



Operating System: →

A program that controls the execution of application programs

Software

An interface between Application and hardware

Main objectives of an OS

- Convenience
- Efficiency
- Ability to evolve

interfaces
keys

Computer Hardware and software structure.

Application
programming
interface

Application Programs

Application

Libraries / Utilities

Binary
Interface

Operating System

Instruction

Execution hardware

Set
Architecture

System interconnect
(bus)

Memory
translation

shadyo

I/O

Devices
and
networking

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Main
memory

hard
ware



operating system services →

- ❖ Program development
- ❖ Program execution
- ❖ Access I/O devices
- ❖ Controlled access to files
- ❖ System access
- ❖ Error detection and response
- ❖ Accounting

Keys Interfaces

- ❖ Instruction set architecture (ISA)
- ❖ Application binary interface (ABI)
- ❖ Application programming interface (API)

Evolution of operating system →

A major OS will evolve over time for a number of reasons

causes of evolution of OS

- ❖ Hardware upgrade
- ❖ New types of hardware
- ❖ New services
- ❖ Files



Stages include →

- serial processing system
- simple batch processing systems
- multiprogrammed batch processing systems



serial processing →

~~earliest computer~~ →

- ♦ No operating system

- ♦ Computer run from a console with display lights, toggle switches, some form of input device, and printer
- ♦ users have access to the computer in series

