

Department of Computer Science

Gujarat University



Certificate

Roll No: 11

Seat No: 30009

This is to certify that Mr./Ms. Rakesh Keshri, student of MCA Semester – III has duly completed his/her term work for the semester ending in December 2020, in the subject of Operating System towards partial fulfillment of his/her Degree of Masters in Computer Applications.

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Date of Submission

Internal Faculty

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MCA - III

Subject: - Operating System

Name: - Rakesh Keshri

Roll No.: - 11 **Exam Seat No.: -** 30009

Operating System Assignment - I

① Base Address:

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

② Batch Processing:

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

③ Binary Semaphore:

A semaphore that takes only the values 0 and 1. A Binary Semaphore allows only one process or thread to have access to a shared critical resource at a time.

④ 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.

(5) B-Trees:

A technique for organizing indexes in order to keep access time to a minimum, it stores the data keys in a balanced hierarchy that continually re-aligns itself as items are inserted and deleted. Thus, all nodes always have a similar number of keys.

(6) Busy Waiting:

The repeated execution of a loop of code while waiting for an event to occur.

(7) Cache Memory:

A memory that is smaller and faster than main memory and that is interposed between the processor and main memory. The cache acts as a buffer for recently used memory locations.

(8) CPU:

that portion of a computer that fetches and executes instructions. It consists of an ALU, a control unit, and registers. Often simply referred to as a processor.

(9) 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 the cluster.

(10) Concurrent:

Pertaining to processes or threads that take place within a common interval of time, during which they may have to alternately share common resources.

(11) Consumable Resource:

A resource that can be created and destroyed. When a resource is acquired by a process, the resource cease to exist.
e.g. of consumable resources are interrupt signals, messages and information in I/O buffers.

(12) Database:

A collection of interrelated data, often with controlled redundancy, organized according to schema to serve one or more applications.

The data are stored so that they can be used in different programs without concern for the data structures or organization. A common approach is used to add new data and to modify and retrieve existing data.

⑬ 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 a similar wait state.

⑭ Deadlock avoidance:

A dynamic technique that examines each new resource request for deadlock. If the new request for deadlock could lead to deadlock, then the request is declined.

⑮ Deadlock Detection:

A technique in which requested resources are always granted when available periodically, the operating system tests for deadlock.

(16) Deadlock Prevention:

A technique that guarantees that a deadlock will not occur. Prevention is achieved by assuring that one of the necessary conditions for deadlock is not met.

(17) Demand Paging:

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

(18) Device Driver:

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

(19) 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 addresses that indicate the physical location of the data.

(20)

DMA:

A form of I/O in which a special module called a DMA module, controls the exchange of data b/w main memory and an 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 been transferred.

(21)

Disabled interrupt:

A condition usually created by the OS, during which the processor will ignore interrupt request signals of a specified class.

(22)

Disk allocation Table:

A Table that indicates which block on secondary storage are free and available for allocation of files.

(23)

Dispatch:

To allocate time on a processor to jobs or tasks that are ready for execution.

(24)

Distributed Operating System:

A common operating system shared by a network of computers. The distributed OS provides support for inter process communications, process migration, mutual exclusion and the prevention or detection of deadlock.

(25)

Dynamic Relocation:

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

(26)

Enabled Interrupt:

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

(27)

External fragmentation:

Occurs when memory is divided into variable-size partitions corresponding to the blocks of data assigned to the memory. As segments are moved in and out of the

memory, gaps will occur b/w the occupied portions of memory.

(28) field:

Defined logical data that are part of record.

The elementary unit of a record that may contain a data item, a data aggregate, a pointer or a link.

(29) file:

A set of related records treated as a unit.

(30) file allocation Table:-

A Table that indicates the physical location on secondary storage of the space allocated to file. There is one file allocation Table for each file.

(31) file organization:

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

(32) FCFS, 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.

(33) 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.

(34) Hashing :-

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

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

(35) Hit-Ratio :-

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

(36) Indexed Access :-

Pertaining to the organization and accessing of the records of a storage structure

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

(37) Indexed file:

A file in which records are accessed according to the value of key fields. An index is required that indicates the location of each record on the basis of each key value.

(38) Indexed Sequential Access:

Pertaining to the organization and accessing of the records of a storage structure through an index of the keys that are stored in arbitrarily partitioned sequential files.

(39) 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 lookup capability to quickly reach the vicinity of a desired record.

(40) Instruction cycle:

The time period during which one instruction is fetched from memory and executed when a computer is given an instruction in machine language.

(41) Internal fragmentation:

Occurs when memory is divided into fixed-size partitions. If a block of data is assigned to one or more partition then there may be wasted space in the last partition. This will occur if that last partition of data is smaller than last partition.

