Definitions:

1. **Data**: A collection of raw facts collected from a specific environment for a specific purpose.
2. **Information**: The meaningful form of data after certain processing.
3. **Schema**: A repository or structure to express the format and other different information about data and database.
4. **Database Application**: A program or group of programs used for performing certain operations on the data stored in the database.
5. **Database Management Systems (DBMS)**: Software or a collection of small programs to perform certain operations on data and manage the data.

Short Question Answers:

1. What is the difference between data and information?
    - Data is a collection of raw facts, while information is the meaningful form of data after certain processing.
2. What is a database application?
    - A database application is a program or group of programs used for performing certain operations on the data stored in the database.
3. What are the two basic operations performed by the DBMS?
    - The two basic operations performed by the DBMS are management of data in the database and management of users associated with the database.

MCQs:

1. What does a schema express in a database?
    - [ ] The number of users
    - [ ] The color scheme
    - [ ] The format and other different information about data and database **(Correct Answer)**
    - [ ] The size of the database
2. What are the basic operations performed by DBMS?
    - [ ] Management of Data in the Database and Management of Database Users **(Correct Answer)**
    - [ ] Creation of new databases
    - [ ] Deletion of old databases
    - [ ] None of the above
3. Which of the following is NOT an advantage of Database Systems?
    - [ ] Data consistency
    - [ ] Better data security
    - [ ] Slower development of new applications **(Correct Answer)**
    - [ ] Better backup and recovery procedures

Definitions:

<u>Advantages of Database</u>

1. **Data Consistency**: Changes made to different occurrences of data should be controlled and managed in such a way that all the occurrences have the same value for any specific data item.
2. **Better Data Security**: All application programs access data through DBMS, so DBMS can efficiently check which user is performing which action and accessing which part of data.
3. **Faster Application Development**: The database environment allows for faster application development because the database is designed with future development in mind.
4. **Economy of Scale**: Databases and database systems are designed to share data stored in one location for many different purposes, so it doesn't need to be stored as many times in different forms as it is used.
5. **Better Concurrency Control**: The access of a database from a number of points simultaneously in such a way that all data accesses are completed correctly and transparently.

Short Question Answers:

1. What does data consistency mean?
    - Data consistency means that changes made to different occurrences of data should be controlled and managed in such a way that all the occurrences have the same value for any specific data item.
2. How does DBMS contribute to better data security?
    - All application programs access data through DBMS, so DBMS can efficiently check which user is performing which action and accessing which part of data.
3. What does better concurrency control mean?
    - Better concurrency control refers to the access of a database from a number of points simultaneously in such a way that all data accesses are completed correctly and transparently.

MCQs:

1. What does data consistency ensure in a database system?
    - [ ] Loss of information
    - [ ] Incorrect results
    - [ ] All occurrences have the same value for any specific data item **(Correct Answer)**
    - [ ] All of the above
2. How does a DBMS contribute to better data security?
    - [ ] By restricting user access
    - [ ] By monitoring user actions
    - [ ] By controlling which part of data a user can access
    - [ ] All of the above **(Correct Answer)**
3. What is an advantage of faster application development in database systems?
    - [ ] The data needed for the new application already resides in the database **(Correct Answer)**
    - [ ] The database needs to be redesigned for each new application
    - [ ] The new application needs to be developed from scratch
    - [ ] None of the above

Cost Involved :

1. **High Cost**: Inherent charges of database systems including the need for specialized software, additional and specialized hardware, and technically qualified staff.
2. **Conversion Cost**: Charges needed for adopting the database system once an organization has decided to switch to a database system.
3. **Difficult Recovery Procedures**: The process of recovering a crashed database which is technical and requires professional skills.

Importance of Data

Data as a Resource: Data is considered a resource because it provides correct information for an organization to make proper decisions.

Levels of data

Real World Data: The level of data at which entities or objects exist in reality.

Meta Data: The way data will be stored in the database, including the type of data, the size of a certain attribute of the real world data, and how many and what attributes will be used to store the data about the entity in the database.

Occurrence/Existence of Data: The actual data regarding the entities at real world level according to the rules defined at the Meta Data level.

Easier:

Real World Data: Information about actual things or objects in the real world.

Meta Data: Details about how the data will be stored, like its type, size, and structure.

Occurrence/Existence of Data: The actual data itself, based on the rules defined by the Meta Data.

Short Question Answers:

1. What does high cost in a database system entail?
    - High cost in a database system entails the need for specialized software, additional and specialized hardware, and technically qualified staff.
2. Why is data considered a resource?
    - Data is considered a resource because it provides correct information for an organization to make proper decisions.
3. What is real world data?

- Real world data refers to the level of data at which entities or objects exist in reality.

