**BISHOP STUART UNIVERSITY**

**PROGRAMMES : BRIMS**

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**Individual Database systems Test 2020**

1. What is a database? Describe the advantages and disadvantages of using of DBMS
2. Explain five duties of Database Administrator.
3. Explain the terms primary key, candidate key and foreign key. Give an example for each
4. Differentiate between logical database design and physical database design. Show how this separation leads to data independence.
5. Describe a method for direct search? Explain how data is stored in a file so that direct searching can be performed.
6. Describe the responsibilities of the DBA and the database designer
7. What are the four main characteristics of the database approach?
8. What is DBMS and what are functions of DBMS ?
9. How many types of users works on database?
10. What are the situations when DBMS should not be used?
11. Explain the structural components of a DBMS.
12. Discuss the differences between the candidate keys and the primary key of a relation.Give example to illustrate your answer.
13. Explain the integrity constraints: Not Null, Unique, Primary Key with an example each.Is the combination ‘Not Null, Primary Key’ a valid combination. Justify.

1.Data base is a structured set of data held in a computer, especially one that is accessible in various ways.

**Advantages of Database Management System (DBMS)**

***Improved data sharing***

An advantage of the database management approach is, the DBMS helps to create an environment in which end users have better access to more and better-managed data.

Such access makes it possible for end users to respond quickly to changes in their environment.

***Improved data security***

 The more users access the data, the greater the risks of data security breaches. Corporations invest considerable amounts of time, effort, and money to ensure that corporate data are used properly. A DBMS provides a framework for better enforcement of data privacy and security policies.

***Better data integration***

Wider access to well-managed data promotes an integrated view of the organization’s operations and a clearer view of the big picture. It becomes much easier to see how actions in one segment of the company affect other segments.

***Minimized data inconsistency***  
Data inconsistency exists when different versions of the same data appear in different places. For example, data inconsistency exists when a company’s sales department stores a sales representative’s name as “Bill Brown” and the company’s personnel department stores that same person’s name as “William G. Brown,” or when the company’s regional sales office shows the price of a product as $45.95 and its national sales office shows the same product’s price as $43.95. The probability of data inconsistency is greatly reduced in a properly designed database.

***Improved data access***

 The DBMS makes it possible to produce quick answers to ad hoc queries. From a database perspective, a query is a specific request issued to the DBMS for data manipulation—for example, to read or update the data. Simply put, a query is a question, and an ad hoc query is a spur-of-the-moment question. The DBMS sends back an answer (called the query result set) to the application. For example, end users, when dealing with large amounts of sales data, might want quick answers to questions (ad hoc queries) such as:

- What was the dollar volume of sales by product during the past six months?  
- What is the sales bonus figure for each of our salespeople during the past three months?  
- How many of our customers have credit balances of 3,000 or more?

***Improved decision making***  
Better-managed data and improved data access make it possible to generate better-quality information, on which better decisions are based. The quality of the information generated depends on the quality of the underlying data. Data quality is a comprehensive approach to promoting the accuracy, validity, and timeliness of the data. While the DBMS does not guarantee data quality, it provides a framework to facilitate data quality initiatives.

***Increased end-user productivity***

 The availability of data, combined with the tools that transform data into usable information, empowers end users to make quick, informed decisions that can make the difference between success and failure in the global economy.

Till now we have seen different benefits of database management systems. But it has certain limitations or disadvantages.

Let's find various disadvantages of database system.

**Disadvantages of Database Management System (DBMS):**

 Although the database system yields considerable advantages over previous data management approaches, database systems do carry significant disadvantages. For example:

**Increased costs**  
one of the disadvantages of dbms is Database systems require sophisticated hardware and software and highly skilled personnel. The cost of maintaining the hardware, software, and personnel required to operate and manage a database system can be substantial. Training, licensing, and regulation compliance costs are often overlooked when database systems are implemented.

**Management complexity**  
Database systems interface with many different technologies and have a significant impact on a company’s resources and culture. The changes introduced by the adoption of a database system must be properly managed to ensure that they help advance the company’s objectives. Given the fact that database systems hold crucial company data that are accessed from multiple sources, security issues must be assessed constantly.

**Maintaining currency**  
To maximize the efficiency of the database system, you must keep your system current. Therefore, you must perform frequent updates and apply the latest patches and security measures to all components.

Because database technology advances rapidly, personnel training costs tend to be significant. Vendor dependence. Given the heavy investment in technology and personnel training, companies might be reluctant to change database vendors.

