Traditional Computer

Q1. 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 or computing functions of the PC

Q3. operating system

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

- principle of processing in PC.

Q2 → 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?

P7 → Solution Paradigms

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

P8 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

Summary

Smaller transistors = faster processors.
Faster processors = increased power consumption
increased power consumption = increased heat.
increased heat = unreliable processors.

---

[2] use multiCore processor Computer

Q9) what is multiCore ?

→ 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)
2. increase the overall speed.
3. reduce Power Consumption
4. More reliable than uniprocessor

Q1/4

Different Between

Multicore	Multiprocessor
is a single cpu or processor with two or more independent processing units called cores that are capable of reading & executing program instructions.	is a system with two or more cpus that allows simultaneous processing of programs
*refers to a single cpu with multiple execution units.	*refers to a system that has two or more cpus
* have multiple cores in single cpu.	* Contains multiple cpus.
*excutes single program faster	*excutes multiple programs faster
* doesn't require complex configuration	- more reliable and capable of excuting multiple programs. because if one cpu failure will not affect other cpus
*has less traffic because all cores are integrated in a ~~chip~~ ship	

Limitations of multicores

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

——— * ——— * ———

[3] Use Parallel Computer System

- Comman way of satisfying the processing needs is to use Parallel Computer (multiprocessor or multicomputer) system.

- Parallel Computer consists of two or more processing untis (cpu or processors)

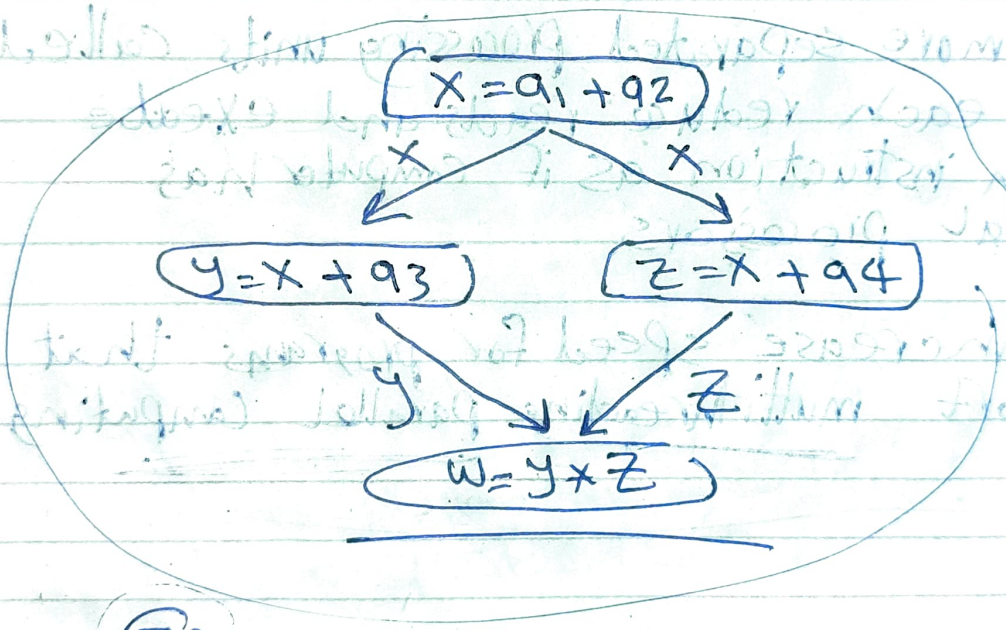
These systems:

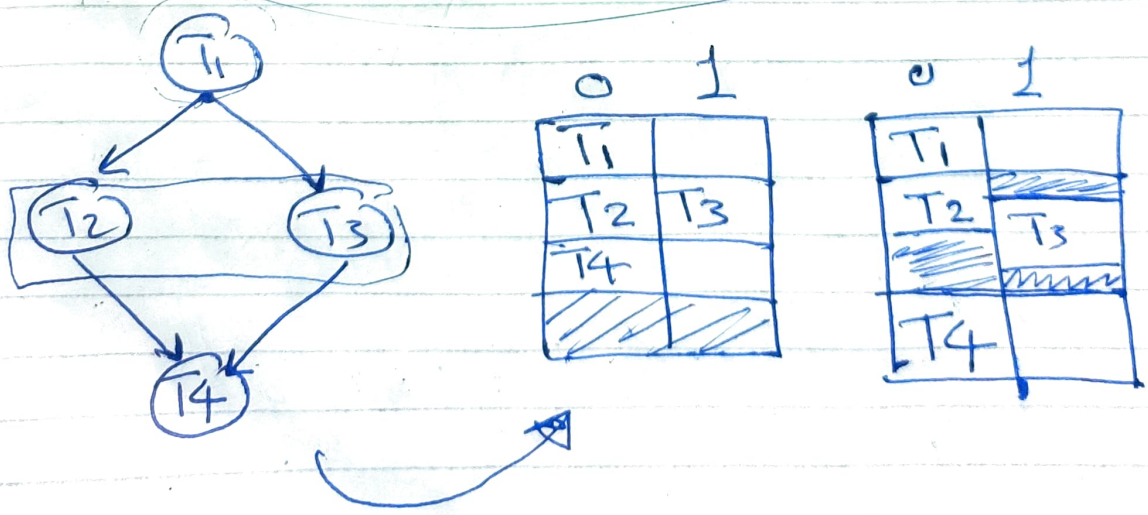
1. execute multiple instructions at the same time
2. increase Throughput
3. if one processor fails, it will not affect the functioning of the other processors

