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### Assignment-01

### Operating System.

Q.1 Explain in detail features of an operating system.

An operating system is a software that acts as an interface between computer hardware components & the user.

Every computer system to must have at least one operating system to run other programs.

Applications like Browsers, MS Office, Notepad, Games, etc need some environment to run & perform its tasks.

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An operating system manages all other applications & programs in a computer, & it is loaded into the computer by a boot program.

It enables applications to interact with a computer hardware.

Through a designated application programme interface, the application programmes request service from operating system.

The Kernel is the software that contains operating system's core components.

To run other programmes, every computer has to have at least one OS installed.

## → Features of operating system -

### 1. Process management -

An operating system manages the processor's work by allocating various jobs to it & ensuring that each process receives enough time from the processor to

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function properly.

## 2. Device management -

There are various input & output devices. Am 0.6 controls the working of these input-output devices.

It receives the requests from these devices, performs a specific task & communicates back to the requesting process.

## 3. File management -

Am 0.6 keeps track of information regarding the creation, deletion, transfer, copy & storage of files in an organized way.

It also maintains integrity of data stored in these files, including the file directory structure by protecting against unauthorized access.

## 4. Security -

0.6 provides various techniques which assures the integrity &

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## Confidentiality of user data.

- Protection against unauthorized access through login.
- Protecting the system memory against malicious access.
- Displaying messages related to system vulnerabilities.

## 5. Error Detection -

From time to time, the OS checks the system for any external threat or malicious software activity.

It also checks the hardware for any type of damage.

This process displays several alerts to the user so that the appropriate action can be taken against any damage caused to the system.

## 6. Job Scheduling -

In a multitasking OS where

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multiple programs run simultaneously, the OS determines which application should run in which order & how much time should be allocated to each application.

Q.2 Explain PCB with a neat diagram.

It is a data structure that contains information of the process related to it.

The process control block is also known as a task control block, entry of the process table, etc.

It is very important for process management as the data structuring for processes is done in terms of the PCB.

→ Structure of Process Control Block -

The process control stores many data item that are needed for efficient process management.

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Process State
Process Number
Program Counter
Registers
Memory limits.
List of open files.
:
:
:

Process Control Block (PCB).

The following are the data items -

Process State -

This specifies the process state,  
i.e., new, ready, running, waiting  
or terminated.

Process Number -

This shows the no. of the particular  
process.

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### Program Counter -

This contains the address of next instruction that needs to be executed in the process.

### Registers -

This specifies the registers that are used by the process. They may include accumulators, index, registers, stack pointers, general purpose registers, etc.

### List of open files -

These are different files that are associated with the process.

### CPU scheduling information -

The process priority, pointers to scheduling queues, etc. is the CPU scheduling information that is contained in the PCB. This may also include any other scheduling parameters.

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## Memory management information -

The memory management information includes the page tables or the segment tables depending on the memory system used. It also contains the value of the base registers, limit registers, etc.

## I/O status information -

This information includes the list of I/O devices used by the process, list of files.

## Accounting information -

The time limits, account no, amount of CPU used, process no are all a part of the PCB accounting information.

## Location of the Process control Block -

The Process control Block is kept in a memory area that is protected from normal user access. This is done because it contains important process information.

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Some of the operating systems place the PCB at the beginning of kernel stack for the process as it is a safe location.

Q.3 Explain operations that can be performed on process.

There are many operations that can be performed on processes.

Some of these are process creation, process preemption, process blocking, & process termination.

→ Process creation -

Process need to be created in the system for different operations.

This can be done by -

- User request for process creation.
- System initialization.
- Execution of a process creation system call by a running process.
- Batch job initialization.

A process may be created by another process using fork().