As a consequence, vendors are less likely to offer pricing point advantages to existing customers, and those customers might be limited in their choice of database system components.

**Frequent upgrade/replacement cycles**  
DBMS vendors frequently upgrade their products by adding new functionality. Such new features often come bundled in new upgrade versions of the software. Some of these versions require hardware upgrades. Not only do the upgrades themselves cost money, but it also costs money to train database users and administrators to properly use and manage the new features.

2. Explain five duties of database administrator

A database administrator's (DBA) primary job is to ensure that data is available, protected from loss and corruption, and easily accessible as needed. Below are some of the chief responsibilities that make up the day-to-day work of a DBA. DSP deliver an outsourced DBA service in the UK, providing [Oracle Support](https://www.dsp.co.uk/oracle-database-support/) and [SQL Server Support](https://www.dsp.co.uk/sql-server-support-2/); whilst mindset and toolset may be different, whether a database resides on-premise or in a Public / Private Cloud, the role of the DBA is not that different.

**Software installation and Maintenance**

A DBA often collaborates on the initial installation and configuration of a new Oracle, SQL Server etc database. The system administrator sets up hardware and deploys the operating system for the database server, then the DBA installs the database software and configures it for use. As updates and patches are required, the DBA handles this on-going maintenance.

And if a new server is needed, the DBA handles the transfer of data from the existing system to the new platform.

**Data Extraction, Transformation, and Loading**

Known as ETL, data extraction, transformation, and loading refers to efficiently importing large volumes of data that have been extracted from multiple systems into a data warehouse environment.

This external data is cleaned up and transformed to fit the desired format so that it can be imported into a central repository.

**Specialised Data Handling**

Today’s databases can be massive and may contain unstructured data types such as images, documents, or sound and video files. Managing a very large database (VLDB) may require higher-level skills and additional monitoring and tuning to maintain efficiency.

**Database Backup and Recovery**

DBAs create backup and recovery plans and procedures based on industry best practices, then make sure that the necessary steps are followed. Backups cost time and money, so the DBA may have to persuade management to take necessary precautions to preserve data.

System admins or other personnel may actually create the backups, but it is the DBA’s responsibility to make sure that everything is done on schedule.

In the case of a server failure or other form of data loss, the DBA will use existing backups to restore lost information to the system. Different types of failures may require different recovery strategies, and the DBA must be prepared for any eventuality. With technology change, it is becoming ever more typical for a DBA to backup databases to the cloud, [Oracle Cloud](https://www.dsp.co.uk/oracle-cloud/) for Oracle Databases and MS Azure for [SQL Server](https://www.dsp.co.uk/sql-server-azure/).

**Security**

A DBA needs to know potential weaknesses of the database software and the company’s overall system and work to minimise risks. No system is one hundred per cent immune to attacks, but implementing best practices can minimise risks.

In the case of a security breach or irregularity, the DBA can consult audit logs to see who has done what to the data. Audit trails are also important when working with regulated data.

**Authentication**

Setting up employee access is an important aspect of database security. DBAs control who has access and what type of access they are allowed. For instance, a user may have permission to see only certain pieces of information, or they may be denied the ability to make changes to the system.

**Capacity Planning**

The DBA needs to know how large the database currently is and how fast it is growing in order to make predictions about future needs. Storage refers to how much room the database takes up in server and backup space. Capacity refers to usage level.

If the company is growing quickly and adding many new users, the DBA will have to create the capacity to handle the extra workload.

**Performance Monitoring**

Monitoring databases for performance issues is part of the on-going system maintenance a DBA performs. If some part of the system is slowing down processing, the DBA may need to make configuration changes to the software or add additional hardware capacity. Many types of monitoring tools are available, and part of the DBA’s job is to understand what they need to track to improve the system. 3rd party organisations can be ideal for outsourcing this aspect, but make sure they offer [modern DBA support](https://www.dsp.co.uk/modern-dba-support-provider/).

**Database Tuning**

Performance monitoring shows where the database should be tweaked to operate as efficiently as possible. The physical configuration, the way the database is indexed, and how queries are handled can all have a dramatic effect on database performance.

With effective monitoring, it is possible to proactively tune a system based on application and usage instead of waiting until a problem develops.

**Troubleshooting**

DBAs are on call for troubleshooting in case of any problems. Whether they need to quickly restore lost data or correct an issue to minimise damage, a DBA needs to quickly understand and respond to problems when they occur.

3. A **primary key** is a field in a table which uniquely identifies each row/record in a **database** table. **Primary keys** must contain unique values. A **primary key** column cannot have NULL values. A table can have only one **primary key**, which may consist of single or multiple fields.