Therefore, multiprocessors are more reliable than multicore system.

Sequential Programs

```
x = a1 + a2;
y = x + a3;
z = x + a4;
w = y * z;
```





Q3) operating system

is a software program manages hardware resources of a personal/single computer to perform specific process.

To ~~improve multi~~

Two or more separated processing units called cores each reduce reads and execute program instruction as if computer has several processors

- To increase speed for programs that support multithreading parallel computing

Ch2

* Characteristics of distributed system.

1. easy to expand or scale
2. Communication are hidden from users.
3. Continuously available.
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.

* 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.

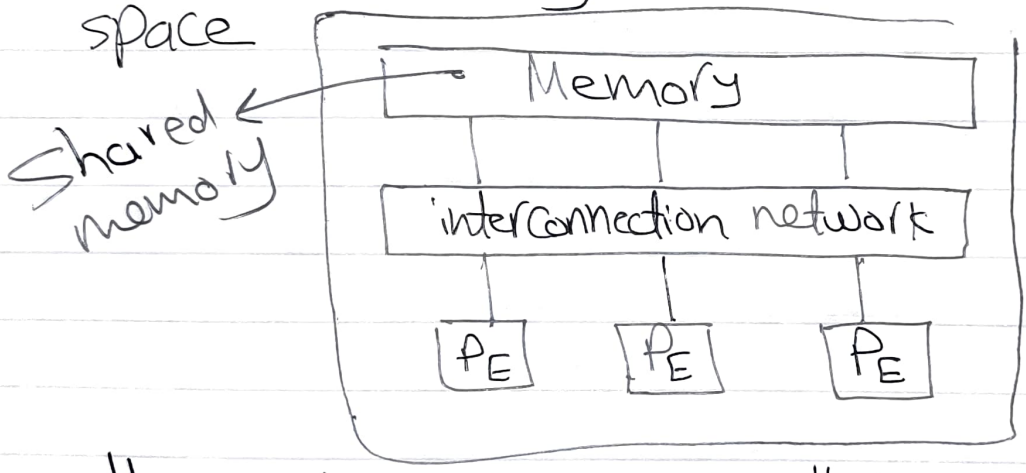
* Architecture of Parallel Systems

Q 12

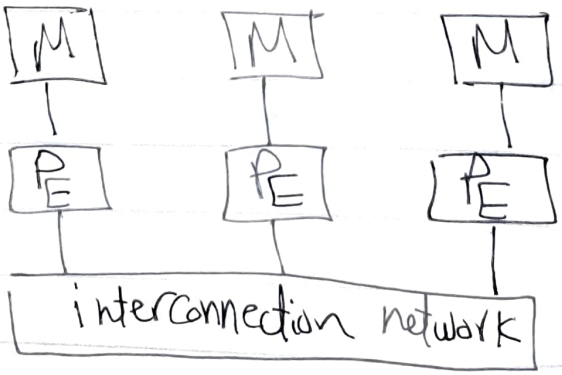
Multiprocessor System

Multicomputer System

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



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

---

* 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"

→ Page 4-2

//

ch5

* what is a process?

Defined as an instance of a Computer Program that is being executed.

* what is a process allocation?

deals with the process of deciding which process should be allocated to which processor in the Parallel and distributed system.

$$X = a + b + c + d;$$

process or task1 ; S1 = a+b
" or task2 ; S2 = c+d
" or task3 ; S3 = S1 + S2

how to distribute task in processor

* process / task model

Both directed and undirected graphs may be used to represent the process.