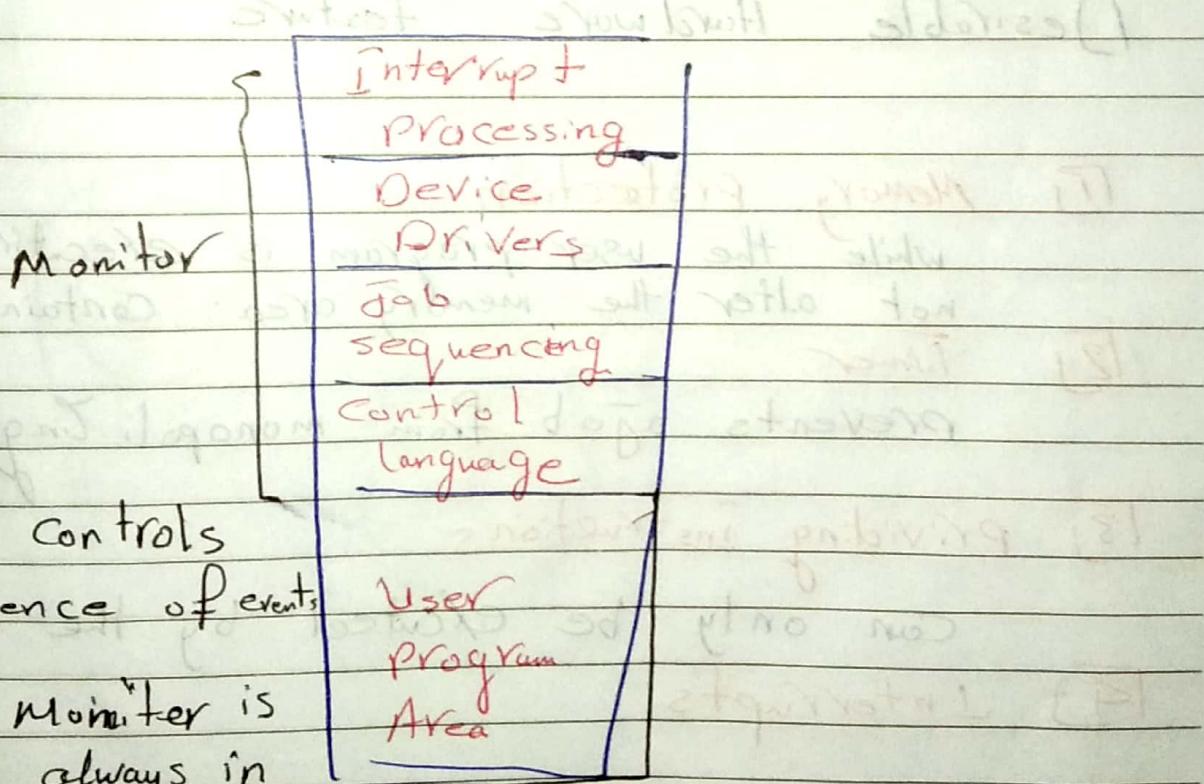
problems →

- ♦ scheduling
- ♦ most installations used a hardcopy sign-up sheet to reserve computer time
- ♦ setup time was a considerable amount of time was spent in getting the program to run



Simple Batch Systems

- Early computers were very expensive
- Important to maximize processor utilization
- Monitor
 - User no longer has direct access to processor
 - Job is submitted to computer operator who batches them together
 - Program branches back to the monitor when finished





Job Control Language (JCL)

special type of programming language used to provide instructions to the monitor.

what compiler to use

what data to use

Desirable Hardware Feature

[1] Memory protection

while the user program is executing, it must not alter the memory area containing the mon

[2] Timer

prevents a job from monopolizing the sys

[3] providing instructions

can only be executed by the monitor

[4] Interrupts

Gives OS more flexibility in controlling user programs



Modes of operation →

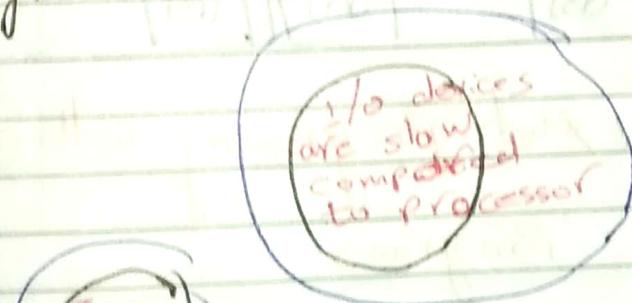
1 → User Mode

2 → Kernel Mode

Simple Batch system overhead →

* Processor time alternates between execution of user programs and execution of the monitor

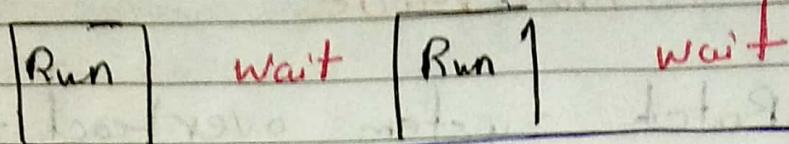
Multi-programmed Batch systems



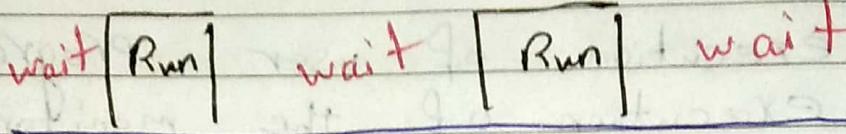


Uni-programming \rightarrow

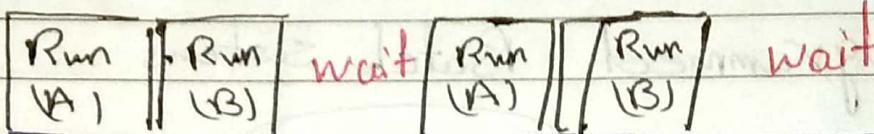
Program
(A)



Program B



Combined



Multi Programming with two
Programs

Time Sharing Systems

- * Can be used to handle multiple interactive jobs
- * Processor time is shared among multiple users
- * Multiple users simultaneously access the system through terminals

Batch vs Multi Programming Versus Time sharing

Principal objectives

	Batch multiprogramming	Time sharing
Principal objective	Maximize processor use	Minimize response time
Source of directives of OS	Job control language commands provide with the job	Commands entered at the terminal

Major Achievements →

- * Major advances in development include
 - * Processes
 - * Memory management
 - * Information protection and security
 - * Scheduling and resource management
 - * System structure

observe

Page _____
Date _____

compatible Time sharing system

Find Yourself to Be what you want

(CTSS)

Batch vs Multi Programming Versus Time sharing

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ch. 4

Process Description
and control

Q1 what is an instruction trace?