For example, students are routinely assigned unique identification (ID) numbers.

**Candidate Key** is a set of attributes that uniquely identify tuples in a table. Candidate Key is a super key with no repeated attributes. The Primary key should be selected from the candidate keys. Every table must have at least a single candidate key. A table can have multiple candidate keys but only a single primary key. example, Students ID and phone both are candidate keys for table **Student**.

**Foreign Key** is a column that creates a relationship between two tables. The purpose of Foreign keys is to maintain data integrity and allow navigation between two different instances of an entity. It acts as a cross-reference between two tables as it references the primary key of another table.

**4. Logical database design** is the process of transforming (or mapping) a conceptual schema of the application domain into a schema for the data model underlying a particular DBMS, such as the relational or object-oriented data model.

Physical database design is the process of transforming a logical data model into a physical model of database.

Data independence is defined as a property of DBMS that helps you to change the Database schema at one level of a database system without requiring to change the schema at the next higher level. Data independence helps you to keep data separated from all programs that make use of it.

11. Direct search is online processing whereby a record can be accessed without accessing the records between it and the beginning of the file. The primary key serves to identify the needed record.

Data can be stored in three ways to enable direct searching as follows;

Sequential organization

Records are physically stored in a specified order according to the key field in each record.

Indexed sequential organization

In this method, records are physically stored in sequential order on magnetic disk or other direct access storage devices based on the key field of each record. Each file contains an index that references one or more key fields of each data records to its storage location address.

Direct organization

It provides the faster direct access to the files because records do not have to be arranged sequence on storage media.

# 12. **Responsibilities of a Database Administrator**

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## The database designer is responsible for defining the detailed database design, including tables, indexes, views, constraints, triggers, stored procedures, and other database-specific constructs needed to store, retrieve, and delete persistent objects.

## Responsibilities of Database Designer

**Write Programming Code**

Database designers write programming code, most commonly using SQL and Python, to create software, web applications, and database processes.

**Consolidate Data**

They consolidate data across multiple sources and databases to make it easier to locate and access.

**Design Online Forms**

These professionals design and implement online forms used for data collection and data processing.

**Program Automated Systems**

Database designers program automated data collection and data storage systems.

**Create and Enhance Data Models**

They also create new data models and enhance existing models to streamline data storage processes.

**Design Database Storage Systems**

Database designers design and implement database storage systems.

**Troubleshoot**

Database designers find potential problems within existing databases and programming codes and make recommendations to improve these systems.

**Analyze Data**

They also analyze existing data and database procedures to determine how much data is being stored and to assess the needs and capacity of current databases.

**Monitor Databases Backups**

Database designers monitor database backup processes and programs to ensure data is being stored efficiently and safely.

## ****13. Characteristics of Database Approach****

### **Manages Information**

A database always takes care of its information because information is always helpful for whatever work we do. It manages all the information that is required to us. Managing information by using a database, we become more deliberated user of our data.

### **Easy Operation Implementation**

All the operations like insert, delete, update, search etc. are carried out in a flexible and easy way. Database makes it very simple to implement these operations. A user with little knowledge can perform these operations. This characteristic of database makes it more powerful.

### **Multiple Views of Database**

Basically, a view is a **subset of the database**. A view is defined and devoted for a particular user of the system. Different users of the system may have different views of the same system.

Every view contains only the data of interest to a user or a group of users. It is the responsibility of users to be aware of how and where the data of their interest is stored.

### **Data For Specific Purpose**

A database is designed for data of specific purpose. **For example**, a database of student management system is designed to maintain the record of student’s marks, fees and attendance etc. This data has a specific purpose of maintaining student record.

### **It has Users of Specific Interest**

A database always has some indented group of users and applications in which these user groups are interested.

**For example**, in a library system, there are three users, official administration of the college, the librarian, and the students.

### **Represent Some Aspects of Real World Applications**

A database represents some features of real world applications. Any change in the real world is reflected in the database. If we have some changes in our real applications like railway reservation system then it will be reflected in database too. **For example**, let us take an example of railway reservation system; we have in our mind some certain applications of maintaining records of attendance, waiting list, train arrival and departure time, certain day etc. related to each train.

**Self Describing nature**

A database is of self describing nature; it always describes and narrates itself. It contains the description of the whole data structure, the constraints and the variables. It makes it different from traditional file management system in which definition was not the part of application program. These definitions are used by the users and DBMS software when needed.