وزن اولوية

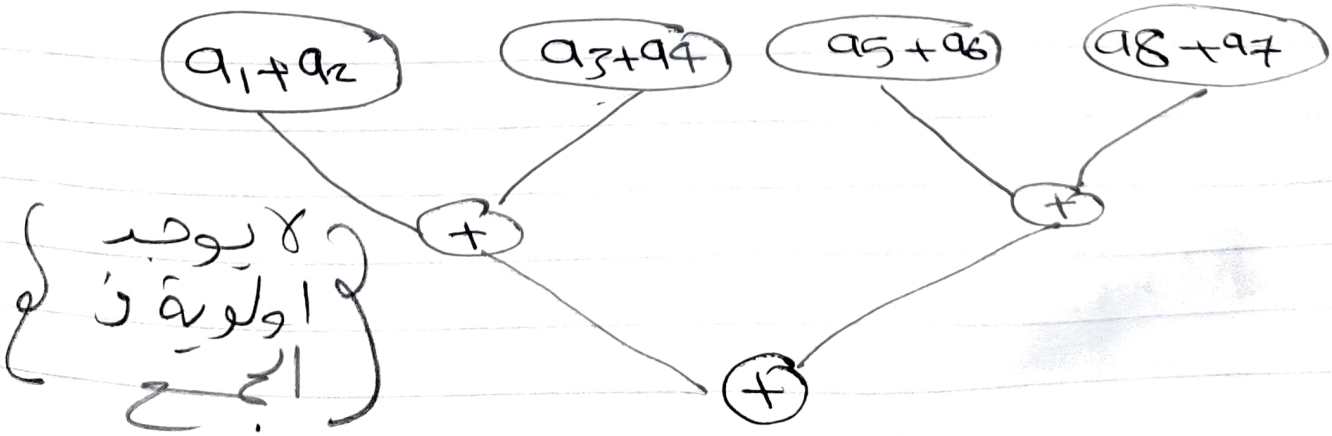
* Directed graph: used to represent precedence relation between tasks
  ↓
  Called (Task precedence Graph)
  TPG

* undirected graph: used to represent data interaction between tasks
  ↓
  Called
  (Task Interaction Graph)
  (TIG)

(Page 174) الرجوع

→ Example TiG

$X = a_1 + a_2 + a_3 \text{ ——— } + a_8$



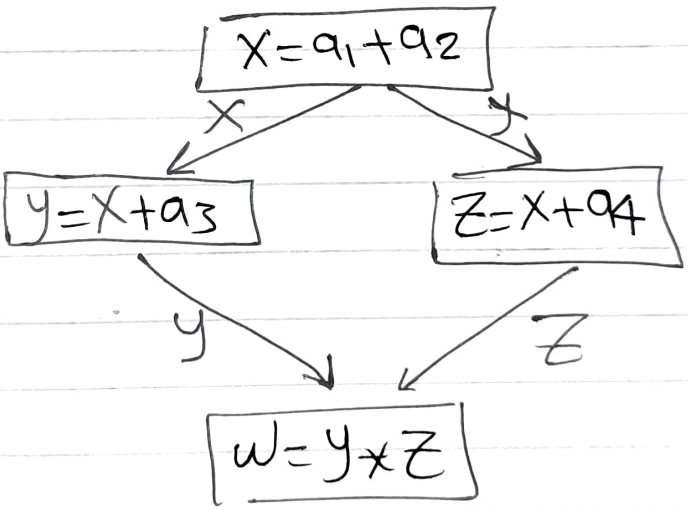
{ لا يوجد اولوية ل ... الخ }

Example of TPG

$W = (a_1 + a_2 + a_3)(a_1 + a_2 + a_4)$

$X = a_1 + a_2;$
$y = X + a_3;$

$Z = X + a_4$
$w = y * Z$



Process Allocation

Depending on task graph, Process Allocation

1. Task Assignment
2. Task scheduling

[1] Task assignment

Concern is to Find where a task should be allocated.

