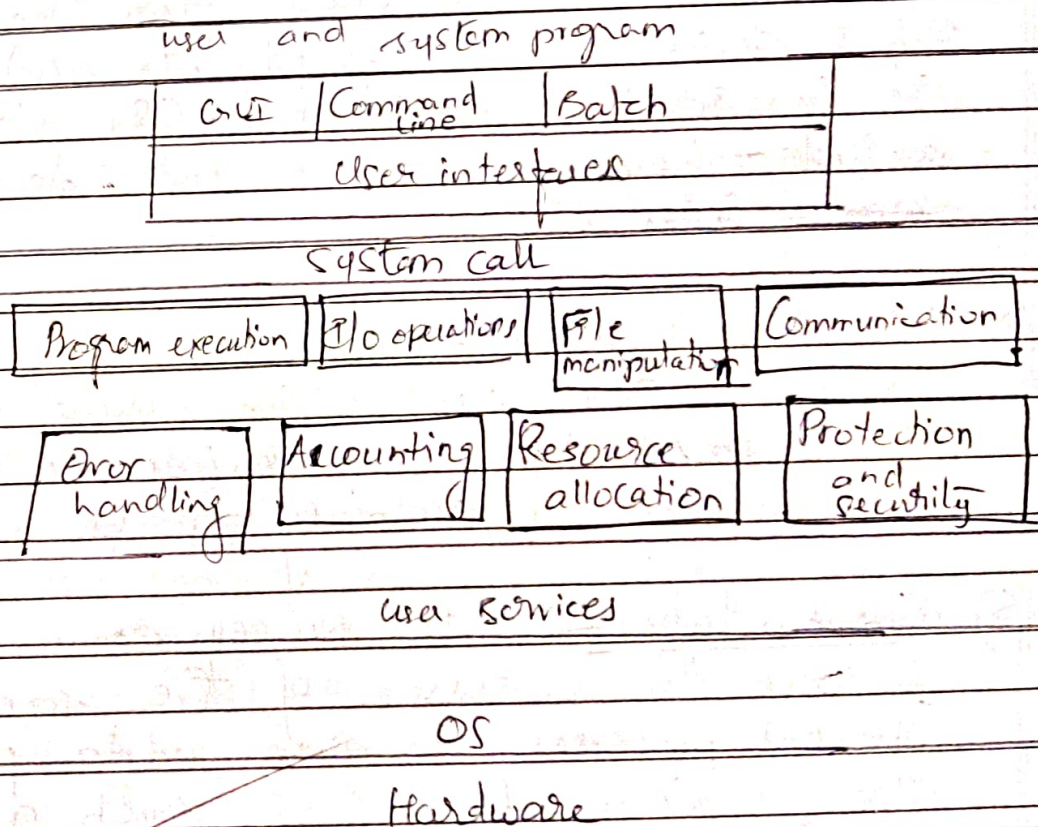


12/1/24

Internals-01Module-01Question-01

- 1a.) OS system (Operating system) is a intermediary between the user and hardware. It controls and coordinates hardware and allows smooth execution of user programs



* Diagram for services of OS

The services of OS:-

- 1) User-interface - It is a means of communicating with the ^(OS) hardware for the user. The various user interfaces depending on system operating systems include Graphical user interface, Command line arguments (etc), batch arguments.
- 2) Program execution - The program must be loaded by OS to RAM and it must be created, executed and then terminated either normally or abnormal.
- 3) P/O operations:- The data from the input or output devices is transferred to and from the system via the services provided by OS. Input devices include - keyboard, etc output devices include - printer etc.
- 4) File Manipulation - Programs require to create file and read and write data onto it or from it respectively. The services to file creation and deletion are provided by the OS.
- 5) Communication - Inter Process Communication i.e. between the processes of the same processor or different processes is made possible by the services of the OS such as system shared memory, message passing. Message passing is difficult to implement with few system calls but is efficient than simpler shared memory with many system calls.

- 6) Resource allocation - The resources must be allocated adequately to multiple tasks at the same time which is implemented as a service by OS.
- 7) Error handling - The errors such as ^(such as printer not having enough sheet / arithmetic overflow) must be detected and handled accordingly.
- 8) Accounting - OS keeps a track of the system activity or the amount of resources allocated for the purpose of billing.
- 9) Protection and security - The systems are provided with limited / controlled access to the non-privileged users and security is provided by setting up strong passwords.

1b) i) Multiprocessing systems
 → Multiprocessing systems consists of 2 or more processors working in tandem sharing a common bus and other peripherals / peripherals
 → It has local storage

→ These systems have less scalability due to shared devices / peripherals / resources

Clustered Systems

→ Clustered system involve 2 or more individual showing communication via a network.

→ It has storage-area-network (SAN) so computers can share memory even when separated by miles.

→ These system have higher scalability as nodes add to cluster

Multiprocessing Systems

→ Have low fault tolerance since they have shared resources (single point of failure)

→ Communication via shared memory

Clustered System

→ Have high availability of services (high fault tolerance) due to distributed resources.

→ Communication via message passing.