MCQs:

1. What does high cost in a database system include?
    - [ ] Specialized software
    - [ ] Additional and specialized hardware
    - [ ] Technically qualified staff
    - [ ] All of the above **(Correct Answer)**
2. Why is data considered as a resource?
    - [ ] It provides correct information
    - [ ] It helps in making proper decisions
    - [ ] It leads to good utilization of other organizational resources
    - [ ] All of the above **(Correct Answer)**
3. What does real world data refer to?
    - [ ] The level of data at which entities or objects exist in reality **(Correct Answer)**
    - [ ] Data that exists in virtual reality
    - [ ] Data that exists in databases
    - [ ] None of the above

Types of Database Users

1. **Application Programmers**: People who create different types of database application programs.
2. **Database Administrators (DBA)**: The most technical class of database users who need to have knowledge of how to design and manage the database use as well as to manage the data in the database.
3. **End Users**: People who use the database application programs developed by the Application programmers.
    i. **Naïve Users**: Users who simply use the application database programs created by the programmers.
    ii. **Sophisticated Users**: Users who have some additional rights over the Naïve users and can access the data stored in the database in any of their desired ways.

Short Question Answers:

1. What is Meta Data?
    - Meta Data is also known as schema for real world data. It defines what type of data will be stored in the database, what will be size of a certain attribute of real world data, and how many and what attributes will be used to store data about an entity in the database.
2. Who are Application Programmers?
    - Application Programmers are those people who create different types of database application programs.
3. What is the difference between Naïve Users and Sophisticated Users?
    - Naïve Users simply use application database programs created by programmers, while Sophisticated Users have additional rights and can access data using application programs as well as other ways of accessing data.

MCQs:

1. What does Meta Data define?
    - [ ] The size of a certain attribute
    - [ ] The type of data
    - [ ] How many and what attributes will be used to store data
    - [ ] All of the above **(Correct Answer)**
2. Who creates different types of database application programs?
    - [ ] End Users
    - [ ] Naïve Users
    - [ ] Sophisticated Users
    - [ ] Application Programmers **(Correct Answer)**
3. Who has more rights to access data?
    - [ ] Naïve Users
    - [ ] Sophisticated Users **(Correct Answer)**
    - [ ] Both have equal rights
    - [ ] None of them

Duties of the DBA

A Database administrator has some very precisely defined duties which need to be performed by the DBA very religiously:

1. **Schema Definition**: The job of creating all the meta data information for the organization on which the database is based.
2. **Granting Data Access**: The responsibility of granting access rights to the database users and continuously monitoring and ensuring the legal use of these rights.
3. **Routine Maintenance**: Activities including database maintenance, database backup, grant of rights to database users, monitoring of running jobs, managing print jobs, and ensuring quality of service to all users.
    a. **Backups**
    b. **Monitoring Disk Space**: The task of monitoring the disk space usage and statistics to ensure that no data overflow occurs at any stage.
    c. **Monitoring Running Jobs**: The task of ensuring the secure and proper functioning of the database system by continuously monitoring some associated activities.

Short Question Answers:

1. What does schema definition involve in a database system?
    - Schema definition involves creating all the meta data information for the organization on which the database is based.
2. What does granting data access entail in a database system?
    - Granting data access entails granting access rights to the database users and continuously monitoring and ensuring the legal use of these rights.
3. What is involved in routine maintenance in a database system?
    - Routine maintenance involves activities such as database maintenance, database backup, grant of rights to database users, monitoring of running jobs, managing print jobs, and ensuring quality of service to all users.

MCQs:

1. What does schema definition involve in a database system?
    - [ ] Creating meta data information (Correct)
    - [ ] Monitoring disk space
    - [ ] Monitoring running jobs
    - [ ] None of the above
2. What does granting data access entail in a database system?
    - [ ] Granting access rights to users
    - [ ] Continuously monitoring and ensuring legal use of rights
    - [ ] Both A and B **(Correct Answer)**
    - [ ] None of the above
3. What is involved in routine maintenance in a database system?
    - [ ] Database maintenance
    - [ ] Database backup
    - [ ] Granting rights to users
    - [ ] All of the above **(Correct Answer)**

Typical Components of a Database Environment:

Different typical components of a database environment are shown in the figures below; they describe graphically the role of different types of users.