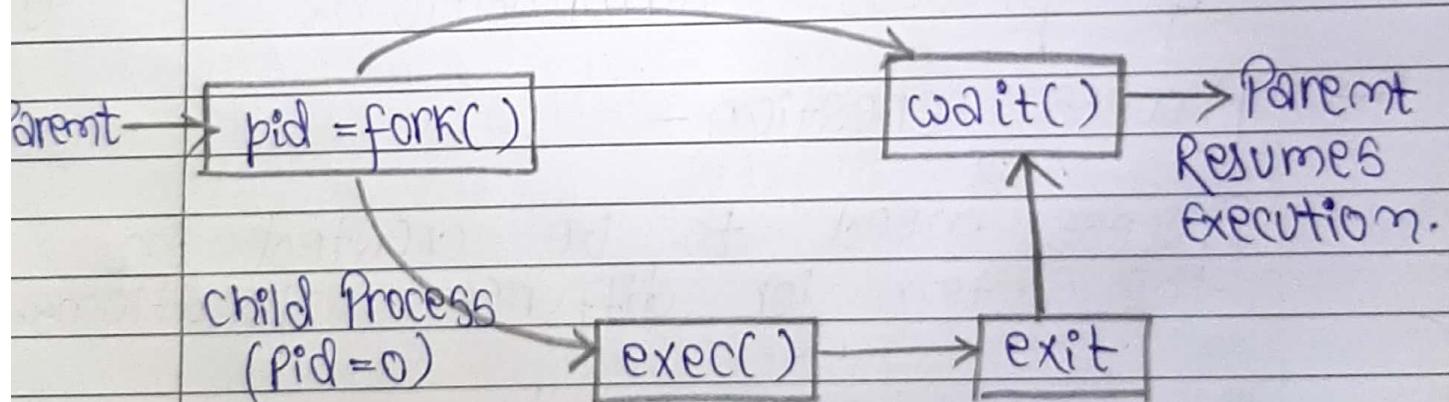
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The creating process is called the parent process & the created process is the child process.

A child process can have only one parent but a parent process can have many children.

Both the parent & child processes have the same memory image, open files & environment strings.

### Parent Process



### Process creation using fork()

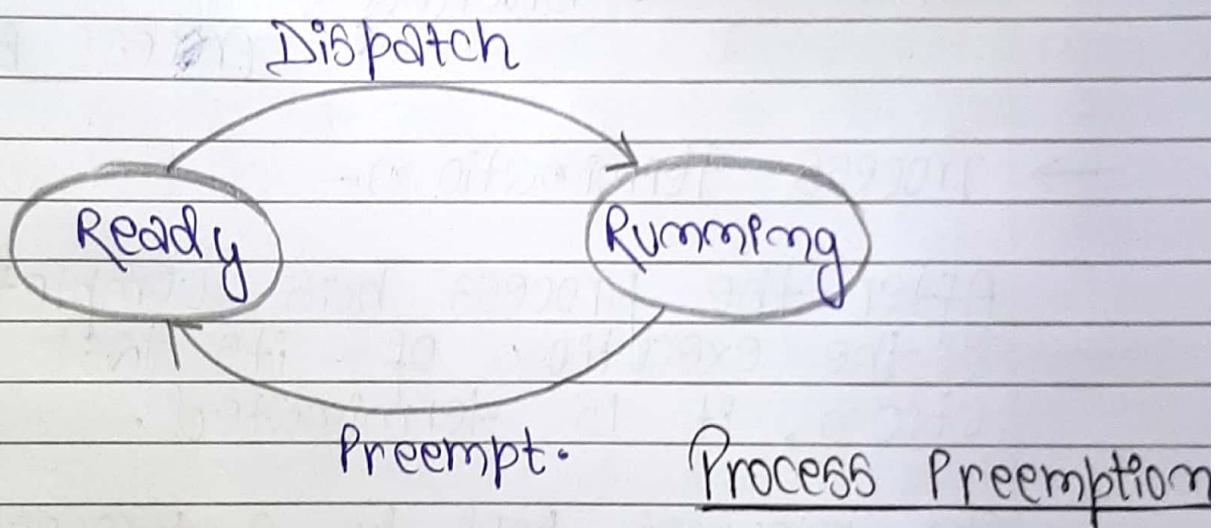
### → Process Preemption -

An interrupt mechanism is used in

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preemption that suspends the process executing currently & the next process to execute is determined by the short-term scheduler.

Preemption makes sure that all processes get some CPU time for execution.



→ Process Blocking -

The process is blocked if it is waiting for some event to occur.