An instruction trace for a program is the sequence of instructions that execute for that process

Q2 what common events lead the creation of process ??

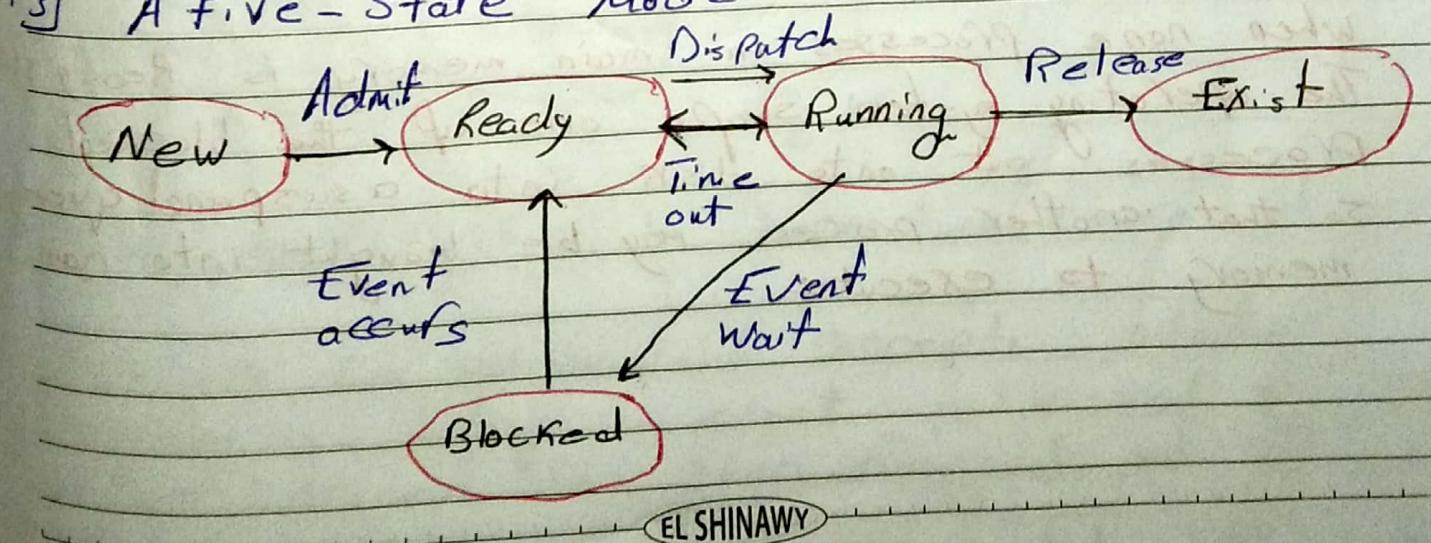
Q3 New batch job

Q4 interactive logon

Q5 created by os to provide a service

Q6 spawned by existing process

Q7 A five-state model



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Running \rightarrow Instructions are being executed

New \rightarrow The process is being created

(Blocked) waiting \rightarrow The process is waiting for some extent to occur such as the completion of ready \rightarrow The process is waiting to be assigned to a processor

(Exit) Terminated \rightarrow The process has finished execution

[Q] what does it mean preempt a process ??

Process Preemption occurs when an executing process is interrupted by the processor so that another process can be executed

[Q] what is swapping and what is its purpose?

