

## Traditional Computer

### Q<sub>2</sub> Digital Computer System.

(traditional von Neumann sequential computer)

- is computing machine consists of a processor unit, memory, input/output and buses connecting these devices.
- is designed to be used by a single person  
PC (Personal Computer).
- Processor in this model is single unit that responsible for processing of computing functions of the PC

### Q<sub>3</sub>. operating system

is software program manages HW resource of PC to perform specific process.

• principle of processing in PC.

Q<sub>4</sub> → Based on sequential processing / execution of the instruction that solve given problem.

- The processor handles all the functionalities through

1] Fetching: Fetches program instruction from the main memory



② Decoding; Decodes the instruction, works out what needs to be done.

③ Executing; Carries out the instruction.

→ The processor manipulates instructions sequentially as written in the program.

### Q5) (Limitations Traditional Computer)

. The problem in the processing strategy

- Processing time for completing a job is relatively proportional with the size of problem.
- As problem size increase, as the processing time to finish the job increases.
- PC will not sufficient to perform a large app.

### Q6) (Need for high performance computers)

- . Available computational power of a PC could not satisfy engineers and new app.
- . Complex problems cannot be solved with today's computers.



How to increase the processing power?

OR

How to decrease processing time of large problem?

④ → Solution Paradigms

- ① Computers with more speeds.
- ② Multicore processor system.
- ③ Multiprocessor / Multicomputer system  
(Parallel Computer)

④ Distributed computer system.

— \* — \* — \* —

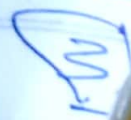
④ ① Computers with more speeds  
How --- ?

1. minimization of electronic component to very small micron-size so electrons only have to travel over very short distances in very short time.

2. increase clock rate.

This solution is limited  
Because

1. the speed of electrons in matter is limited.
2. limitations of current lithographic manufacturing  
chip size





Q14

## Different Between

### Multicore

is a single CPU or processor with two or more independent processing units called cores that are capable of reading & executing program instructions.

\* refers to a single CPU with multiple execution units.

\* have multiple cores in single CPU.

\* executes single program faster

\* doesn't require complex configuration

\* has less traffic because all cores are integrated in a ~~chip~~ ship

### Multiprocessor

is a system with two or more CPUs that allows simultaneous processing of programs

\* refers to a system that has two or more CPUs

\* contains multiple CPUs.

\* executes multiple programs faster

- more reliable and capable of executing multiple programs.

because if one CPU failure will not affect other CPUs



## Summary

Smaller transistors = Faster processors  
Faster processors = increased power consumption

increased power consumption = increased heat.

increased heat = unreliable processors.

## 2] Use multiCore Processor Computer

(Qy)

What is multiCore?

~ في الحاسب  
~ في الحاسب

cpu (processor)

registers

1. ALU

1. Control unit

Processing engine

→ The CPU handles all functionalities of the computer. The execution unit of the CPU is called Core.

- CPU with single core is called uniprocessor.
- CPU has more than one core called multicore.
- CPU with two core called dual-core.
- CPU with four core called quad-core.

(Q10) why MultiCore --- ?

1. Processing multiple instructions simultaneously on separate cores. (instruction parallelism) only
2. increase the overall speed.
3. reduce power consumption.
4. More reliable than uniprocessor.



