HRM:

memory management.

Q1* Role of virtual memory.
how does OS map virtual address to physical addres
Second chance, LRU, FIFO., Optimal., SCAN

Q. Thrashing? ways to prevent
~~Content switchg with~~

Q. logical & physical address. - diff:
contiguous & non-contiguous memory allocation.

Q Internal & enternal fragmentation.
how enternal combat.
Direct mapping, & Block mapping
Prepasing?
Set page replacement Algo. - workins
TLB? *

Q What is page fault.
what is pre-paging?

Q. Explain working set page replacement Algo
with example.

Q Optimal page replacement have lesser page
fault than FIO. Is this correct? Explain.

Q Draw & Describe memory hierarchy diagram.
How virtual memory increase performance of comp.
system.

One Qstn from theory.
One from Algo (numerical) } 15

Memory

Store programs or data on a temp or permanent basis

Fm

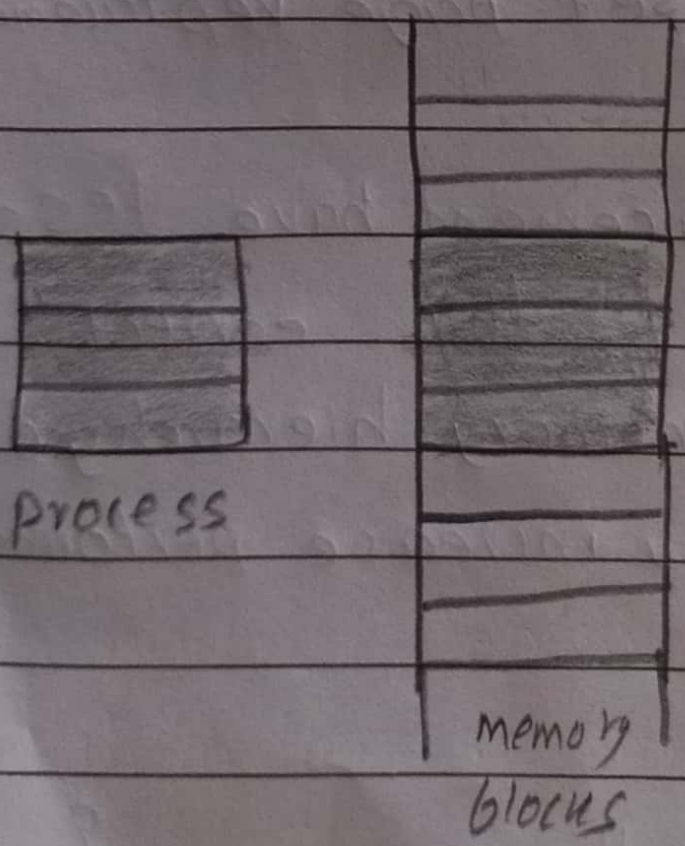
In

Contiguous & Non-contiguous memory allocation.

Contiguous memory allocation.

Contiguous memory allocation is a memory management technique where a process is allocated a single contiguous section of memory based on its size requirement.

It will limit the degree of multiprogramming to the no. of fined partition done in memory



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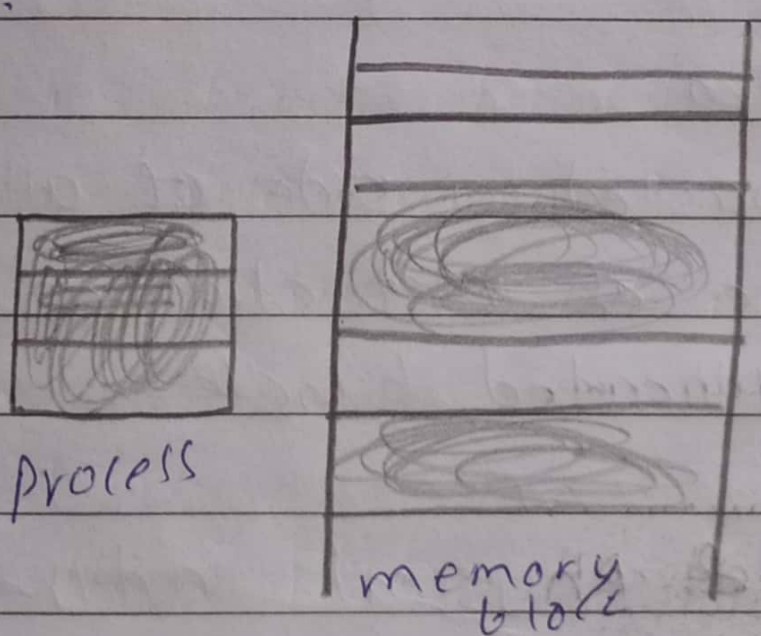
Advantages
Easy to implement
Excellent Read performance

Disadvantages
Fragmentation occur
Difficult to grow file.