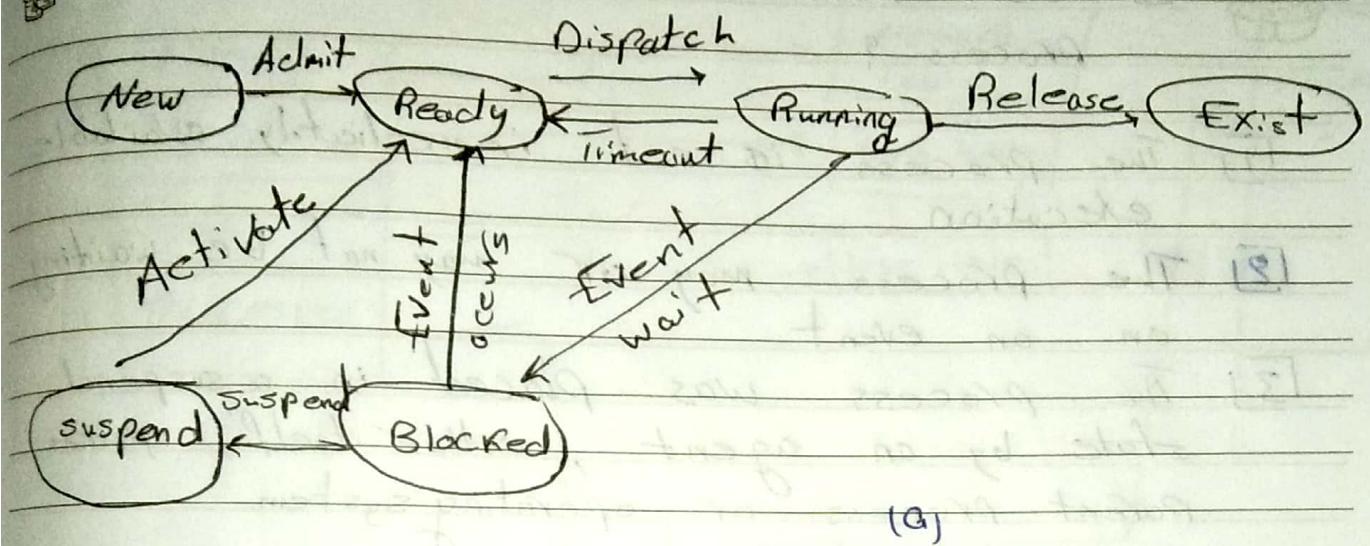
Swapping \rightarrow involves moving part or all of process from main memory to disk.

when none processes in main memory is Ready state. The operating system swaps one of the blocked processes out onto disk into a suspend queue so that another process may be brought into main memory to execute

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(one suspend state)



(Two suspend states)