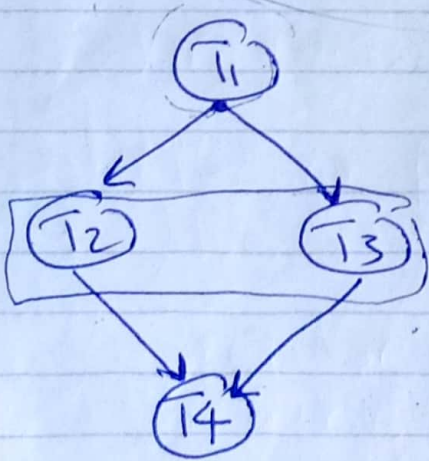
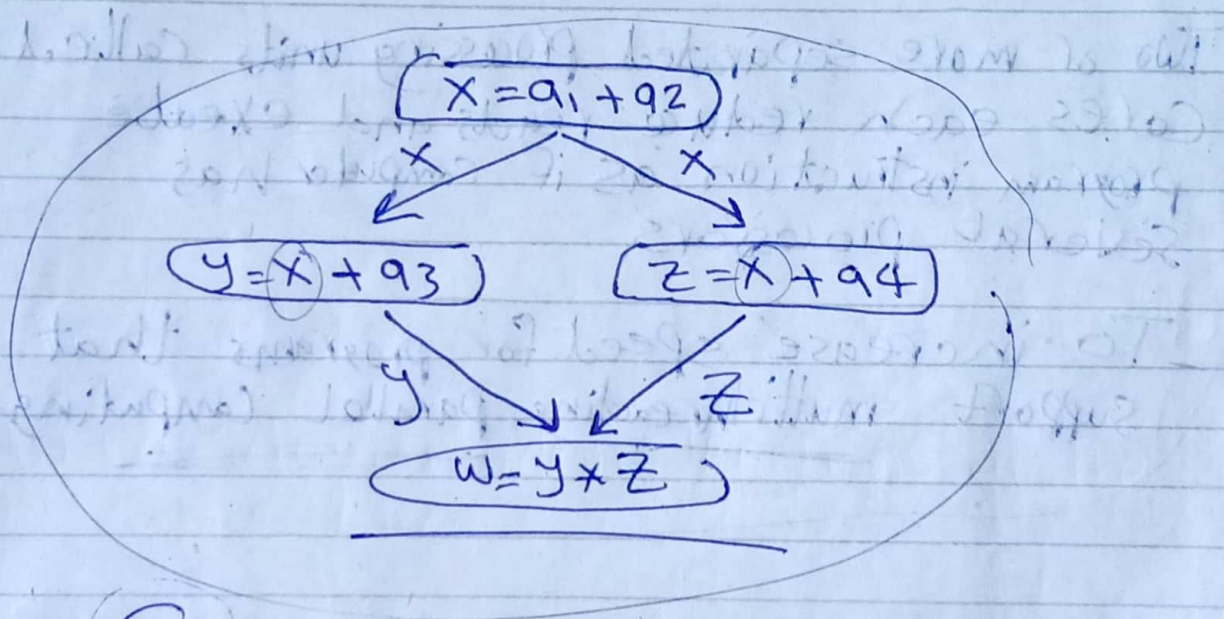
# Sequential Program

$$x = a_1 + a_2;$$

$$y = x + a_3; \quad \checkmark$$

$$z = x + a_4; \quad \checkmark$$

$$w = y * z;$$



| 0  | 1  |
|----|----|
| T1 |    |
| T2 | T3 |
| T4 |    |
|    |    |

| 0  | 1  |
|----|----|
| T1 |    |
| T2 | T3 |
|    |    |
| T4 |    |

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## Limitations of multicores

1. Limit Cores according to size.
2. More expensive

### [3] Use Parallel Computer System

- Common way of satisfying the processing needs is to use Parallel Computer (multiprocessor or multicomputer) system.
- Parallel Computer consists of two or more processing units (CPU or processors)

These systems:

- ① execute multiple instructions at the same time
  - ② increase throughput
  - ③ if one processor fails, it will not affect the functioning of the other processors.
- Therefore, multiprocessors are more reliable than multicore system.



## Ch2

### \* Characteristics of distributed system.

1. easy to expand or scale
2. Communication are hidden from users.
3. Continuously available. *دائم*
- 4. Computer are autonomous, heterogeneous.
5. Each Computer has its own memory and runs its own operating system.
6. Crash of a Computer never prevents a user from doing work.
7. Computers are communicate by a messages passing. (Software)

### \* Popularity of distributed Systems.

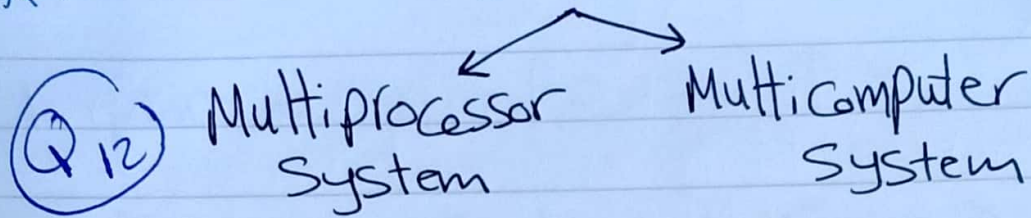
1. Information sharing among users.
2. Resource sharing
3. Better Response Time and throughput
4. higher Reliability.

