Chapter 4

2. How to maintain security for Database Administration?
Ans:
Security refers to activities and measures to ensure the confidentiality, integrity, and availability of an information system and its main asset, data.It is important to understand that securing data requires a comprehensive, company-wide approach.
That is, you cannot secure data if you do not secure all the processes and systems around it. Indeed, securing data entails securing the overall information system architecture, including hardware systems, software applications, the network and its devices, people (internal and external users), procedures, and the data itself.

Database security refers to the use of the DBMS features and other related measures to comply with the security requirements of the organization. From the DBA's point of view, security measures should be implemented to protect the DBMS against service degradation and the database against loss, corruption, or mishandling. In short, the DBA should secure the DBMS from the point of installation through operation and maintenance.

To protect the DBMS against service degradation there are certain minimum recommended security safeguards. For example:
_ Change default system passwords.
_ Change default installation paths.
_ Apply the latest patches.
_ Secure installation folders with proper access rights.
_ Make sure only required services are running.
_ Set up auditing logs.
_ Set up session logging.
_ Require session encryption.

Furthermore, the DBA should work closely with the network administrator to implement network security to protect the DBMS and all services running on the network. In current organizations, one of the most critical components in the information architecture is the network.
Protecting the data in the database is a function of authorization management. **Authorization management** defines procedures to protect and guarantee database security and integrity. Those procedures include, but are not limited to, user access management, view definition, DBMS access control, and DBMS usage monitoring.

Maintaining The Security:
_ *User access management.* This function is designed to limit access to the database and likely includes at least
the following procedures:
- *Define each user to the database.*
- *Assign passwords to each user.*
- *Define user groups.*
- *Assign access privileges.*

- *Control physical access.*

_ *View definition.* The DBA must define data views to protect and control the scope of the data that are accessible to an authorized user. The DBMS must provide the tools that allow the definition of views that are
composed of one or more tables and the assignment of access rights to a user or a group of users.

_ *DBMS access control.* Database access can be controlled by placing limits on the use of DBMS query and
reporting tools. The DBA must make sure that those tools are used properly and only by authorized personnel.

_ *DBMS usage monitoring.* The DBA must also audit the use of the data in the database. Several DBMS
packages contain features that allow the creation of an **audit log**, which automatically records a brief description of the database operations performed by all users.

The integrity of a database could be lost because of external factors beyond the DBA's control. For example, the database might be damaged or destroyed by an explosion, a fire, or an earthquake. Whatever the reason, the spectre of database corruption or destruction makes backup and recovery procedures crucial to any DBA.

3. What is need of database in an organization?
5. Explain role of the database in an organization development.
Ans:

Data are used by different people in different departments for different reasons. Therefore, data management must address the concept of shared data.
Whatever the type of organization, the database's predominant role is to support managerial decision making at all levels in the organization while preserving data privacy and security.

An organization's managerial structure might be divided into three levels: top, middle, and operational. Top-level management makes strategic decisions, middle management makes tactical decisions, and operational management makes daily operational decisions. Operational decisions are short term and affect only daily operations; for example, deciding to change the price of a product to clear it from inventory. Tactical decisions involve a longer time frame and affect larger-scale operations; for example, changing the price of a product in response to competitive pressures.
Strategic decisions are those that affect the long-term well-being of the company or even its survival; for example, changing pricing strategy across product lines to capture market share.

The DBMS must provide tools that give each level of management a useful view of the data and that support the required level of decision making. The following activities are typical of each management level.

At the top management level, the database must be able to:
Provide the information necessary for strategic decision making, strategic planning, policy formulation, and goals definition.

Provide access to external and internal data to identify growth opportunities and to chart the direction of such growth. (Direction refers to the nature of the operations: Will a company become a service organization, a manufacturing organization, or some combination of the two?)
Provide a framework for defining and enforcing organizational policies. (Remember that such polices are translated into business rules at lower levels in the organization.)
Improve the likelihood of a positive return on investment for the company by searching for new ways to reduce costs and/or by boosting productivity.
Provide feedback to monitor whether the company is achieving its goals.