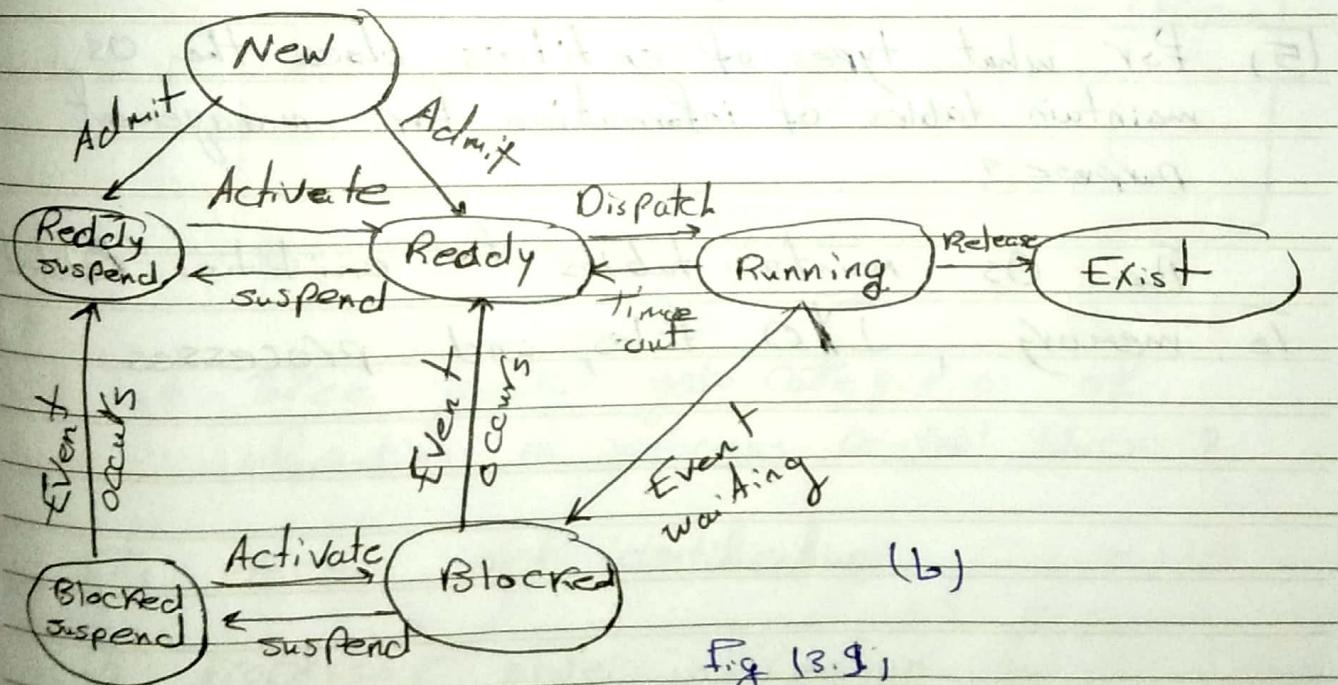


Fig (3.9)

Q] Why does Fig (3.9) b have two blocked states?

There are two independent concepts: whether process is waiting on event is (blocked or not) and whether process has been swapped out of main memory (suspend or not). To accommodate 2×2 comb we need two Ready states and two Blocked

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Q) List four characteristics of a suspended process ?

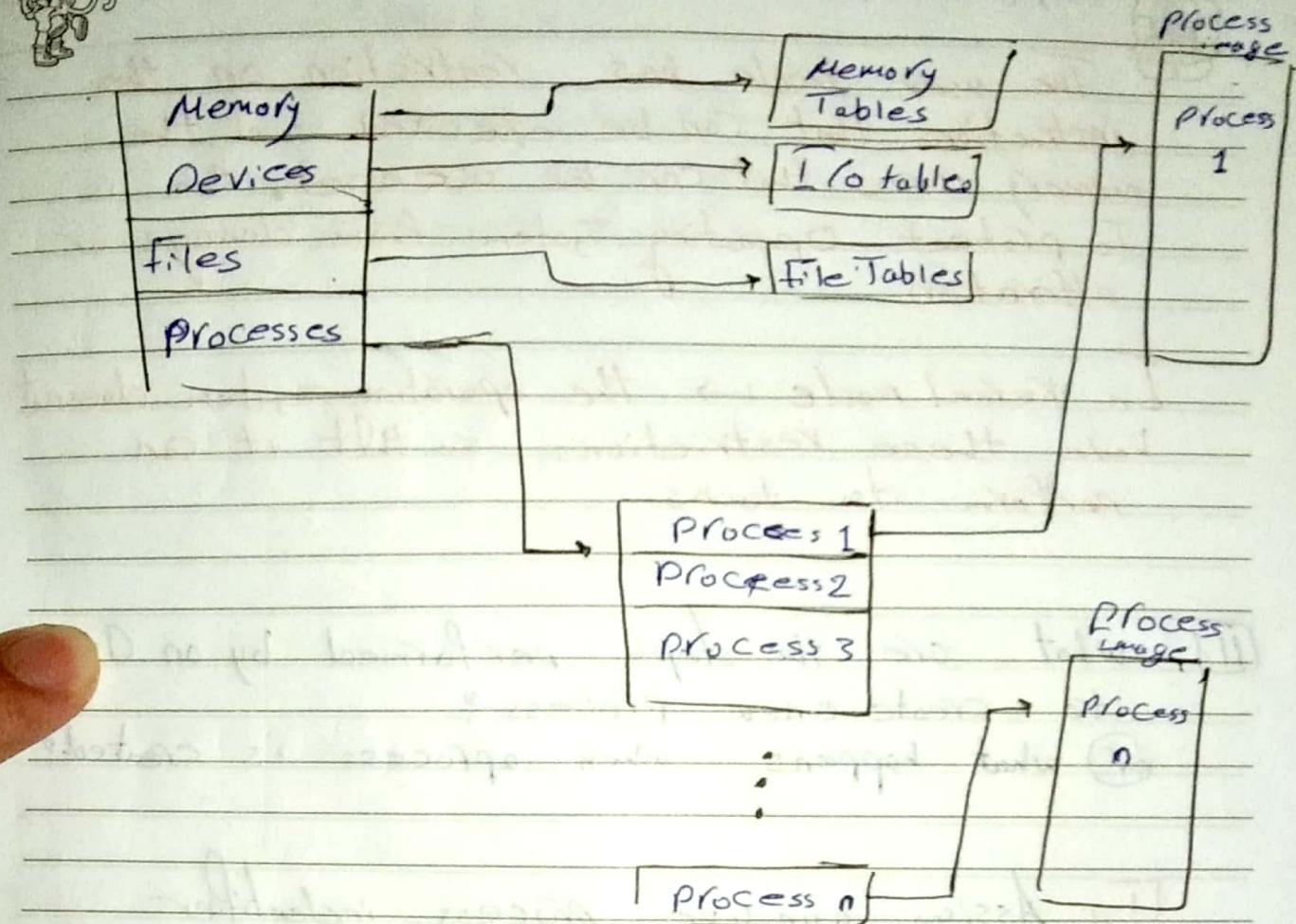
- [1] The process is not immediately available for execution
- [2] The process may or may not be waiting on an event
- [3] The process was placed in a suspend state by an agent, either itself, a processes parent process or operating system
- [4] The process may not be removed from this state until the agent explicitly orders the removal
- [5] For what types of entities does the OS maintain tables of information for management purpose?