### \* Drawbacks of Distributed Systems

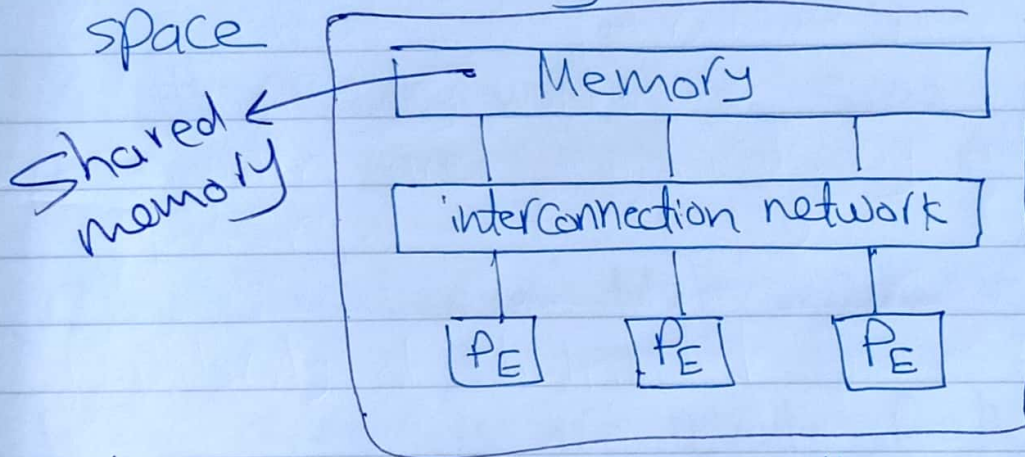
1. Software shortage & complexity
2. Dependency on network reliability.
3. Security weaknesses
4. loss of flexibility.



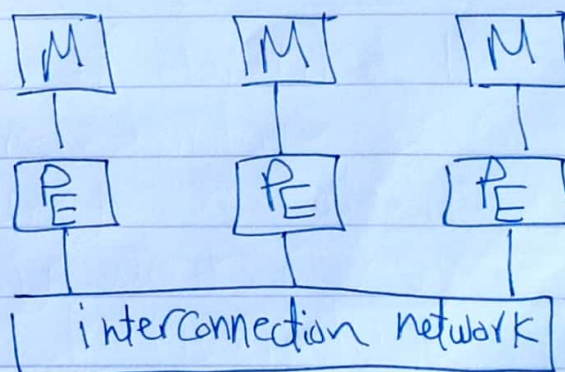
## \* Architecture of Parallel Systems



→ Multiprocessor; a parallel system in which the multiple processors have direct access to shared memory which common address space



→ multicomputer system, a parallel system in which the multiple processors do not have shared memory but each processor has its own memory





## \* Characteristics of Multiprocessor system.

1. Processor are usually of the same type.
  - \* 2. Processor are housed within the same box with shared memory.
  3. Processors do not have a common clock.
  4. All processors run the same OS.
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## \* Characteristics of Multicomputer system.

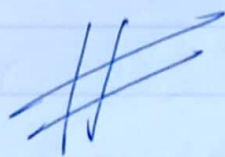
1. The processors are usually of the same type.
- \* 2. each processor has its own memory.
3. Processors do not have common clock.
4. homogenous hardware & software
- \* 5. processors communicate either via common address space OR message-passing



## \*Classifications of Parallel Computers.

- ① The First, the way the processors are connected with the memory.
- ② The Second the number of instruction-streams and the number of data-streams called "Flynn's classification"
- ③ Finally, different memory access methods called "johnson's classification"

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## Relationship between Multicore and Multiprocessor

Q- Latest parallel computers have multiple CPUs each with multiple cores to read and execute several instructions at a time.