Non-contiguous memory allocation.

It is a memory management technique where memory is allocated to a process in multiple disjointed sections rather than a contiguous block.



Advantages
Flexibility
~~Reduced fragmentation~~ Virtual memory support
Security
Disadvantages
Complexity
Potential for thrashing
Overhead.

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Fragmentation.

It is a technique of partition of memory into different blocks or pages while a process are loaded or removed from the memory.

Two types of fragmentation
Enternal & Internal.

Enternal fragmentation.

It happens when a dynamic memory allocation algorithm allocates some memory and small pieces are left over that cannot be effectively used.

Internal fragmentation

the space wasted inside of allocated memory blocks because of restriction on the allowed sizes of allocated blocks.

Logical address & Physical address

Address generated by CPU - logical address. Vir
Address available on memory unit - physical a
Logical address is also known as virtual add

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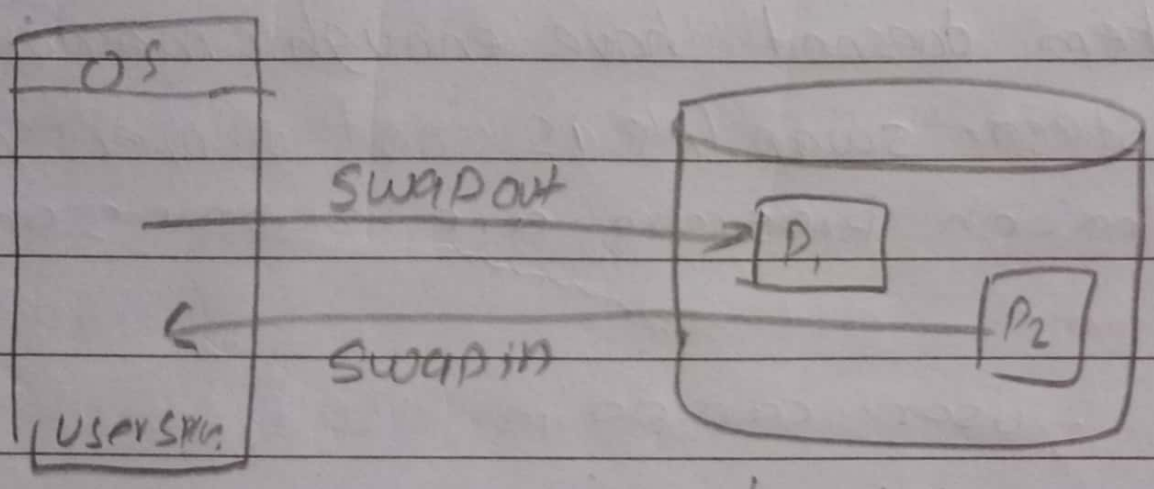
set of all logical addresses generated by a program - logical address space.
set of all physical address corresponding to these logical - ph

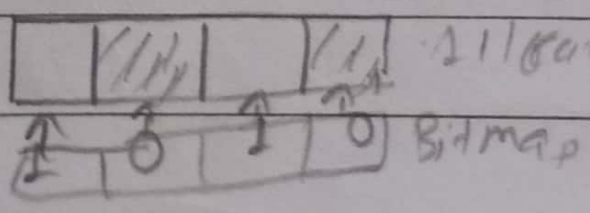
MMU use :- to convert virtual address to physical address.

Swapping
The process of transferring a process from main memory to backing storage & vice-versa.

main - back - swapped out.
back - main - swapped in.



memory with bit maps :- zero = memory free.
one = used.



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Virtual memory

A memory management technique that allows the execution of processes that may not be completely fit in main memory.

Paging

optimal - future

Thrashing

condition in which excessive paging operations are taking place.

any situation in which multiple processes are competing for the same resource

The high paging activity is called Thrashing.

ofte caused when :-

1) system doesnot have enough memory
11 System swap file is not properly configured
too much program are running on comp.

