

Operating System

Assignment.

Defination of all chapters

* Base Address

An address that is used as the origin in the calculation of addresses in the execution of a computer program.

* Batch Processing

Pertaining to the technique of executing a set of computer programs such that each is completed before the next program of the set is started.

* Binary Semaphore

A semaphore that takes on only the values 0 & 1. A binary semaphore always only one process or thread to have access to a shared critical resource at a time.

* Block

A collection of contiguous records that are recorded as a unit, the units are separated by interblock gaps.

A group of bits that are transmitted as a unit in packets to memory storage.

* B tree

A technique for organizing indices in order to keep access time to a minimum.

It stores the data keys in a balanced hierarchy that continually realigns itself as items are inserted & deleted, thus all nodes always have a similar number of keys.

* Busy waiting

The repeated execution of a loop of code while waiting for

an event to occur.

* Cache Memory

A memory that is smaller and faster than main memory & that is interpreted between the processor & main memory.

The cache acts as a buffer for recently used memory locations.

* Central Processing Unit (CPU)

That portion of a computer that fetches & executes instructions.

It consists of an Arithmetic & logic unit, control units & registers often simply referred to as a processor.

* Cluster

A group of interconnected whole

Computers working together as a unified computing resource that can create the illusion of being one machine

→ The term whole computer means a system that can run on its own, apart from cluster.

* Concurrent: Pertaining to processes or threads that take place within a common interval of time during which they may have to alternatively share a common resources.

* Consumable resources: A resource that can be created & destroyed, when a resource is acquired by a process, the resource comes to exist.

Examples of consumable resources are interrupt, signals, messages &

information in I/O buffers

* Database

A collection of interrelated data often with controlled redundancy, organized according to a schema to serve one or more applications; the data are stored so that can be used by different programs without concern for the data structure or organization.

A common approach is used to add new data and to modify & retrieve existing data.

* Deadlock

An impasse that occurs when multiple processes are waiting for the availability of a resource, that will not become available because it is being held by another process that is in similar wait state.

An impasse that occurs when multiple processes are waiting for an action by or a response from another process that is in a similar wait state.

* Demand Paging.

The transfer of page from secondary memory to main memory storage at the moment of need.
Compare prepaging.

* Device drivers.

An operating system module that deals directly with a driver or I/O module.

* Direct Access.

The capability to obtain data from a storage device or to enter data into a storage device in a sequence independent of

their relative position, by means of address that indicate the physical location of the data.

* Direct Message Access (DMA)

A form of I/O which a ~~uses~~ special module, called a DMA Module, controls the exchange of data between main memory and I/O device.

The processor sends a request for the transfer of a block of data to the DMA module and is interrupted only after the entire block has transferred.

* Disable interrupt

A condition usually created by the operating system during which the processor will ignore interrupt requests signal of a specified class.

* Disk allocation table.

A table that indicates which blocks of secondary storage are free & available for allocation to files.

* Distributed Operating System.

A common operating system shared by a network of computers.

The distributed operating system provides support for interprocess communication, process migration, mutual exclusion & thus prevention or detection of deadlock.

* Dynamic Relocation.

A process that assigns here absolute address to a computer program during execution so that the program may be executed from a different area of main storage.

* Enable Interrupt

A condition usually created by the operating system during which the processor will respond to interrupt request signals of a specified class.

* External fragmentation.

Occurs when memory is divided into variable size partition corresponding to the blocks of data assigned to the memory.

As segments are moved into and out of the memory, gaps will occur between the occupied partitions of the memory.

* File

A set of related records treated as a unit.

* field

- (1) Defined logical data that are part of a record.
- (2) The elementary unit of a record that may contain a data item, a data aggregate, a pointer or a link.

* ~~file~~

* file allocation table (FAT)

A table that indicates the physical location and secondary storage of the space allocated to a file.

There is one file allocation table for each file.

* file Management system

A set of system software that provides services to users & applies in the use of files including file access, directory maintenance & access control.

* file organization

The physical order of records in a file, as determined by the access method used to store & retrieve them.

* First in first out (FIFO)

A queuing technique in which the next item to be retrieved is the item that has been in the queue for the longest time.

* First come first serve (FCFS)

Same as FIFO

* Hash file

A file in which records are accessed according to the values of a key field.

Hashing is used to locate a record.

on the basis of its key value.

