

# **Securiumfox Internship-Day 1 Report**

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**Topic: OS, DBMS, CN**

**Orientation:** The report contains summary of Operating Systems, DBMS, Computer Networks which we have learnt in our previous semesters

# Operating Systems

In this course, we have learnt about

1. OS structure
2. OS functions
3. IPC mechanism.
4. Multithreading
5. Process scheduling
6. Process synchronization.
7. Dead lock handling mechanisms
8. Memory management techniques.
9. Concepts of file management
10. Secondary storage management.

## **1. OS Structure:**

We have learnt about the layered structure of OS.

- The main advantage is simplicity of construction and debugging.
- The main difficulty is defining the various layers.

## **2. OS functions:**

The functions of OS are:

- Program Execution
- Handling Input/output Operations
- Manipulation of File System
- Error Detection and Handling
- Resource Allocation
- Accounting
- Security
- Memory Management
- Processor Management

## **3. IPC mechanism:**

Processes can communicate with each other through both:

- Shared Memory  
Ex: producer consumer problem
- Message passing  
send(message, destination) or send(message)  
receive(message, host) or receive(message)

#### **4.Multithreading:**

Multithreading is a program execution technique that allows a single process to have multiple code segments (like threads)

Multithreading models are three types:

- Many to many relationship.
- Many to one relationship.
- One to one relationship.

#### **5. Process Scheduling:**

- **Process Scheduling Queues:** Job Queue, Ready Queue, Device Queue
- **Schedulers:** Long term scheduler, Short Term scheduler, Medium term scheduler
- **Process scheduling types:** FCFS, SJF, PRIORITY, ROUND ROBIN SCHEDULING

#### **6.Process Synchronization:**

- Critical Section Problem
- Peterson solution
- Mutex locks
- Semaphores

## **7. Deadlock handling mechanisms:**

Deadlock is a situation where a process or a set of processes is blocked, waiting for some other resource that is held by some other waiting process.

- **Deadlock Prevention:** Mutual exclusion, Hold and wait, no preemption
- **Deadlock avoidance:** Bankers and safe state Algorithm
- **Deadlock detection**

## **8. Memory Management Techniques:**

Memory management is the functionality of an operating system which handles or manages primary memory and moves processes back and forth between main memory and disk during execution.

Different techniques are:

- Swapping
- Fragmentation: Internal, External
- Paging
- Segmentation
- Demand Paging

## 9. Concepts of file management:

- **Contiguous Allocation:** Each file occupies a contiguous address space on disk. External fragmentation is a major issue.
- **Linked Allocation:** Each file carries a list of links to disk blocks. Directory contains link / pointer to first block of a file.
- **Indexed Allocation:** A index block is created having all pointers to files.

## 10. Secondary Storage Management:

Disk Scheduling:

- First Come First Served Scheduling
- Shortest Seek Time First Scheduling
- SCAN Scheduling
- CSCAN Scheduling
- LOOK Scheduling

# **DBMS**

## **Database Management Systems**

In this course, we have learnt about

1. Fundamental concepts of database system design.
2. Advanced formal relational Languages
3. SQL to query, update, and manage a database
4. Normal forms
5. Concurrency Control in Databases
6. Database Recovery Protocols
7. Introduction to Database Security

# 1. Fundamental concepts of database system design

## Three-Schema Architecture:

Internal level

External level

Conceptual level

**Centralized Architecture:** A centralized architecture implies the availability of a single or a few entities that have control over the entire network.

**Client/server Architecture:** A computer network in which many clients (remote processors) request and receive service from a centralized server (host computer).

**Entity-Relationship Diagram:** ER Diagrams contain different symbols that use rectangles to represent entities, ovals to define attributes and diamond shapes to represent relationships.

The main components and its symbols in ER Diagrams:

- **Rectangles:** This Entity Relationship Diagram symbol represents entity types
- **Ellipses:** Symbol represent attributes
- **Diamonds:** This symbol represents relationship types
- **Lines:** It links attributes to entity types and entity types with other relationship types
- **Primary key:** attributes are underlined
- **Double Ellipses:** Represent multi-valued attributes



## 2. Advanced formal relational Languages

### Unary Relational Algebra Operations:

**Select operation ( $\sigma$ ):** It selects tuples that satisfy the given predicate from a relation.

**Project operation ( $\pi$ ):** It projects column(s) that satisfy a given predicate.

### Relational Algebra Operations from Set Theory:

- UNION ( $\cup$ )
- INTERSECTION ( $\cap$ )
- DIFFERENCE ( $-$ )
- CARTESIAN PRODUCT ( $\times$ )

### Binary Relational Algebra Operations:

**Join operation:** Join operation is essentially a Cartesian product followed by a selection criterion. Join operation denoted by  $\bowtie$ .

Inner Joins:

- Theta join
- EQUI join
- Natural join

Outer join:

- Left Outer Join
- Right Outer Join
- Full Outer Join

### 3. SQL to query, update, and manage a database

SQL is a standard language for storing, manipulating and retrieving data in databases.