The OS maintains tables for entities related to memory, I/O files, and processes

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General structure of OS tables



Q9) List three general categories of information in a process control block ?

[1] Process : identi~~cation~~ identification

[2] Processor state information

[3] Process control information



why [for] why we have two modes (user, kernel) needed

The user mode has restriction on the instructions that can be executed and the memory areas that can be accessed. This is to protect operating system from damage or alteration.

In Kernel mode \rightarrow the operating system doesn't have these restrictions, so that it can perform its tasks.

[1] what are the steps performed by an OS to create a new process?

or what happens when a process is created?

[1] Assign a unique process identifier

[2] Allocate space for the process

[3] Initialize Process Control Block (PCB)

[4] set up appropriate linkages

ex. \rightarrow add new process to linked list used for scheduling queue

[5] create of expand other data structure

ex. \rightarrow maintain an accounting file

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Engineering Fundamentals

Q2

Give three examples of an interrupt ?

- ① clock interrupt
- ② I/O interrupt
- ③ memory fault



Operating System

Lecture - 1

Operating → exploits the hardware resources of one or more processors to provide a set of services to system users

Manage secondary memory and I/O devices →

Basic elements of OS →

[1] Processor

which accept the orders of OS

function →

[1] Controls signals

[2] Performs operation

[3] Referred to as central processing unit (CPU)

[2] Memory →

[1] Volatile

[2] contents of the Memory is lost when the computer is shut down

[3] Referred to as memory or primary memory

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③ I/O Modules →

Move data between
The Computer and
The external environment
such as

The diagram illustrates the function of I/O Modules. It shows a central box labeled "I/O Modules" with three arrows pointing to its right, each leading to a separate box: "storage (hard drive)", "Communication equipment", and "Terminals".

④ System Bus →

p. provides for communication among
processors, main memory and
I/O modules

lecture (2)

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