

## ADBMS Final Term Assignment

Name: Sumaiya Tasnim

ID: 23-50014-1

Signature: Sumaiya Tasnim

1. Information Retrieval: Information Retrieval is the study and practice of efficiently finding and presenting relevant information from large and often unstructured collections such as text documents, web pages, images and multimedia. It underpins the functioning of modern search engines, e-libraries, and recommendation systems by analyzing user queries and retrieving the most meaningful content from millions of possible matches. Traditional systems relied on keyword matching, where documents were retrieved if they contained the words typed by the user, but modern IR has advanced into semantic search, natural language processing, and machine learning.

Name: Sumaiya Tasnim

ID: 23-50014-1

Sign: Sumaiya Tasnim

techniques do understand the intent behind a query rather than just the words. For example, if someone searches for "best medicine for headache", an intelligent system should know that terms like "painkiller" or "ibuprofen" are relevant even if the word "headache" isn't explicitly mentioned. IR systems also focus on ranking results, ensuring that the most relevant appear first, while filtering out duplicates or irrelevant matches. With explosion of digital content, IR has become essential in many fields - from academic research and online shopping recommendations to personal assistants like Siri and Alexa that fetch answers instantly. In conclusion, this makes it easier and faster for people to explore vast amounts of information in today's digital world.

Name: Sumaiya Tasnim

ID: 23-50014-1

Sign: Sumaiya Tasnim

2. Cloud Database: Cloud database refers to databases hosted and managed on cloud computing platforms, enabling organizations and individuals to store, access and manage data integration without the need for local servers or extensive infrastructure. Unlike traditional databases that require expensive hardware, on site IT staff, and constant maintenance, cloud databases operate in a virtual environment managed by providers such as Amazon Web Services (AWS), Microsoft Azure, and Google Cloud. These providers offer relational models (like SQL-based MySQL or PostgreSQL) as well as NoSQL systems (like MongoDB and Cassandra), giving flexibility for different use cases. The biggest advantage of cloud databases is scalability - businesses

Name: Sumaiya Tasnim  
ID: 23-50014-1  
Sign: Sumaiya Tasnim

Cloud databases can quickly increase storage or processing power as their data grows, or scale down during low usage) to save costs, often paying only for what they consume. Another strength is accessibility: teams across different countries can access the same database at the same time, ensuring real-time collaboration. Security, automatic backups, and disaster recovery are also built-in, reducing the risks of data loss. For example, an e-commerce company can rely on a cloud database to handle millions of transactions during peak shopping seasons without investing in extra servers. Overall, cloud databases provide flexibility, cost-efficiency and global access, making them essential for modern digital businesses.

3. Graph Database: Graph Database is a specialized database designed to handle highly connected data by storing it in the form of nodes (representing entities) and edges (representing relationships between them). Unlike relational databases, which organize information in rows and tables, graph databases naturally model real-world networks such as social media, supply chains, biological networks and recommendation systems. For instance, in a social network, a person is a node and their friendships or interactions are edges; finding "friends or friends" or discovering communities becomes faster and simpler in this model compared to performing multiple table joins in relational systems. Graph databases are especially powerful in queries where relationships are the main focus, such as fraud detection.

(by analyzing suspicious transaction links), logistics optimization, or suggesting movies and products based on shared interests among users. Popular systems include Neo4j, Amazon Neptune, and OrientDB, which use query languages like Cypher to easily explore patterns and connections. In today's world, where data is increasingly interconnected, graph databases provide an efficient and intuitive way to store, analyze and make sense of complex relationships.

4. Distributed Database: Distributed Database is a type of database system in which data is not stored in one single physical location but spread across multiple computers connected by a network, often across different geographic areas. Despite being distributed, it behaves as a single database to the user, allowing seamless access to information. This design offers several benefits, including reliability, since the

failure of one node does not bring down the entire system, and performance, since queries can be processed in parallel across different sites. Distributed databases are crucial for large organizations and tech giants like google, facebook and amazon, which must handle billions of requests daily from users worldwide. They can be homogeneous, where all systems use the same hardware and software, or heterogeneous, where different systems work together.

However, managing distributed databases comes with challenges, such as maintaining consistency when data is updated simultaneously at different locations or handling network delays and failures. Solutions like replication, partitioning and distributed transaction protocols are used to overcome these issues. For example, an online banking system may use distributed databases

so that customers in different countries can access their account information locally while still maintaining synchronized global data. Ultimately, distributed databases strike a balance between scalability, performance and reliability, making them the backbone of large-scale applications.

5. Bioinformatics: Bioinformatics is an interdisciplinary field that combines biology, computer science, mathematics and statistics to analyze and interpret complex biological data. With the rapid advancement of genome sequencing technologies, scientists now generate massive amounts of biological information, far beyond what humans can process manually. Bioinformatics provides computational tools to store, compare, and analyze this data, turning raw sequences into meaningful biological insights. One major application

is genomics, where DNA sequences are studied to identify genes responsible for diseases, understand evolutionary relationships, or develop personalized medicine. For instance, by comparing the genetic makeup of patients, doctors can recommend specific drugs that are more effective based on their DNA. Another key area is proteomics, where the structure and functions of proteins are analyzed with the help of simulations and predictive algorithms, aiding in drug discovery and disease research. Bioinformatics also plays a role in agriculture, helping design crops that are more resistant to diseases and environmental stress. Bioinformatics has become one of the most transformative areas of science, bridging raw biological data with practical medical, agricultural and environmental applications.