(42) Interrupt:

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

(43) Interrupt handler:

A routine generally part of the OS. When an interrupt occurs, control is transfer to corresponding interrupt handler which takes some action in response to the condition that caused the interrupt.

(44)

Job:

A set of computational steps packages to run as a unit.

(45)

Kernel:

A portion of OS that includes the most heavily used portions of software. Generally the kernel is maintained permanently in main memory. The kernel runs in a privileged mode and responds to calls from processes and interrupts from devices.

(46)

Kernel mode:

A privileged mode of execution reserved for the kernel of the OS. Typically, Kernel Mode allows access to regions of main memory that are unaccessible to processes executing in a less-privileged mode and also enables execution of certain machine instructions that are restricted to the kernel mode. Also referred to as system mode or privileged mode.

(47)

LIFO:

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

48

Live lock:

A condition in which two or more processes continuously change their state in response to changes 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.

49

Logical address:

A reference to a memory location independent of the current assignment of data to memory. A translation must be made to a physical address before the memory access can be achieved.

50

Logical record:

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

51

Main Memory: Memory that is internal to the computer system, is program addressable and can be loaded into registers for subsequent

execution or processing.

(2) Malicious Software:

Any software designed to cause damage or use up the resource of a target computer. Malicious software is frequently concealed within or masquerades as legitimate software. In some cases, it propagates itself to other computers via e-mail or infected disks.

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

(3) 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 from or written to memory.

(4) Memory Partitioning:

The sub-division of storage into independent sections.

(55)

Micro kernel:

A small privileged OS core that provides process scheduling, memory management and communication services and relies on other processes to perform some of the functions traditionally associated with OS kernel.

(56)

Multi processing:

A mode of operation that provides for parallel processing by two or more processors of a multi processor.

(57)

Multi- Programming:

A mode of operation that provides for the interleaved execution of two or more computer programs by a single processor. The same as Multi-Tasking using different Terminology.

(58)

Multi Programming level:

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

(59)

Multi Tasking:

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

Multi Programming using different terminology.

(60) Mutual Exclusion:

→ A condition in which there is set of process only one of which is able to access a given resource or perform a given function at any time. See critical section.

(61) Operating Systems:

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

(62) Page:

In virtual storage, a fixed length block that has a virtual address and that is transferred as a unit b/w main memory and secondary memory.

(63) Page fault:

→ Occurs when the page containing a referenced word is not in main memory. This causes an interrupt and requires the proper page be brought into main memory.

(64) Page Frame:

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

(65) Paging:

The transfer of pages b/w main memory and secondary memory.

(66) Physical address:

The absolute location of a unit of data in memory.

(67) Pipe:

A circular buffer allowing two processes to communicate on the producer-consumer model. Thus, it is a first-in-first-out queue, written by one process and read by another.

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

(68) Precemption:

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

(69)

Pre Paging:

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.

(70)

Process:

A program in execution. A process is controlled and scheduled by the OS. same as task.

(71)

PCB:

The manifestation of a process in an OS. It is a data structure containing information about the characteristics and state of the process.

(72)

Process State:

All of the information that the OS needs to manage a process and that the process needs to properly execute the process. The process state includes the contents of the various processor registers, such as the program counter and data registers, it also includes information of use to the OS, such as the priority of the process.

and whether the process is waiting for the completion of particular I/O event. Same as execution context.

(73) Processor:

In a computer, a functional unit that interprets and executes instructions. A processor consists of at least an instruction control unit and an arithmetic unit.

(74) Program Counter:

Instruction address register.

(75) Programmed I/O:

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

(76) Real Time System:

An OS that must schedule and manage real-time tasks.

(77) Real Time Task:

A Task that is executed in connection with some

process or function or set of events external to the computer system and that must meet one or more deadlines to interact efficiently and correctly with the external environment.

(78)

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 only by the CPU for control purposes.

(79)

Relative Address:

An address calculated as a displacement from a base address.

(80)

Response Time:

In a data system, the elapsed time b/w the end of transmission of an enquiry message and the beginning of the receipt of a response message measured at the enquiry terminal.

(81) 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 some event returns control to the scheduler.

(82) Scheduling:

To select jobs or tasks that are to be dispatched. In some OS other units of work such as I/O operations, may also be scheduled.

(83) Secondary memory:

Memory located outside the computer system itself; i.e. it cannot be processed directly by the processor. It must be copied into main memory.
e.g. Include disk and tape.

(84) Segment:

In virtual memory, a block that has a virtual address. The blocks of a program may be of unequal length and may even be of dynamically varying lengths.

(85) Segmentation:

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

(86) 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 and increment.