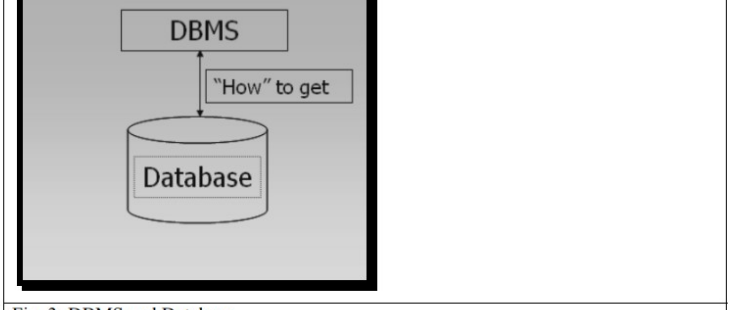

Fig. 3: DBMS and Database

Database is used to store data and DBMS uses mechanisms to get data from the database

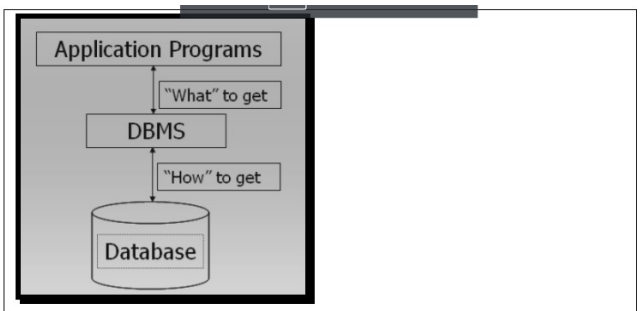

Fig. 4: Application Programs

Application programs talk to DBMS and ask for the data required

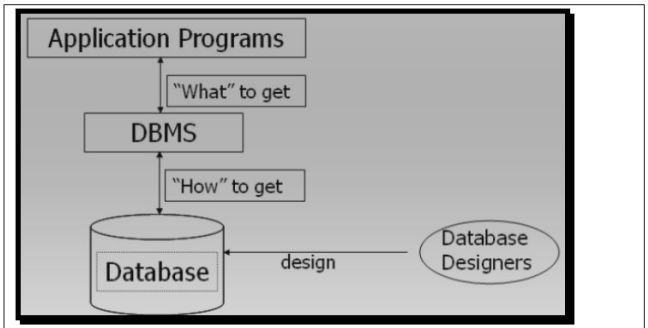

Fig. 5: Database Designers

Database designers design (for large organizations) the database and install the DBMS for use by the users of the database in any specific organization.

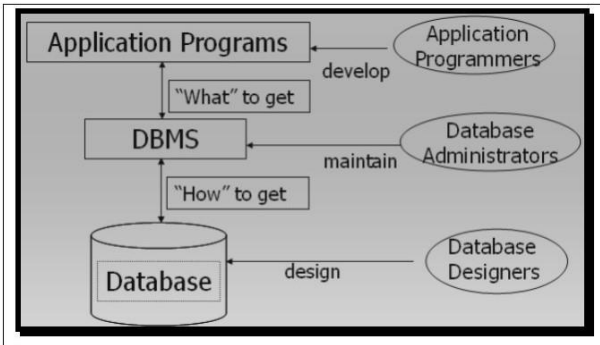

Fig. 6: Database Administrator

Once Database has been installed and is functioning properly in a production environment of an organization the Database Administrator takes over the charge and performs specific DBA related activities including:

- Database maintenance
- Database Backup
- Grant of rights to database users
- Monitoring of Running Jobs
- Managing Print jobs
- Ensuring quality of Service to all users

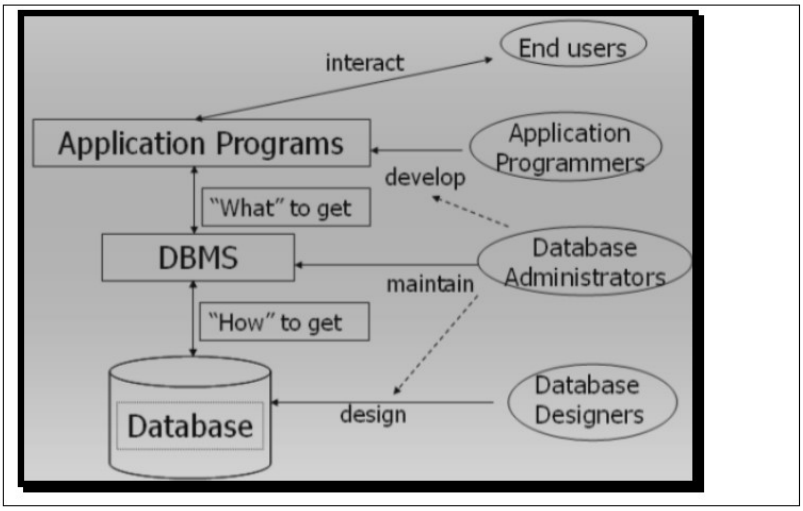

Fig. 7: Database Administration's interaction with other users

- Database administrator can interact with the database designer during database design phase so that he has a clear idea of the database structure for easy reference in future.
- This helps DBA perform different tasks related to the database structure.
- DBA also interacts with the application programmers during the application development process and provides his services for better design of applications.
- End users also interact with the system using application programs and other tools as specified in the description above.