### **Logical Relationship Between Records and Data**

A database gives a logical relationship between its records and data. So a user can access various records depending upon the logical conditions by a single query from the database.

### **Shelter Between Program and Data**

In traditional file management system, if any user makes changes in the structure of a file then all the programs accessed by that file needed to be changed. The structure of data files is defined by the application programs.

14. **Database Management System** (**DBMS**) refers to the technology solution used to optimize and manage the storage and retrieval of data from databases. **DBMS** offers a systematic approach to manage databases via an interface for users as well as workloads accessing the databases via apps.

***Data Dictionary Management***

Data Dictionary Management is the one of the most important function of database management system.

 DBMS stores definitions of the data elements and their relationships (metadata) in a data dictionary.So, all programs that access the data in the database work through the DBMS.

The DBMS uses the data dictionary to look up the required data component structures and relationships which relieves you from coding such complex relationships in each program.

***Data Storage Management***

  One of the DBMS functionality is creating and managing the complex structures required for data storage, thus relieving you from the difficult task of defining and programming the physical data characteristics.

A modern DBMS system provides storage not only for the data, but also for related data entry forms or screen definitions, report definitions, data validation rules, procedural code, structures to handle video and picture formats, and so on.

Data storage management is also important for database performance tuning. Performance tuning relates to the activities that make the database perform more efficiently in terms of storage and access speed. So, the data storage management is another important function of Database Management System.

***Data transformation and presentation***

 The DBMS transforms entered data in to required data structures. The DBMS relieves you of the chore of making a distinction between the logical data format and the physical data format. That is, the DBMS formats the physically retrieved data to make it conform to the user’s logical expectations. For example, imagine an enterprise database used by a multinational company. An end user in England would expect to enter data such as July 11, 2009, as “11/07/2009.” In contrast, the same date would be entered in the United States as “07/11/2009.” Regardless of the data presentation format, the DBMS system must manage the date in the proper format for each country.

***Security Management***  
Security Management is another important function of Database Management System(DBMS). The DBMS creates a security system that enforces user security and data privacy. Security rules determine which users can access the database, which data items each user can access, and which data operations (read, add, delete, or modify) the user can perform. This is especially important in multiuser database systems.

***Multi User Access Control***  
Multiuser access control is another important DBMS Function. To provide data integrity and data consistency, the DBMS uses sophisticated algorithms to ensure that multiple users can access the database concurrently without compromising the integrity of the database.

***Backup and Recovery Management***  
The DBMS provides backup and data recovery to ensure data safety and integrity.

Current DBMS systems provide special utilities that allow the DBA to perform routine and special backup and restore procedures. Recovery management deals with the recovery of the database after a failure, such as a bad sector in the disk or a power failure. Such capability is critical to preserving the database’s integrity.

***. Data Integrity Management***  
Data integrity management is another important DBMS function.

The DBMS promotes and enforces integrity rules, thus minimizing data redundancy and maximizing data consistency.

The data relationships stored in the data dictionary are used to enforce data integrity. Ensuring data integrity is important DBMS functionality in transaction-oriented database systems.

***Database Access Languages and Application Programming Interfaces***  
The DBMS provides data access through a query language. A query language is a non procedural language—one that lets the user specify what must be done without having to specify how it is to be done.

Structured Query Language (SQL) is the defacto query language and data access standard supported by the majority of DBMS vendors.

***Database Communication Interfaces***  
Current-generation DBMS's accept end-user requests via multiple, different network environments. For example, the DBMS might provide access to the database via the Internet through the use of Web browsers such as Mozilla Firefox or Microsoft Internet Explorer.

15. Database users are categorized based up on their interaction with the data base.

These are seven types of data base users in DBMS.

1. **Database Administrator (DBA) :**  
   Database Administrator (DBA) is a person/team who defines the schema and also controls the 3 levels of database.  
   The DBA will then create a new account id and password for the user if he/she need to access the data base.  
   DBA is also responsible for providing security to the data base and he allows only the authorized users to access/modify the data base.
   * DBA also monitors the recovery and back up and provide technical support.
   * The DBA has a DBA account in the DBMS which called a system or superuser account.
   * DBA repairs damage caused due to hardware and/or software failures.
2. **Naive / Parametric End Users :**  
   Parametric End Users are the unsophisticated who don’t have any DBMS knowledge but they frequently use the data base applications in their daily life to get the desired results.

For examples, Railway’s ticket booking users are naive users. Clerks in any bank is a naive user because they don’t have any DBMS knowledge but they still use the database and perform their given task.