To resolve, usor cando :-

Increase RAM

Decrease amount of program

Adjust size.

Kernel

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Kernel serves as core component of an OS, acting as bridge between application & hardware-level data processing.

kernel is responsible for :-

Process management
Memory management, allocation & I/O.
Device management
System call control,

Types of kernel.
Monolithic kernel, ii) Micro kernel

monolithic kernel

~~Ear~~ There were two approacher for mohol,thic kernel architecture.

~~Mon~~ Traditional Approach.

all basic system services packaged into a single module in kernel space.

Drawbacks :-

huge kernel size,
paor maintainability.

Modern Modular Approach.

'Kernel consist of separate dynamically loadable modules.

modular approach allows easy extention of OS cababilitis.

Enhances maintainability
No need to recompile entire kernel.
Linux follow monolithic modular approach

Microkernels:-
This architecture solve the problem of large kernel in traditional system.
Basic services like:
Device driver,
networking,
file system.
run outside kernel in user space.
This reduces the kernel size.
If a service crashes, only its part of memory is affected, leaving rest of system functional.

Hybrid kernel.
min between monolithic & microkernel architecture
kernel is larger than microkernel but smaller than mothodithic.
device drivers -- attached
This is found in windows, Mac, & Linux Software.

Nano kernel - hypervisor
only offer hardware abstraction.
no services & kernel spaces
- has minimal & streamlined design.
- Goal is to provide only essential function

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Exo kernel.
Smallest kernel.
process protection & resource handling

Content switching

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Deadlock.

why deadlock more critical than staroation?

Deadlock & starvation are both undesirable situation in concorrent system, but deadlock is considered more critical than starvation due to its more severe consequences.

Resoorce utilization

In deadlock multiple processes are blocked & unable to proceed because each is waiting for other to releases it. and resources are not utilized effecitively impacting system efficiency & throughput.

In starvation, while some processes may not be getting the resources they need, other processes are still be able to progress. The overall system may continue to function but with reduced efficiency.

Completeness of failure.

Deadlock represent the total failure in the progress of the involved process while starvation is a partial failure which affects only sobset of process, allowing rest of system to continue functioning.

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lain each.
kernel

Recovery difficulties & predictability.

Deadlock are generally harder to recover from the instance of starvation & deadlock are often less predictable.

(RAG)

Syllabus -V

Resource Allocation Graph is a directed graph. that is used to represent the allocation of resources in a system & rltnship between process & resources.

I/O
different I
techniqus

necessary characteristics of deadlock.

1) Mutual Exclusion

At least one resource must be kept in non-sharareable state; if another Process request for it, it must wait for it tobe released.

2) Hold & wait

A process must hold at least one resource. while also waiting for at least one resource that another process is currently holding

3) No Dremption.

Once a process holds a resource, that resource cannot be taken away from that process until the process voluntarily releases it.

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Circular wait -

It occurs when a process holds a resource while waiting for another resource that held by another process

Same are prevention (These shouldnot be repeated)

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Avoidance methods.

① Safe state.
Safe state is a state in which the system can allocate resource to process in some order & eventually all process will complete.

② Banker's Algorithm.
It checks whether the system will be in a safe system after allocating resources to a process & decides whether to grant the request.

③ Resource Allocation Graph.
By monitoring RAG, system can make decisions to avoid cycles & potential deadlocks.

Deadlock modelling using RAG.
① Initial resource allocation.
② Graphical representation (nodes)
③ Resource request ($P_1 \rightarrow R_1 \rightarrow P_2$)
④ Resource release.
⑤ Cycle detection.
⑥ Decision making

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Deadlock avoidance using Banker's Algo.

Unit-5 (I/O management)

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PQ What are the reasons for not connecting I/O devices directly to system bus? What are the different I/O techniques? Diff. programmed I/O & interrupt I/O techniques.

- The reasons for not connecting I/O devices directly to system bus are :-

1) Data Transfer Rate

I/O devices have slower data transfer rates compared to the CPU, which can lead to inefficiencies if directly connected.

4) Data format & work lengths

I/O devices often have different data format & work lengths than CPU requiring intermediary module like I/O module.