* Hashing

The selection of a storage location for an item of data by calculating the address as a function of the contents of the Delta.

This technique complicates the storage allocation function but results in a rapid random interval.

* Hit ratio

In a two-level memory, the fraction of all memory access that are bound in the faster memory.

* Indexed access

Pertaining to the organization & accessing of the records of a

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Storage structure through a separate index to the locations of stored records.

* Indexed file

A file in which records are accessed directly to the value of key fields.

An index is required that indicates the location of each record on the basis of each key value.

* Indexed sequential access

Referring to the organization & accessing of the records of a storage structure through an index of the keys that are stored in arbitrary partitioned sequential files.

* Indexed sequential file

A file in which records are ordered

according to the values of a key field.

The main file is supplemented with an index file that contains a partial list of key values; the index provides a quick capability to quickly search the vicinity of a desired record.

* Instruction Cycle

The time period during which one instruction is fetched from memory & executed when a computer is given instruction in Machine Language.

* Internal fragmentation

Occurs when memory is divided into fixed size partitions. If a block of data is assigned to one or more partitions, then there may be wasted space in the last partition.

This will occur if the last partition

of data is smaller than the last partition

* Interrupt

A suspension of a process such as the execution of computer program, caused by an event external to the process & performed in such a way that the process can be resumed.

* Interrupt handling

A notice, generally part of the operating system, when an interrupt occurs, control is transferred into the corresponding interrupt handler which takes some action in response to the condition that caused the interrupt.

* Job

A set of computational steps packaged to run as a unit

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* Kernel.

A partition of the operating system that includes most heavily used portions of software. Generally the kernel is maintained permanently in main memory.

The kernel runs in a privileged mode & responds to calls from processes & interrupt from devices.

* Kernel mode:

A privileged mode of execution reserved for the kernel of the operating system.

Typically kernel mode allows access to regions of main memory that are unavailable to processes executing in a less privileged mode & also enables execution of certain machine instructions that are restricted to the kernel mode.

Also referred as system mode or privilege mode

* LIFO

A queuing technique in which the next item to be retrieved is the item most recently placed in queue.

* Livelock

A condition in which two or more processes continuously change their state in response to change in the other processes without doing any useful work.

This is similar to deadlock in that no progress is made but it differs in that neither process is blocked or waiting for anything.

* Logical Address

A reference to a memory location independent of the current assignment data of memory.

A Translation must be made to

a physical address before the memory access can be achieve

* Logical record

A record independent of its physical environment positions of one logical record may be located in different physical record or several logical records or several logical records or parts of logical records may be located in one physical record.

* Main Memory

Memory that is internal to the computer system, is program addressable and can be loaded into registers for subsequent execution or processing.

* Malicious software

Any software designed to

cause damage to or use up the resources of a target computer

Malicious software is frequently concealed within or masquerades as legitimate software.

In some cases, it spreads itself to other computers via email or infected disks.

Types of malicious software include viruses, Trojan horses, worms & hidden software for launching denial of service attacks.

* Memory cycle time *

The time it takes to read one word from or write one word to memory.

This is the inverse of the rate at which words can be read or written to memory.

* Memory Partitioning *

The subdividing of storage into independent sections

* Microkernel

A small privilege operating system core that provides basic scheduling, memory management & communication services & relies on other processes to perform some of the function traditionally associated with the operating system kernel.

* Multiprocessing

A mode of operation that provides for parallel processing by two or more processors of multiprocessor.

* Multiprogramming

A mode of operations that provides for the interleaved

Execution of two or more computer programs by a single processor.

The same as Multitasking using different terminology.

* Multiprogramming Level

The number of processes that are partially or fully resident in main memory.

* Multi-tasking.

A mode of operation that provides for the concurrent performance or interleaved execution of 2 or more computer tasks.

The same as multiprogramming using different terminology.

* Mutual Exclusion

A condition in which there is a set of processes, only one of which is able to access a given resource or perform a given function at any time.

* Operating System

Software that controls the execution of program & that provides services such as resource allocation, scheduling, input / output control & data management.

* page

In virtual storage; a fixed length block that has a virtual address & that is transferred as a unit between main memory & secondary memory.

* page built.

Occurs when the page containing

a referenced word is not in main memory.

This causes an interrupt & requires that the proper page be brought into main memory.

