Q.3.(30 pts.)

a) What services are provided by the kernel of an operating system? Specify any three

~~1-Part~~ ~~2-Run a Operation~~

1- يشغل النظام
2- يدير العملية حسب الأولوية
3- جزء رئيسي من نظام التشغيل

b) What an interrupt is?

4

c) **In Priority Scheduling,** some processes may suffer from **starvation,** explain in your own words what is starvation, and suggest a new solution to this problem.

نحل المشكلة عن طريق استخدام الـ Thread لانه أخف وزنا من الـ Process

d) **Message passing and shared memory** are two frequent methods used for the **process of communication,** compare the mentioned methods using your own words.

Message passing → frequent Process – must be faster (يجب ان يكون سريع)

shared memory → in frequent Process – may be shorter (يجب ان يكون بطيء)

e) Define in your own words the following terms briefly:

1. Caching

(main memory) ذاكرة وسطى مؤقتة

2. Dual-mode

جعل العملة في وضع الانتظار إلى حين انتهاء العملية الأ

3. Spooling

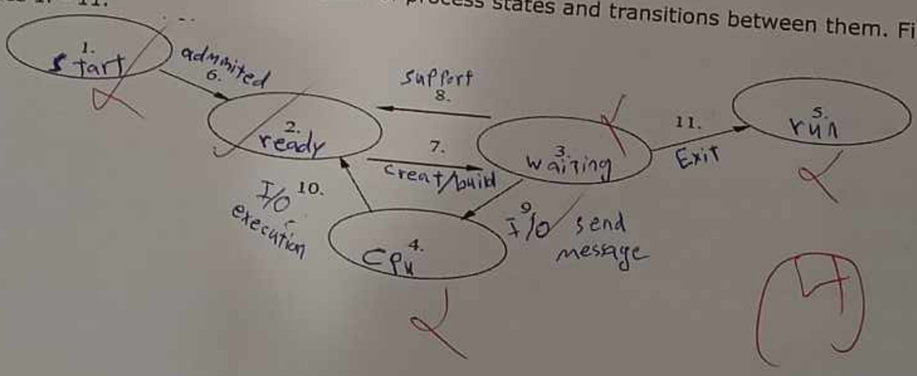
4. Process Control Block

5. Short-term scheduler

أقصر وقت ممكن لتنفيذ عملية

2

Q.4. (10 pts) Below there is a diagram of process states and transitions between them. Fill in entries 1. - 11.

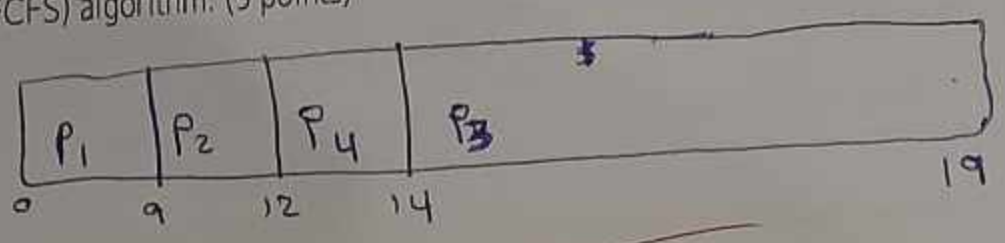


4

Q.1. (30 pts) Consider the following set of processes:

Process ID	Arrival Time	CPU Burst Time (ms)
P_1	0	9
P_2	3	3
P_3	5	5
P_4	4	2

a) Draw a Gantt chart illustrating the execution of these processes using the First Come First Serve (FCFS) algorithm. (9 points)



30

b) Calculate **mean waiting time**, **mean turn-around time**, and **CPU utilization**. **Show details of your calculations (6 points)**

W = وقت الانتظار = وقت البدء - وقت الوصول (Arrival)

$w(P_1) = 0 - 0 = 0$ ms

$w(P_2) = 9 - 3 = 6$ ms

$w(P_3) = 14 - 5 = 9$ ms

$w(P_4) = 12 - 4 = 8$ ms

TAT = Exit Process − Arrival

$TAT(P_1) = 9 - 0 = 9$ ms

$TAT(P_2) = 12 - 3 = 9$ ms

$TAT(P_3) = 19 - 5 = 14$ ms

$TAT(P_4) = 14 - 4 = 10$ ms

$$\text{CPU utilization} = \frac{\text{Total waiting}}{\text{Total Time}} \times 100\%$$

$$= \frac{0+6+9+8}{19} \times 100\%$$

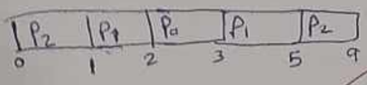
$$= \frac{23}{19} \times 100\%$$

2

Q.2. (30 pts) Consider the following set of processes:

Process ID	Arrival Time	CPU Burst Time
P_0	2	1
P_1	1	3 2
P_2	0	5 4

a) Draw Gantt charts illustrating the execution of these processes using the Shortest Remaining Time First (SRTF) algorithm.



30

b) Based on your work above, fill in the table below giving both the **waiting time (Wait)** and **turnaround time (tat)** for each process: **Show details of your calculations**

Scheduling Algorithm	Parameter	Process ID		
		P_0	P_1	P_2
SRTF	Wait	0 ms	1 ms	4 ms
	Tat	1 ms	4 ms	9 ms

$w(P_0) = 2-2 = 0ms$

$w(P_1) = (1-1)+(3-2) = 0+1 = 1ms$

$w(P_2) = (0-0)+(5-1) = 0+4 = 4ms$

$TAT(P_0) = 3-2 = 1ms$

$TAT(P_1) = 5-1 = 4ms$

$TAT(P_2) = 9-0 = 9ms$