Different I/O techniques :-

1) Programmed I/O (PIO)

In programmed I/O, the CPU directly controls data transfer between peripheral device & memory. It continuously checks the status of the I/O device to determine when data transfer is complete.

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lain each. kernel

2) Interrupt driven I/O

With this technique, the CPU initiates an I/O operation & continues with other tasks. When the peripheral device completes the operation, it sends an interrupt signal to the CPU, which temporarily suspends its current task to handle the interrupt & process data transfer.

syllabus

3) The difference between Programmed I/O & Interrupt-driven I/O techniques lies in how they handle the control of data transfer :-

I/O different techniques

Feature	Programmed I/O	Interrupt driven I/O
CPU involvement	CPU actively controls data transfer	CPU initiates operation & handle interrupts.
CPU utilization	High CPU utilization during data transfer.	Low CPU utilization during data transfer.
Efficiency	less efficient due to constant Polling	more efficient as CPU perform other task concurrently.
Device status checking	continuous Polling of devices status by CPU	CPU is interrupted when device has data transfer.

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Redundant Array of Independent Disk (RAID)

One of the important disk organization method is RAID.

RAID (redundant array of independent disks, originally redundant array of inenpensive disks is a storage technology that combine multiple disk drive components into a logical unit.

RAID level 0 :-

Create one large virtual disk from a number of smaller disks.

It implements stripped disk array where data is broken down into blocks & each block is written to separate disk drive.

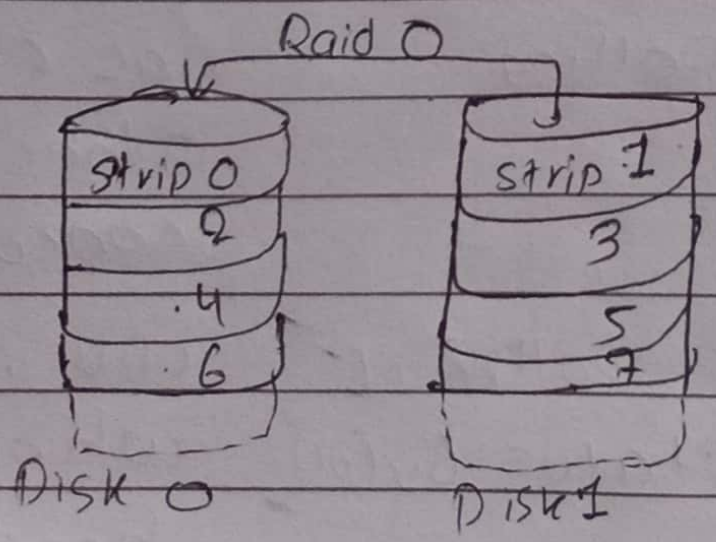
RAID 0 has :-

No redundancy

Improved performance

Additional storage

but no faulit tolerance



a) Raid 0 (non redundant)

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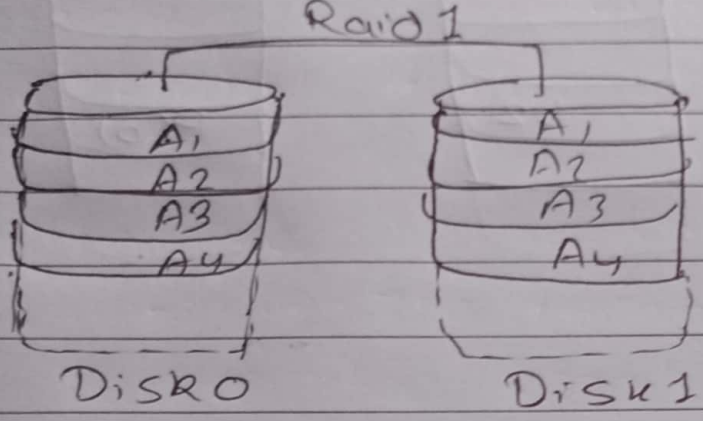
RAID level 1 :-

It provide disk mirroring.

It is a technique in which data is written to duplicate disk simultaneously.

If one fails instantly switch to other, without loss.