* Page frame

A fixed size contiguous block of main memory used to hold a page.

* Paging

The transfer of pages between main memory & secondary memory.

* Physical address

The absolute location of a unit of data in memory
Eg word or byte in memory block
or secondary memory.

* Pipes

A circular buffer ~~allocation~~
allowing 2 processes to communicate
on the producer-consumer
model.

Thus, it is a first in first out queue, written by one process & read by another.

In some systems the pipe is generalized to allow any item in the queue to be selected for consumption.

* Preemption

Reclaiming a resource from a process before the process has finished using it.

* Befraging

The retrieval of pages other than the one demanded by a page fault.

The hope is that the additional pages will be needed in the near future, conserving disk I/O. compare demand paging.

* Process

A program in execution, a process is controlled & scheduled by a operating system.

* Process Control Block (PCB)

The manifestation of process in an operating system.

It is a data structure containing information about the characteristics & data of the process.

* Process Migration

The transfer of a sufficient amount of the state of a process from one machine to another for

the process to execute on the target Machine.

* Process State

All the information that operating system needs to manage a process & that the processor needs to properly execute the process.

The process state includes the contents of various processor registers such as the program counter & data registers; it also includes informations of uses to the operating system, such as the priority of the process & whether the process is waiting for the completion of a particular no event, same as execution context.

* Program Counter (PC)

Instruction address register

* Processor

In a computer, a functional unit that interprets & executes instruction.

A processor consists of at least an instruction control unit & an arithmetic unit.

* Programmed I/O.

A form of I/O in which the CPU issues an I/O command to an I/O module & must then wait for the operation to be complete before proceeding.

* Real time system.

An operating system that must schedule & manage real time things

* Real Time Tasks.

A task that is executed in connection with some process or function or set of events external to the computer system & that must meet one or more deadlines to interact effectively & correctly with the external environment.

* Registers.

High Speed memory Internal to the CPU.

Some registers are user visible that is available to the programmer via the machine instruction set other registers are used by the CPU for control purposes.

* Relative Address.

An address calculated as a displacement from a base address.

* Remote procedure call (RPC)

A technique by which 2 programs on different machines interact using procedure call & return syntax & semantics.

Both the called & calling program behave as if the partner program were running on the same machine.

* Response Time

In a data system, the elapsed time between the end of transmission of an Enquiry message & the beginning of the receipt of a response messages, measured at the enquiry terminal.

* Round Robin

A Scheduling algorithm in which processes are activated in a fixed cyclic order; that is all

processes are in a circular queue

A process that cannot proceed because it is waiting for an event. returns control to the scheduler.

* Scheduling

To select jobs or tasks that are to be dispatched. In some operating systems, other units of work, such as input/output operations may also be scheduled.

* Secondary Memory

Memory located outside the computer system itself; that is it cannot be processed directly by the processor.

It must first be copied into main memory.

Examples include disks & tapes

* Segment

In virtual memory, a block that has a virtual address.

The blocks of a program may be unequal length & may even be of dynamically varying lengths.

* Segmentation:

The division of a program or application into segments as part of virtual memory scheme.

* Semaphore:

An integer value used for signaling among processes only three operations may be performed on a semaphore, all of which are atomic: initialize, decrement & increment.

Depending on the exact definition of the semaphore, the decrement operation may result in the

blocking of a process & the increment operation may result in the unblocking of a process.

Also known as counting semaphore & general semaphore.

* Sequential file.

A file in which records are ordered according to the values of one or more key fields & processed in the same sequence from the beginning of the file.

* Session.

A collection of one or more processes that represents single interactive user application or operating system function.

All Keyboard & mouse input is directed to the foreground session is directed to the display screen.

* Shell

The portion of the operating system that intercepts interactive user commands & job control language commands.

If functioning as an interface between the user & the operating system

* Stack

An ordered list in which items are appended to and deleted from the same end of the list known as top that is the next item appended to the list is put on the top & the next item to be removed from the list is the item that has been in list shortest time.

This method is characterized as last in first out.

* Starvation

A condition in which a process is indefinitely delayed because other processes are always given performance.

* Starvation:

A semaphore in which all processes waiting on the same semaphore are queued and will eventually proceed in the same order as they executed the wait operations.

* Swapping:

A process that interchange the contents of an area of main storage with the contents of an area in secondary memory.