1b (ii)

Multiprogramming

→ ~~The task~~ When 2 or more processors are executed in the same processor (in parallel) at the same time

→ No user-interaction is provided

→ The concept used here is context swapping / switching

→ Goal is to keep the CPU as busy as possible and never idle

→ Used in batch processing where limited user interaction is ~~not~~ needed

Multitasking

→ When 2 or more processes at same time in different processors

→ The concept of time sharing provides for user interaction

→ The concept used here is time sharing

→ Goal is to provide a responsive environment to user interactions

→ Used in responsive, user interactive environment

Module - 02

Question 4

Process	Arrival Time (AT)	Burst time (BT)	Waiting Time (WT)	Turnaround Time (TAT)
P ₁	0	9	0	9
P ₂	1	4	9	13
P ₃	2	9	13	22
P ₄	3	5	22	27

P_1	P_2	P_3	P_4
0	9	19	22
			27

$$\frac{2}{4} = \frac{1}{2}$$

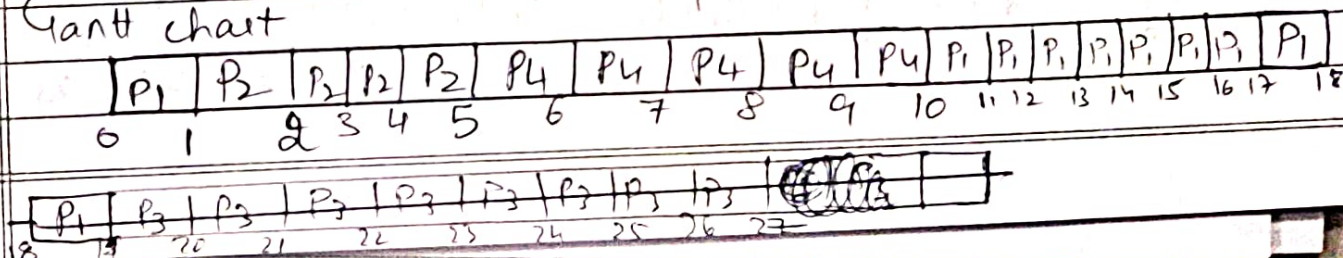
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$$= 17.75 \text{ ms}$$

(iv) SRTF (mode-preemptive)

Process	AT	RT	WT	CT	TAT	TAT
P ₁	0	9	9	18	18	WT = TAT - BT
P ₂	1	4	0	5	4	TAT = CT - AT
P ₃	2	9	16	10 2	25	
P ₄	3	5	2	10	7	

Gantt chart



P ₃	P ₃	P ₃	P ₃	P ₃	P ₃	P ₃	P ₃	P ₃
18	19	20	21	22	23	24	25	26

Average WT = $\frac{9+0+16+2}{4}$

$= \frac{27}{4}$

$= 6.75 \text{ ms}$

Average TAT = $\frac{18+4+25+7}{4}$

$= \frac{54}{4}$

$= 13.5 \text{ ms}$

(ii) Round Robin ($T_q=2$)

Process	RT	AT	CT	WT	TAT
P ₁	9	0	26	17	26
P ₂	4	1	12	7	11
P ₃	9	2	27	16	25
P ₄	5	3	23	15	20

Gantt chart

Ready queue



Running queue

P ₁	P ₂	P ₃	P ₁	P ₄	P ₂	P ₃	P ₁	P ₄	P ₃	P ₁	P ₄	P ₃	P ₁	P ₄	P ₃
0	2	4	6	8	10	12	14	16	18	20	22	23	25	26	27

DDMMYYYY

$$\text{Average TAT} = \frac{26 + 11 + 20 + 20}{4}$$

$$= 20.5 \text{ ms}$$

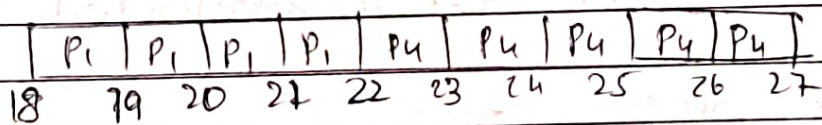
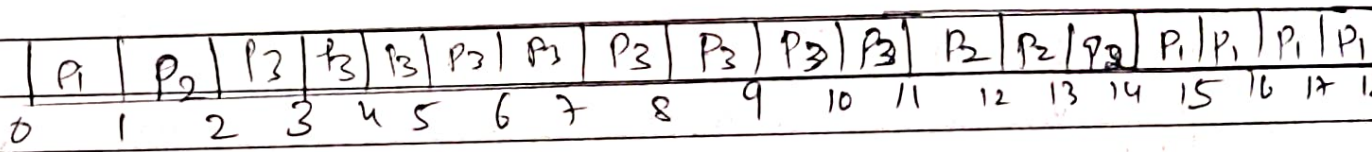
$$\text{Average WT} = \frac{17 + 7 + 16 + 15}{4}$$

$$= 13.75 \text{ ms}$$

(In) Priority (Preemptive)

Priority	Process	AT	BT	CT	WT	TAT
3	P ₁	0	9	22	13	22
2	P ₂	1	4	14	9	13
1	P ₃	2	9	11	0	9
4	P ₄	3	5	27	19	24

Gantt chart



$$\text{Average WT} = \frac{13 + 9 + 0 + 9}{4} = 10.25 \text{ ms}$$

$$\text{Average TAT} = \frac{22 + 13 + 9 + 24}{4} = 17 \text{ ms}$$

4b)

Process

- Process is a heavyweight process. It is an individual unit of execution.
- Process failure does NOT affect rest of process.
- Has resource and memory overhead.
- Separate memory location for each process.

Thread

- Thread is a lightweight process. It is a basic unit of process.
- Failure/Blocking ^{system} call by one thread affects rest of threads in the process same process.
- No Less resource/memory overhead.
- Threads have shared memory space.

Quiz

1. a) fork() ✓
2. b) unable to run until task is completed ✓
3. b) between 2 processes ✓
4. b) Program counter ✓
5. a) 4 ✗