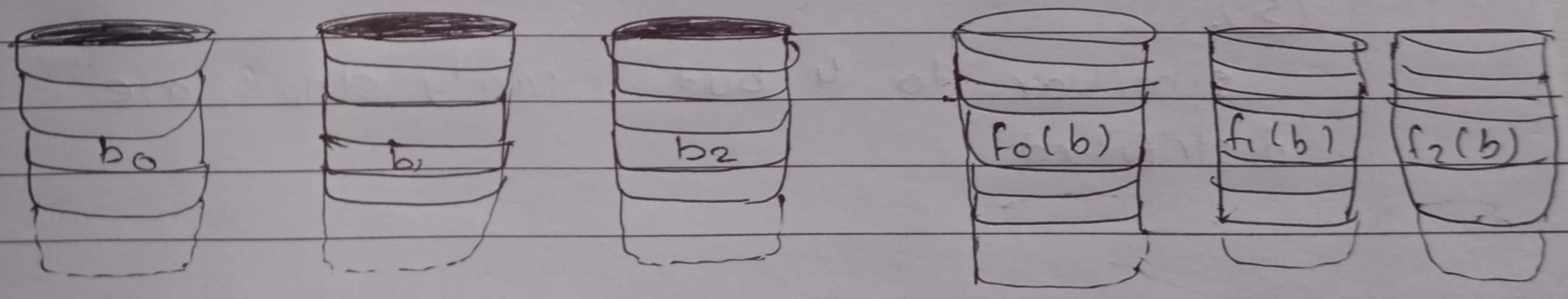


b) Raid 1 (Mirrored).

Raid level 2

It make use of parallel access technique in which all disks participate in execution of I/O request.

It is effective to use in environment where probability of disk error is high.



c) Raid 2 (Redundancy through hamming code.

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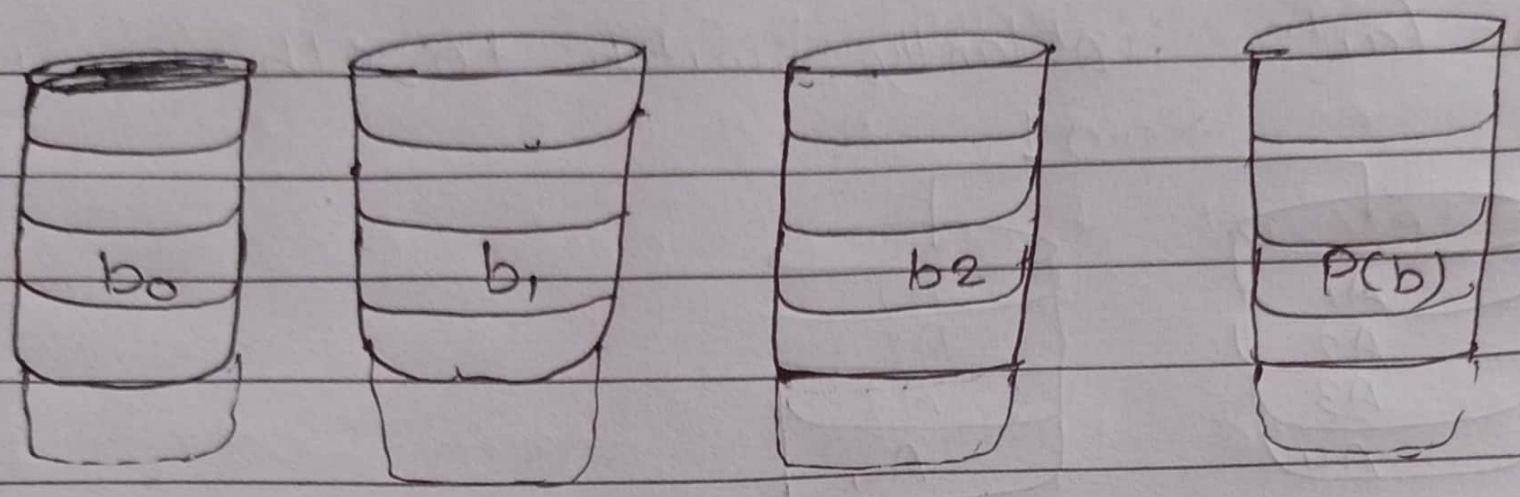
RAID level 3:

It is similar to RAID2, difference is that RAID3 requires only a single redendant disle, individual bits in same position.



Raid level 4 & 5,

- It make use of independent access technology.

here, a bit-by-bit parity is calculated across corresponding strips on each data disk. & parity bits are stored in corresponding strip on Parity disk.

(5).

similar to 4 but parity strips are distribut-ed.