Different data types in SQL. Some of them are:

- CHAR
- VARCHAR
- Date
- Number
- Float
- Raw
- Long Raw

#### Select syntax:

```
SELECT column1, column2, ...  
FROM table_name;
```

#### Insert syntax:

```
INSERT INTO table_name (column1, column2, column3, ...)  
VALUES (value1, value2, value3, ...);
```

#### Update syntax:

```
UPDATE table_name  
SET column1 = value1, column2 = value2, ...  
WHERE condition;
```

## 4. Normal forms

**First Normal Form(1NF):** A relation is in first normal form if every attribute in that relation is single valued attribute.

**Second Normal Form(2NF):** For a table to be in 2NF it must be in first normal form and no partial functional dependencies must exist in the given table.

**Third Normal Form(3NF):** A relation is in 3NF if at least one of the following condition holds in every non-trivial function dependency  $X \rightarrow Y$

1. X is a super key.
2. Y is a prime attribute (each element of Y is part of some candidate key).

**Boyce-Codd Normal Form(BCNF):** A relation is in BCNF if and only if in every non-trivial functional dependency  $X \rightarrow Y$ , X is a super key.

**Fourth Normal Form(4NF):** A relation will be in 4NF if it is in Boyce-Codd normal form and has no multi-valued dependency.

**Fifth Normal Form(5NF):** A relation is in 5NF if it is in 4NF and not contains any join dependency and joining should be lossless.

## **5.Concurrency Control in Databases:**

- Two-Phase Locking Techniques for Concurrency Control
- Concurrency Control Based on Timestamp Ordering
- Multi version Concurrency Control Techniques
- Validation (Optimistic) Concurrency Control Techniques

## **6.Database Recovery Protocols:**

- Recovery Techniques Based on Deferred Update
- Recovery Techniques Based on Immediate Update
- Shadow Paging.

## **7.Introduction to Database Security:**

- Discretionary Access Control Based on Granting and Revoking Privileges
- Mandatory Access Control
- Role based Access Control for Multi-Level Security
- SQL Injection

# Computer Networks

In this course, we have learnt about

1. Fundamental concepts of computer networks.
2. Physical Layer
3. Data link layer
4. MAC sublayer
5. Network layer
6. Network layer in the Internet
7. Transport Layer
8. Application Layer

## **1.Fundamental concepts of Computer Networks**

**Network Hardware:** Networking hardware, also known as network equipment or computer networking devices, are electronic devices which are required for communication and interaction between devices on a computer network.

**Network Software:** Network software encompasses a broad range of software used for design, implementation, and operation and monitoring of computer networks.

## **2.Physical Layer:**

Transmission media which is divided into:

Guided and unguided media.

In Guided media transmission occurs via:

- Twisted pair cable
- Coaxial cable
- Fiber optic cable

In Unguided media(wireless) transmission occurs via:

- radio waves.
- microwaves.

### 3.Data link layer

It deals with elementary data link protocols and sliding window protocols.

#### Elementary data link protocols:

- An unrestricted simplex protocol
- A simplex stop-and-wait protocol
- A simplex protocol for a noisy channel

#### Sliding window protocols:

- **A one-bit sliding window protocol:** In this protocol, the window size is 1 at both sender side and receiver side.
- **A protocol using Go Back N:** In this protocol, the window size is n on sender side and 1 on receiver side.
- **A protocol using selective repeat:** In this protocol, the window size is n at both sender and receiver side.

### 4.Medium access control(MAC) sublayer

Carrier sense multiple access protocols(CSMA):

- 1-persistent CSMA
- Non-persistent CSMA
- P-persistent CSMA

Ethernet:

- Classic Ethernet
- Switched Ethernet

## **5.Network layer:**

Various routing algorithms are:

- Flooding
- Shortest path routing
- Distance vector routing
- Link state routing
- Hierarchical routing
- Broadcast routing
- Multicast routing

## **Congestion control:**

When too many packets are present in the subnet, it is called congestion. It can be controlled by warning bit, choke packets, hop-by-hop choke packets.

## **6.Network layer in the Internet**

### **IP protocol (IPv4):**

Minimum header length is 20 bytes, it consists of 13 fields and 1 options field and has 4.3 billion addresses.

### **IP protocol (IPv6):**

Header length is 40 bytes, it consists of only 7 fields and it has 340 undecillionth addresses.



## **7.Transport Layer**

### **Elements of Transport Protocol:**

- Connection Establishment: 3-way handshake protocol
- Connection Release: Asymmetric and symmetric

Transport layer consists of TCP and UDP protocols.

## **8.Application Layer**

**Domain Name System(DNS):** It is the worldwide collection of domain name servers which is used for managing the names of websites and other internet domains.

### **Electronic Mail:**

MIME (Multipurpose Internet Mail Extension Protocol)

SMTP (Simple Mail Transfer Protocol)