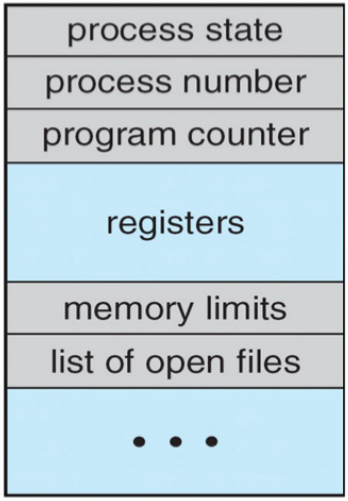


Process Control Block (PCB)

Information associated with each process

(also called **task control block**)

- Process state – running, waiting, etc
- Program counter – location of instruction to next execute
- CPU registers – contents of all process-centric registers
- CPU scheduling information- priorities, scheduling queue pointers
- Memory-management information – memory allocated to the process
- Accounting information – CPU used, clock time elapsed since start, time limits
- I/O status information – I/O devices allocated to process, list of open files







OS Component – CPU Scheduling

- Even single-CPU systems act like multiprocessor ones when virtualized
  - One or more virtual CPUs per guest
- Generally VMM has one or more physical CPUs and number of threads to run on them
  - Guests configured with certain number of VCPUs
    - Can be adjusted throughout life of VM
  - When enough CPUs for all guests -> VMM can allocate dedicated CPUs, each guest much like native operating system managing its CPUs
  - Usually not enough CPUs -> CPU **overcommitment**
    - VMM can use standard scheduling algorithms to put threads on CPUs
    - Some add fairness aspect

لما يكون عدد الـ CPU غير كافي يجي الـ VMM ويرتب الوقت بين العمليات عشان يكون فيه توازن





Scheduling Algorithm Optimization Criteria

معايير تحسين خوارزمية الجدولة

List:

- Max CPU utilization
- Max throughput

(max) نريد تزيد الشغل والانتاجية

- Min turnaround time
- Min waiting time
- Min response time

(min) وما نضيع الوقت

Question 2, 1x6=6 Marks

Mark the below Statements True or False:

1. One of the goals of scheduling techniques is to maximize turnaround time. ? F [خطأ]
2. CPU utilization means keeping the CPU as busy as possible. [✓]

السلايد السابق





Scheduling Criteria

- **CPU utilization** – keep the CPU as busy as possible
- **Throughput** – # of processes that complete their execution per time unit
- **Turnaround time** – amount of time to execute a particular process
- **Waiting time** – amount of time a process has been waiting in the ready queue
- **Response time** – amount of time it takes from when a request was submitted until the first response is produced, not output (for time-sharing environment)





Protection and Security

Difference:

- **Protection** – any mechanism for controlling access of processes or users to resources defined by the OS
- **Security** – defense of the system against internal and external attacks
  - Huge range, including denial-of-service, worms, viruses, identity theft, theft of service
- Systems generally first distinguish among users, to determine who can do what
  - User identities (**user IDs**, security IDs) include name and associated number, one per user
  - User ID then associated with all files, processes of that user to determine access control
  - Group identifier (**group ID**) allows set of users to be defined and controls managed, then also associated with each process, file
  - **Privilege escalation** (increase) allows user to change to effective ID with more rights





Reasons for Distributed Systems

list:

- Reasons for distributed systems
  - **Resource sharing**
    - Sharing and printing files at remote sites
    - Processing information in a distributed database
    - Using remote specialized hardware devices
  - **Computation speedup** – **load sharing** or **job migration**
  - Reliability – detect and recover from site failure, function transfer, reintegrate failed site
  - Communication – **message** passing
    - All higher-level functions of a standalone system can be expanded to encompass a distributed system
  - Computers can be downsized, more flexibility, better user interfaces and easier maintenance by moving from large system to multiple smaller systems performing distributed computing





Implementing Security Defenses

مهم الدكتور قاله لمدة 3 أيام / مهم مقارنة

Difference:

- **Defense in depth** is most common security theory – multiple layers of security
- Security policy describes what is being secured
- Vulnerability assessment compares real state of system / network compared to security policy
- Intrusion detection endeavors to detect attempted or successful intrusions
  - **Signature-based** detection spots known bad patterns — يكتشف الهجمات بناءً على انماط معروفة مسبقًا
  - **Anomaly detection** spots differences from normal behavior — يكتشف اي انحراف لسلوك النظام
    - Can detect **zero-day** attacks
  - **False-positives** and **false-negatives** a problem

مهم جدًا مقارنة

- Virus protection
- Auditing, accounting, and logging of all or specific system or network activities



Ch:5

E. Consider the following table:

Process	Duration (Burst time)	Arrival Time
P1	20	1
P2	2	0
P3	6	4
P4	2	6

* SJF

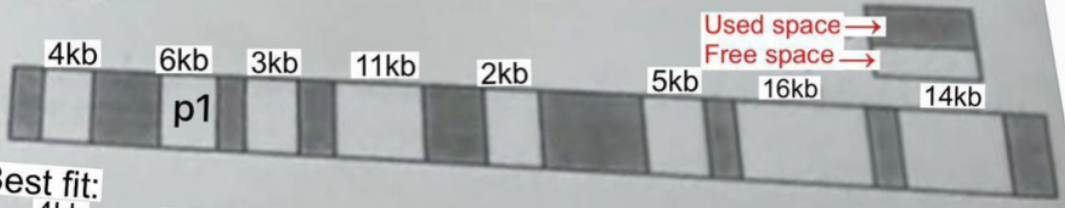
Use the Shortest-remaining-time-first algorithm,

Use the Shortest-remaining-time-first algorithm, draw the Gantt chart for the processes, and calculate the average waiting time. [5 marks]

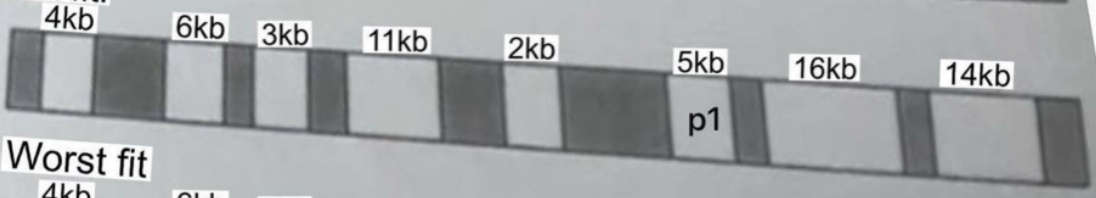
Apply the Dynamic Storage-Allocation method to allocate a suitable hole for the following process P1 of size 5 Kb, Determine the location of P1 using first-fit, Best-fif, and Worst-fit.

[6 mark

First fit:



Best fit:



Worst fit

