 + 16)/4 = 10.75$ ms
Avg turnaround = $(16 + 7 + 20 + 22)/4 = 16.25$ ms

(Q9) i) Virtualized cloud Migration

(a) Microkernal Architecture would be the best choice because,

High scalability → services (like driver, file systems, networking) run in user space and can be extended / updated easily
High security & fault isolation → failure in one service doesn't crash the entire system.



(ii) Smart Home System (IoT devices)

(a) OS role with scholduting + IPC

- Process scheduling ⇒ The OS assigns higher prioriity to critical tasks (eg. intrusion detection) so they prempt less urgent ones (like lighing)
- Inter-process communcication (IPC) → Enables devices and controller processes to exchange data quickly (eg: camera sends motion alert → controller process reacts immediatly)