Q 13 The general idea for **parallel processing/computing** is to distribute computation among processors or split the job into tasks and execute these tasks concurrently on different processors.

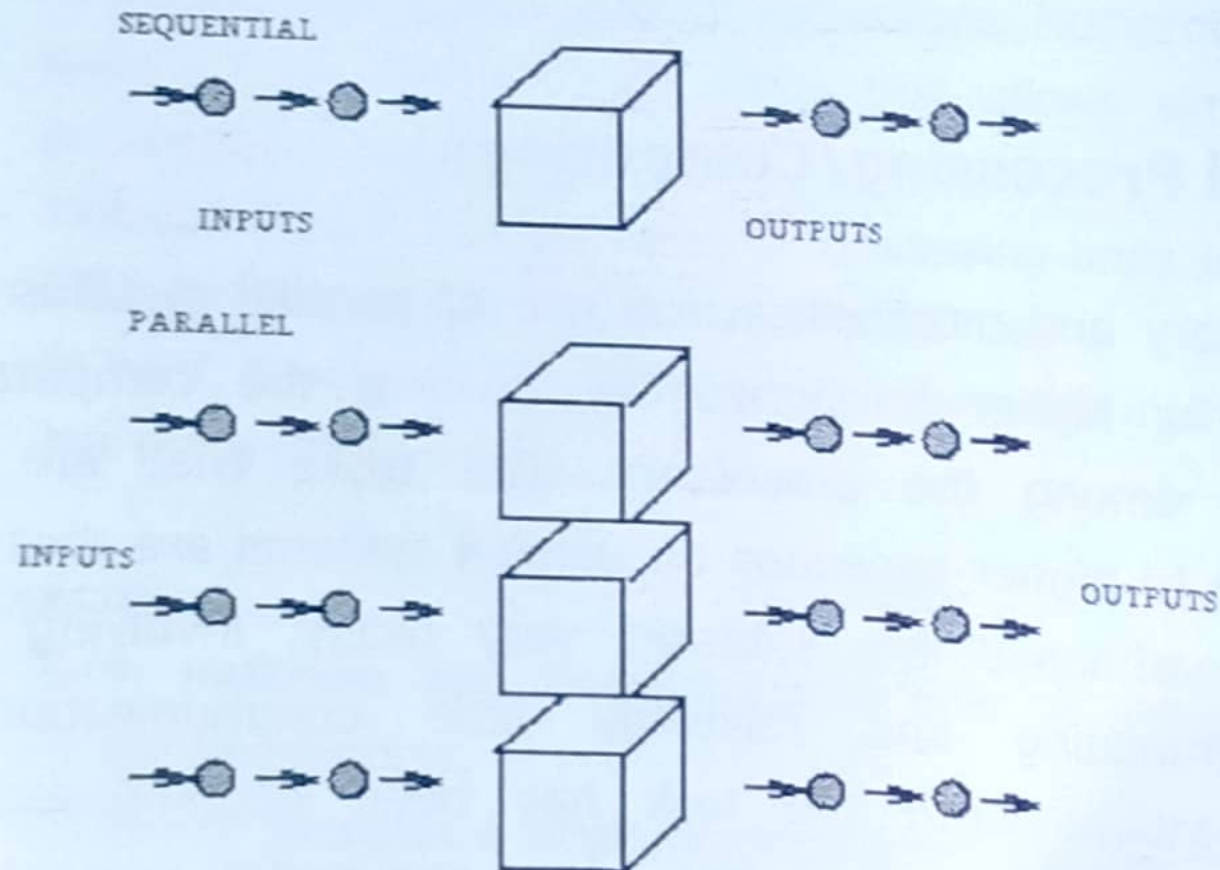


Figure 1.4: Sequential and parallel processing.