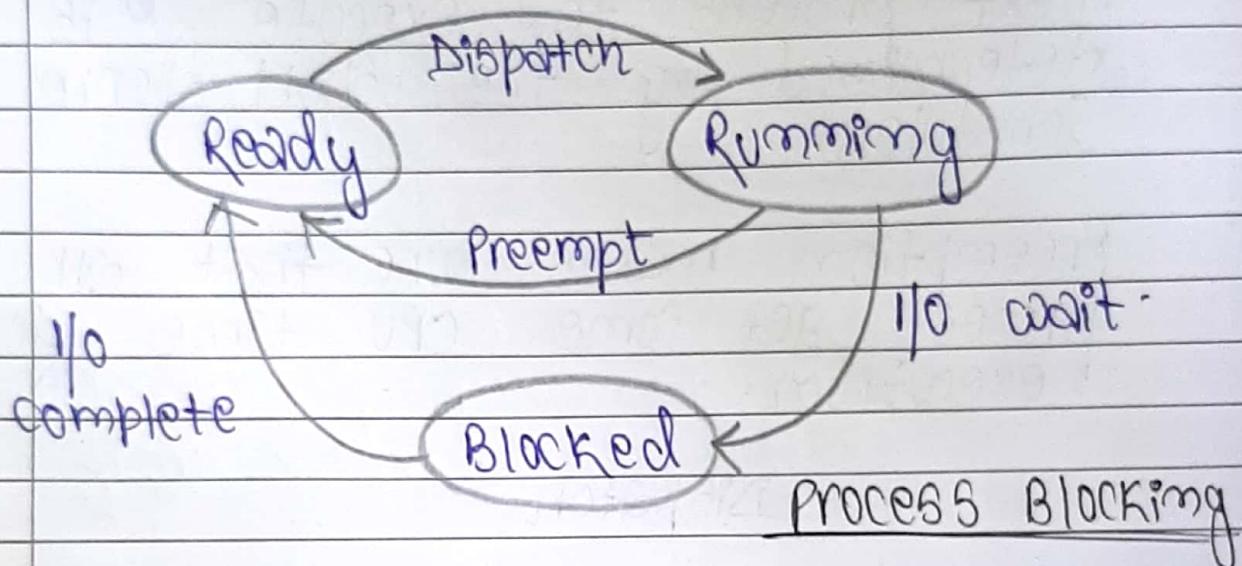
This event may be I/O as the I/O events are executed in the main memory & don't require the processor.

After the event is complete, the

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process again goes to the ready state.



### → Process Termination -

After the process has completed, the execution of its last instruction, it is terminated.

The resources held by a process are released after it is terminated.

A child process can be terminated by its parent process if its task no longer relevant.

The child process sends its status information to the parent process before it terminates.

Also, when a parent process is

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If a parent process is terminated, its child processes are terminated as well as the child processes cannot run if the parent processes are terminated.

Q.4 List and explain services provided by the system call.

A system call is a programmatic way in which a computer program requests a service from the kernel of the OS it is executed on.

A system call is a way for programs to interact with the operating system.

A computer program makes a system call when it makes a request to the operating system's kernel.

System call provides the services of the OS to the user program via Application Program interface (API).

It provides an interface between a processes to request services of the operating system.

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System calls are the only entry points into the Kernel system.

A user program can interact with the operating system using a system call.

A system call is a mechanism used by programs to request services from operating system.

It is a way for a program to interact with the underlying system.

→ Services provided by system calls -

1. Process creation & management.
2. Memory management.
3. File access, Directory & file system management.
4. Device handling.
5. Protection.
6. Networking.

- Process control - end, abort, create, terminate, allocate & free memory.

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- file management - create, open, close, delete, read files.
- Device management
- Information maintenance.
- communication.

### → Features of System Calls -

- Security - system calls ensure that user space applications cannot harm the system or interfere with other processes.
- Abstraction - programs do not need to know the specifics of network hardware configurations to send data over the internet.
- Access Control - system calls enforce security measures by checking whether a program has the appropriate permissions to access resources.
- Consistency - interaction between the OS and program remain consistent, regardless of the underlying hardware configuration.