* Symmetric Multiprocessing (SMI)

A form of Multiprocessing that allows the operating system to

execute on any available processor
or on several available processor
simultaneously.

* Synchronous Operations.

An operation that occurs
regularly or predictably with respect
to the occurrence of specified event
in another process, for example
the calling of an input / output
routine that receives control at
pre coded location in a computer
program.

* Synchronization

Situation in which two or
more processes coordinate their
activities based on a condition.

* System bus

A bus used to interconnect
major computer components.

(CPU, memory, I/O)

* Task

Same as process

* Thrashing

A phenomenon in virtual memory schemes, in which the processor spends most of its time swapping pieces either the executing instructions.

* Thread

A dispatchable unit of work. It includes a processor context and its own data area for stack.

A thread executes sequentially & is interruptible so that the processor can turn to another thread.

A process may contain one or more threads.

* Thread switch.

The act of switching processes control from one thread to another within the same process.

* Time sharing.

The concurrent use of a device by a number of users.

* Time slice.

The maximum amount of time that a process can execute before being interrupted.

* Time slicing.

A model of an operation on

which two or more processes are assigned quanta of time on the same processor

* Trace

A sequence of instructions that are executed when a process is running.

* Trap

An unprogrammed conditional jump to a specified address that is automatically activated by the hardware;

the location from which the jump was made is recorded

* Trap door

Secret undocumented entry point into a program, used to grant access without normal

methods of access authentication

* Trojan horse

Secret undocumented routine embedded within a useful program execution of program results in execution of secret routine.

* User mode.

The least privileged mode of execution. Contains segments of main memory & certain machine instructions cannot be used in this mode.

* Virtual Address

The address of a storage location in virtual memory.

* Virtual memory

The storage space that may be regarded as addressable main storage by the user & computer system in which virtual addresses are mapped into real addresses.

The size of virtual storage is limited by the addressing scheme of the computer system and by the amount of secondary memory available & not by actual number of main storage locations.



* **Virus**: A self-replicating program embedded within a useful program execution of the program results in execution of secret routine.



* **weak semaphore**

A semaphore in which all processes waiting on the same semaphore proceed in an unspecified order.

Assignment 2

Bankers Algorithm.

Process	Allocation			Max			Available			Need		
	A	B	C	A	B	C	A	B	C	A	B	C
P0	0	1	0	7	5	3	3	3	3	3	2	
P1	2	0	0	3	2	2						
P2	3	0	2	9	0	2						
P3	2	1	1	2	2	2						
P4	0	0	2	4	3	3						

→ Process	Allocation			Max.		
	A	B	C	A	B	C
P0	0	1	0	3	2	2
P1	2	0	0	9	0	2
P2	3	0	2	2		
P3	2	1	1			
P4	0	0	2			

Process	Allocation			Max			Available			Need		
	A	B	C	A	B	C	A	B	C	A	B	C
P0	0	1	0	7	5	3	3	3	3	7	4	3
P1	2	0	0	3	2	2				1	2	
P2	3	0	2	9	0	2				6	0	0
P3	2	1	1	2	2	2				0	1	1
P4	0	0	2	4	3	3				4	3	1

⇒ Need ≤ work \Rightarrow work = need + Allocation

P0 $743 \leq 332 \leftarrow x$ condition fails.

P1 $122 \leq 332$ condition true

$$\begin{aligned}
 W &= w + \text{allocation} \\
 &= 532 + 211 \\
 &= 743
 \end{aligned}$$

$$\begin{aligned}
 \rightarrow p_4 &\quad \text{Need} \leq \text{work} \Rightarrow w = w + \text{alloc} \\
 &431 \leq 743 \\
 &= 743 + 002 \\
 &= 745
 \end{aligned}$$

$$\begin{aligned}
 \rightarrow p_0 &\quad \text{Need} \leq \text{work} \Rightarrow w = \text{work} + \text{alloc} \\
 &743 \leq 745 \\
 &= 745 + 010 \\
 &= 755
 \end{aligned}$$

$$\begin{aligned}
 \rightarrow p_2 &\quad \text{Need} \leq \text{work} \Rightarrow w = \text{work} + \text{alloc} \\
 &600 \leq 755 \\
 &= 755 + 102 \\
 &= 1057
 \end{aligned}$$

Safe sequence is $\rightarrow \langle p_1, p_3, p_4, p_0, p_2 \rangle$

* FIFO.