1. **System Analyst :**  
   System Analyst is a user who analyzes the requirements of parametric end users. They check whether all the requirements of end users are satisfied.
2. **Sophisticated Users :**  
   Sophisticated users can be engineers, scientists, business analyst, who are familiar with the database. They can develop their own data base applications according to their requirement. They don’t write the program code but they interact the data base by writing SQL queries directly through the query processor.
3. **Data Base Designers :**  
   Data Base Designers are the users who design the structure of data base which includes tables, indexes, views, constraints, triggers, stored procedures. He/she controls what data must be stored and how the data items to be related.
4. **Application Program :**  
   Application Program are the back end programmers who writes the code for the application programs.They are the computer professionals. These programs could be written in Programming languages such as Visual Basic, Developer, C, FORTRAN, COBOL etc.
5. **Casual Users / Temporary Users :**  
   Casual Users are the users who occasionally use/access the data base but each time when they access the data base they require the new information, for example, Middle or higher level manager.

16. When a **DBMS** may be unnecessary:

If the database and applications are simple, well defined, and **not** expected to change.

If there are stringent real-time requirements that may **not** be met because of **DBMS** overhead.

If access to data by multiple users is **not** required.

If the database system is not able to handle the complexity of data because of modeling limitations.

## 17. Components of DBMS

DBMS have several components, each performing very significant tasks in the database management system environment. Below is a list of components within the database and its environment.

***Software***  
This is the set of programs used to control and manage the overall database. This includes the DBMS software itself, the Operating System, the network software being used to share the data among users, and the application programs used to access data in the DBMS.

***Hardware***  
Consists of a set of physical electronic devices such as computers, I/O devices, storage devices, etc., this provides the interface between computers and the real world systems.

***Data***  
DBMS exists to collect, store, process and access data, the most important component. The database contains both the actual or operational data and the metadata.

***Procedures***  
These are the instructions and rules that assist on how to use the DBMS, and in designing and running the database, using documented procedures, to guide the users that operate and manage it.

***Database Access Language***  
This is used to access the data to and from the database, to enter new data, update existing data, or retrieve required data from databases. The user writes a set of appropriate commands in a database access language, submits these to the DBMS, which then processes the data and generates and displays a set of results into a user readable form.

***Query Processor***  
This transforms the user queries into a series of low level instructions. This reads the online user’s query and translates it into an efficient series of operations in a form capable of being sent to the run time data manager for execution.

***Run Time Database Manager***  
Sometimes referred to as the database control system, this is the central software component of the DBMS that interfaces with user-submitted application programs and queries, and handles database access at run time. Its function is to convert operations in user’s queries. It provides control to maintain the consistency, integrity and security of the data.

***Data Manager***  
Also called the cache manger, this is responsible for handling of data in the database, providing a recovery to the system that allows it to recover the data after a failure.

***Database Engine***  
The core service for storing, processing, and securing data, this provides controlled access and rapid transaction processing to address the requirements of the most demanding data consuming applications. It is often used to create relational databases for online transaction processing or online analytical processing data.

***Data Dictionary***  
This is a reserved space within a database used to store information about the database itself. A data dictionary is a set of read-only table and views, containing the different information about the data used in the enterprise to ensure that database representation of the data follow one standard as defined in the dictionary.

***Report Writer***  
Also referred to as the report generator, it is a program that extracts information from one or more files and presents the information in a specified format. Most report writers allow the user to select records that meet certain conditions and to display selected fields in rows and columns, or also format the data into different charts.

18. **Primary Key** is a unique and non-null **key** which identify a record uniquely in table. A table can have only one **primary key**. Primary key column value can not be null. Primary key is most important part of any relation or table. Primary Key is a candidate key. for example student (ID,F\_name,M\_name,L\_name)

**Candidate key** is also a unique **key** to identify a record uniquely in a table but a table can have multiple **candidate keys**. Candidate key signifies as which key can be used as Primary Key. Candidate key may or may not be a primary key. Forexample; student (ID,first name, last name, A)

19. Constraints in SQL serve are prefined rules and restrictions that ate enforced in a single column or multiple columns, regarding the valve allowed the columns to maintain the intergrity, accurancy and reliability of that columns data.

The NOT NULL constraint enforces a column not to accept NULL values.

This enforces a field to always contain a value which means that you cannot insert a new record or updated record without adding a value to this field.

Unique

The unique constraint ensures that all values in a column are different. Both the unique and the primary key constraints provide a guarantee for uniqueness for column or set of columns.

A PRIMARY KEY constraints automatically has a unique constraint.

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