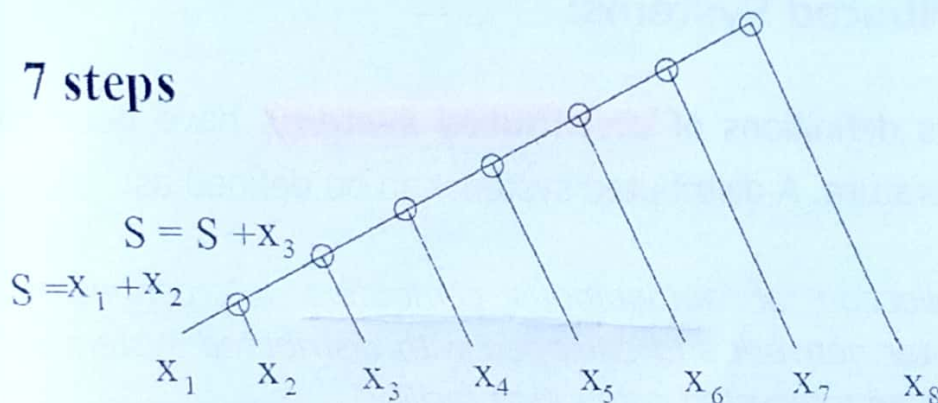
**Example:** Show how the following operation may be computed at a uniprocessor system and at a multiprocessor system.

$$S = x_1 + x_2 + x_3 + x_4 + x_5 + x_6 + x_7 + x_8$$

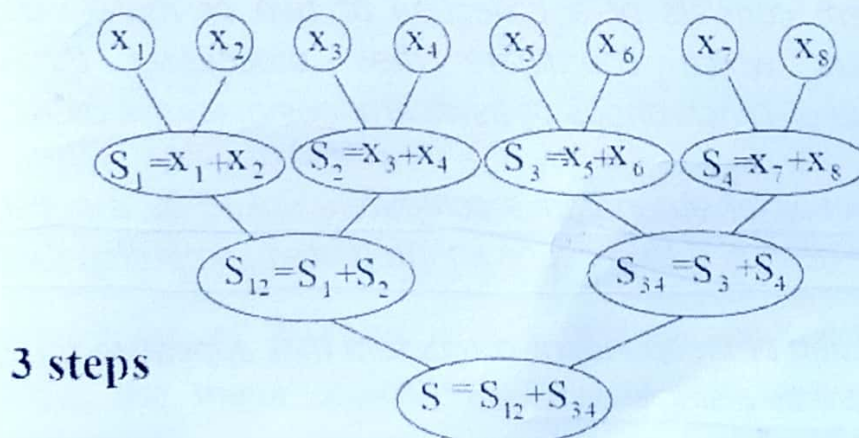
**Solution:**

(Q1)

**For uniprocessor system** (sequential processing), 7 steps computations are done sequentially.



**For multiprocessor system** (parallel processing), 3 step computations are done.





system and what is distributed processing/computing?

## Distributed Systems:

Various definitions of **distributed systems** have been given in the literature. A distributed system can be defined as:

"A collection of autonomous computers interconnected by a computer network and equipped with distributed system software to form an integrated computing facility"

"A system in which hardware or software components located at networked computers that communicate and coordinate their actions only by message passing"

"A system consists of a collection of two or more independent computers which coordinate their processing through the exchange of synchronous or asynchronous message passing"

"A collection of autonomous computers linked by a network with software designed to produce an integrated computing facility"

"A collection of independent computers that appear to the users of the system as a single computer"



## Chapter 1: Introduction.

In short, a distributed system is basically a collection of independent computers interconnected by a communication network and coordinate their actions only by message passing but appears to its users as a single coherent system.

A typical distributed system would look as shown in Figure 1.5. Each computer has a memory unit and a processing unit.

## Distributed Processing/Computing:

Distributed computing offers the ability to solve complex problems in reasonable times. Despite this, the full potential of large scale multiprocessor systems is still to be realized.

The goal of distributed processing is thus to solve a given problem more rapidly or to enable the solution of a problem that would otherwise be impracticable by a single computer.

Distributed computing is a science which solves a large problem by giving small parts of the problem to many computers to solve concurrently and then combining the solutions for the parts into a solution for the problem. Co-operation will always be necessary between computers during problem solution, even if this is a simple agreement on the division of labor. These ideas can be illustrated by a simple analogy of tackling the problem of emptying swimming pool using buckets.