goals

1. Find best locations
2. optimize performance.

used in TIG

[2] Task scheduling

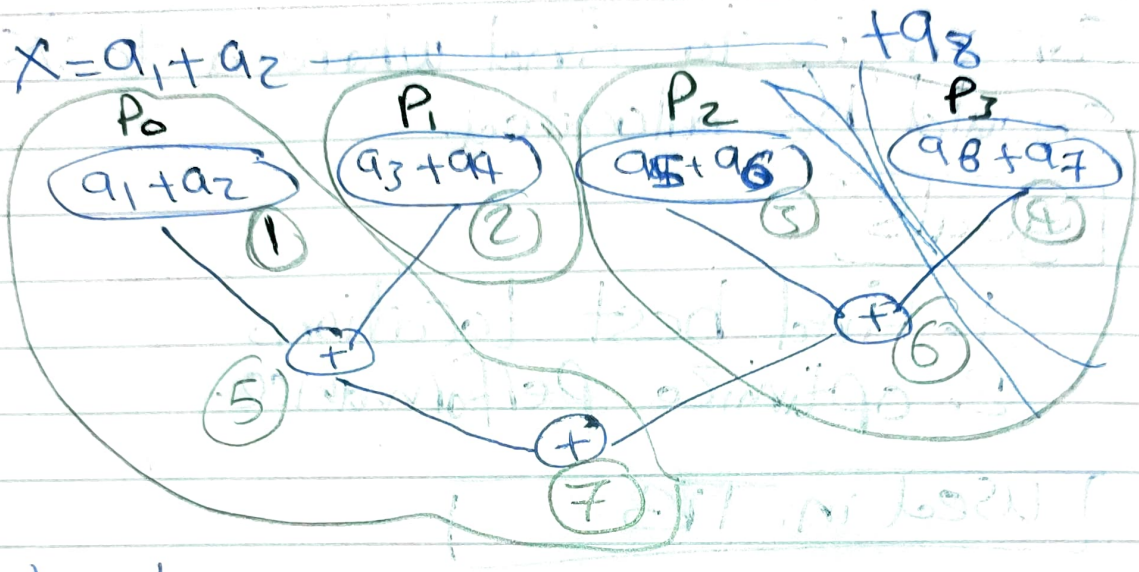
Concern is to find where the task should be allocated when the task may start executing and when it finishes.

goals:

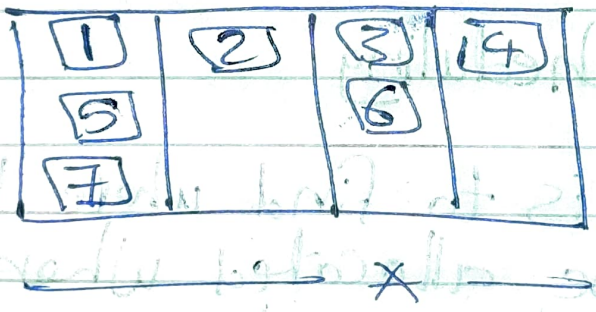
1. Find best location and order their execution
2. Minimize the schedule length.

used in TPG

Example Task assignment:-



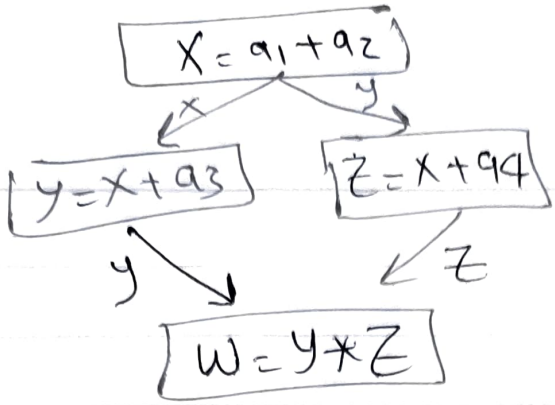
schedule



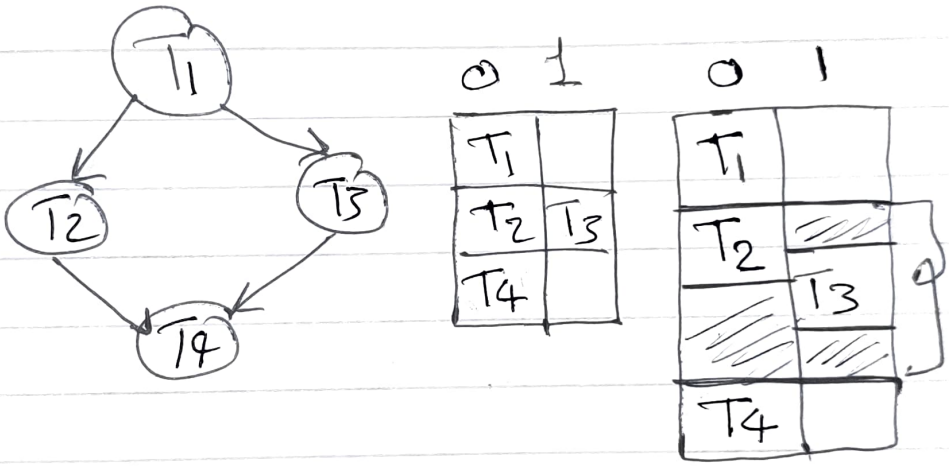
Example of Task scheduling:-

$$W = (a_1 + a_2 + a_3)(a_1 + a_2 + a_4)$$

```
X = a1 + a2;
y = X + a3;
z = X + a4;
w = y * z;
```



Task scheduling:- ① Assign task to processor
② order execution within each processor.



Task assignment deals with the process of deciding which task should be assigned to which processor in the distributed system.

* Basic Assumptions & Concepts:
  - process has been split into tasks.
  - amount of computation required & speed of each processor are known.
  - The cost of processing each task on every node
  - inter_process communication (IPS).