Depending on the exact definition of semaphore, the decrement operation may result in the blocking of a process, and the increment operation may result in the unblocking of the process. Also known as (a counting semaphore or a general semaphore).

(87) Sequential file:

A file in which records are orders according to the value of the key fields and processed in the same sequence from the beginning of the file.

(88) Shell:

The portion of OS that interacts interactive user commands and job control language commands. IF function

as an interface b/w the user and the OS.

(8)

Stack:

An ordered list in which items are appended to and deleted from the same end of the list, known as the top. i.e. the next item appended to the list is put on the top and the next item to be removed from the list that has been in the list for shortest time. This method is characterized as Last In First Out.

(9)

Starvation:

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

(10)

Strong Semaphore:

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 (w) operations.

(q2)

Swapping:

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

(q3)

SMP:

A form of multi processing that allows the OS, to execute on any available processor or on several available processors simultaneously.

(q4)

Synchronous Operation:

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

(q5)

Synchronisation:

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

(q6)

System Bus:

A bus used to interconnect major computer components.

(97)

Thread:

A dispatchable unit of work. It includes a processor context and its own data area for a stack. A Thread executes sequentially and it's interruptible so that the processor can switch to another thread. A process may consist of multiple threads.

(98)

Thread switch:

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

(99)

Time sharing:

The concurrent use of a device by a no. of users.

(100)

Time slice:

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

(101)

Trap:

An unprogrammed conditional jump to a specified address that is automatically activated by hardware, the location from which the jump was made is recorded.

(102)

Trojan Horse:

secret undocumented routine embedded within a still useful program. Execution of the program results in execution of the secret routine.

(103)

Clean Mode:

The least privileged mode of execution. Certain regions of main memory and certain machine instructions cannot be used in this mode.

(104)

Virtual address:

The address of a storage location in virtual memory.

(105)

Virtual Memory:

The storage space that may be regarded as addressable main storage by the user of a computer system in which virtual addresses are mapped into real addresses. The size of virtual storage is limited by the addressing schema of the computer system and by the amount of the secondary memory available and not by the actual no. of main storage locations.

(106)

Viruse:

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

(107)

weak semaphore:

- A semaphore is which all process waiting on the same semaphore proceed in an unspecified order.

(108)

Word:

- An ordered set of bytes or bits that is the normal unit in which information may be stored, transmitted or operated on within a given computer. Typically if a processor has a fixed length instruction set, then the instruction length equals the word length.

(109)

Worm:

- Program that can travel from computer to computer across network connections, may contain a virus or bacteria.

Q

Numerical:

①

Banker's Algorithm:

(Work)

Process	Allocation	Max	Available	Need
	A B C	A B C	A B C	A B C
P ₀	0 1 0	1 5 3	3 3 2	
P ₁	2 0 0	3 2 2		
P ₂	3 0 2	0 0 2		
P ₃	2 1 1	2 2 2		
P ₄	0 0 2	4 3 3		

→

Process	Allocation	Max	Available	Need
	A B C	A B C	A B C	A B C
P ₀	0 1 0	1 5 3	3 3 2	4 4 3
P ₁	2 0 0	3 2 2		1 2 2
P ₂	3 0 2	0 0 2		6 0 0
P ₃	2 1 1	2 2 2		0 1 1
P ₄	0 0 2	4 3 3		4 3 1

→

Need ≤ Work \Rightarrow work = work + allocation.P₀: 4 4 3 ≤ 3 3 2 X condition fails.P₁: 1 2 2 ≤ 3 3 2 \rightarrow condition true.

$$W = 3 3 2 + 2 0 0 = 5 3 2 .$$

P₂: 6 0 0 ≤ 5 3 2 X ~~as 532 < 600~~ ≤ 4 4 3.P₃: 0 1 1 ≤ 5 3 2 ✓ $w = 5 3 2 + 2 1 1 = 7 4 3 .$

$$P_4: 431 \leq 743 \Rightarrow w = 743 + 002 = 745$$

$$P_0: 743 < 745 \Rightarrow w = 745 + 010 = 755$$

$$P_2: 600 \leq 755 \Rightarrow w = 755 + 302 = 1057.$$

safe sequence: $\{ P_1, P_3, P_4, P_0, P_2 \}$.

* HFO :-

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

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

$$\text{page fault} = 15$$

$$\text{no. of frames} = 8.$$

* LRU:-

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

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

w. 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.

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

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

no. of frames = 3

page fault = 9.

* FIFO :- 1, 3, 0, 3, 5, 6, 3.

1	3	0	3	5	6	3
1	1	1		5	5	5
3	3			3	6	6
	0			0	0	3

page fault = 6 no of frames: 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	0	3	2	3
7	7	7	7		3		3						
0	0	0			0		0						
	1	1			1		4						
	2				2		2						