7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 0, 3, 2,
1, 2, 0, 1, 7, 0, 1

7	0	1	2	0	3	0	4	2
7	0	1	2	0	3	1	3	0

0	3	0	3	2	1	2	0	1
0					0	0		
2					1	1		
3					3	2		

7	0	1
7	7	7
1	0	0
2	2	1

page fault = 15

no of frames = 3

* IRU.

7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1.

7	0	1	2	0	3	0	4	2	3
7	7	7	2	2	0	4	0	4	4
0	0	0	0	0	3	0	3	0	3
1	1	1	1	1	3	3	2	2	2

0	3	0	3	2	1	2	0	1
0	3	0	3	2	1	2	0	1
3	2	0	3	1	3	2	0	2

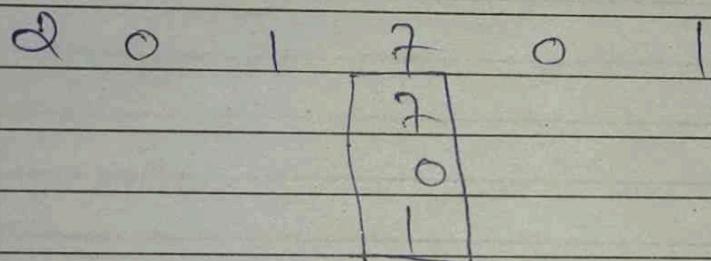
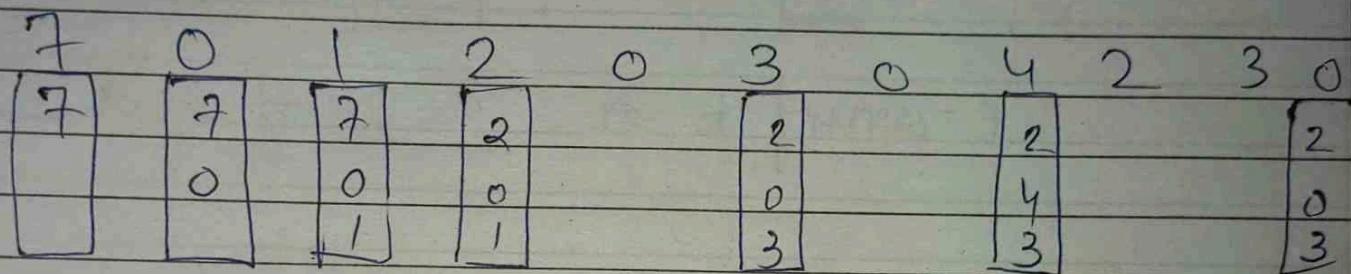
7	0	1
1	0	1
0	7	0

no of frames = 3

page fault = 12

Optimal

7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 0, 3, 2, 1, 2, 0,
1, 7, 0, 1

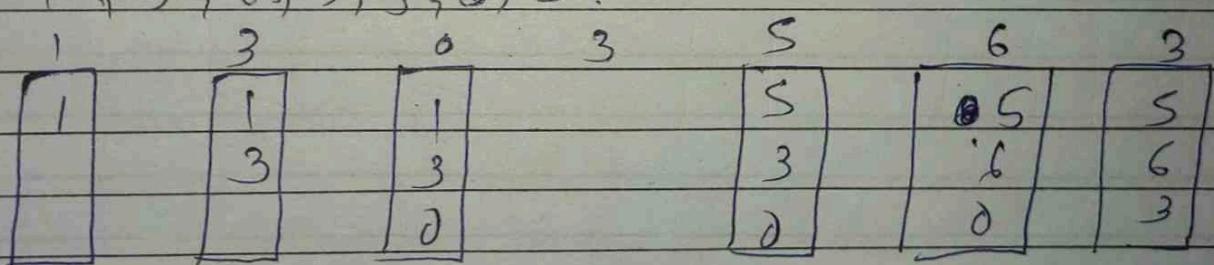


no of frames = 3
page fault = 9



FIFO

1, 3, 0, 3, 5, 6, 3.



page fault = 6 no of frame = 3

→ optimal

7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 3

7	0	1	2	0	3	0	4	2	3
7	7	7	7	0	3	0	3	0	4

Page fault 26 no of frames = 4.