At the middle management level, the database must be able to:
Deliver the data necessary for tactical decisions and planning.
Monitor and control the allocation and use of company resources and evaluate the performance of the various departments.
Provide a framework for enforcing and ensuring the security and privacy of the data in the database. Security means protecting the data against accidental or intentional use by unauthorized users. Privacy deals with the rights of individuals and the organization to determine the "who, what, when, where, and how" of data usage.

At the operational management level, the database must be able to:
Represent and support the company operations as closely as possible. The data model must be flexible enough to incorporate all required present and expected data.
Produce query results within specified performance levels. Keep in mind that the performance requirements increase for lower levels of management and operations. Thus, the database must support fast responses to a greater number of transactions at the operational management level.
Enhance the company's short-term operational ability by providing timely information for customer support and for application development and computer operations.

A general objective for any database is to provide a seamless flow of information throughout the company.

The company's database is also known as the corporate or enterprise database. The enterprise database might be defined as "the company's data representation that provides support for all present and expected future operations."

Most of today's successful organizations depend on the enterprise database to provide support for all of their operations—from design to implementation, from sales to services, and from daily decision making to strategic planning.

4. Explain special considerations aspects of a DBMS into an organization.
Ans:
Having a computerized database management system does not guarantee that the data will be properly used to provide the best solutions required by managers. A DBMS is a tool for managing data; like any tool, it must be used effectively to produce the desired results.

The introduction of a DBMS represents a big change and challenge; throughout the organization, the DBMS is likely to have a profound impact, which might be positive or negative depending on how it is administered. For example, one key consideration is adapting the DBMS to the organization rather than forcing the organization to adapt to the DBMS. The main issue should be the organization's needs rather than the DBMS's technical capabilities. However, the introduction of a DBMS cannot be accomplished without affecting the organization. The flood of new DBMS-generated information has a profound effect on the way the organization functions and, therefore, on its corporate culture.

The introduction of a DBMS into an organization has been described as a process that includes three important aspects:
Technological. DBMS software and hardware.
Managerial. Administrative functions.
Cultural. Corporate resistance to change.

The technological aspect includes selecting, installing, configuring, and monitoring the DBMS to make sure that it efficiently handles data storage, access, and security. The person or people in charge of addressing the technological aspect of the DBMS installation must have the technical skills necessary to provide or secure adequate support for the various users of the DBMS: programmers, managers, and end users. Therefore, database administration staffing is a
key technological consideration in the DBMS introduction. The selected personnel must exhibit the right mix of technical and managerial skills to provide a smooth transition to the new shared-data environment.

The managerial aspect of the DBMS introduction should not be taken lightly. A high-quality DBMS does not guarantee a high-quality information system, just as having the best race car does not guarantee winning a race.

The cultural impact of the introduction of a database system must be assessed carefully. The DBMS's existence is likely to have an effect on people, functions, and interactions. For example, additional personnel might be added, new roles might be allocated to existing personnel, and employee performance might be evaluated using new standards.

The introduction of a DBMS into an organization requires careful planning to create an appropriate organizational structure to accommodate the person or people responsible for administering the DBMS. The organizational structure must also be subject to well-developed monitoring and controlling functions. The administrative personnel must have excellent interpersonal and communications skills combined with broad organizational and business understanding. Top management must be committed to the new system and must define and support the data administration functions, goals, and roles within the organization.

A cultural impact is likely because the database approach creates a more controlled and structured information flow. Department managers who are used to handling their own data must surrender their subjective ownership to the data administration function and must share their data with the rest of the company.

Application programmers must learn and follow new design and development standards. Managers might be faced with what they consider to be an information overload and might require some time to adjust to the new environment.

When the new database comes online, people might be reluctant to use the information provided by the system and might question its value or accuracy. The database administration department must be prepared to open its doors to end users, listen to their concerns, act on those concerns when possible, and educate end users about the system's uses and benefits.

6. Explain in brief evolution of the database administration function.
Ans:

Data administration has its roots in the old, decentralized world of the file system. The cost of data and managerial duplication in such file systems gave rise to a centralized data administration function known as the electronic data processing (EDP) or data processing (DP) department. The DP department's task was to pool all computer resources to support all departments at the operational level. The DP administration function was given the authority to manage all existing company file systems as well as resolve data and managerial conflicts created by the duplication and/or misuse of data.

The advent of the DBMS and its shared view of data produced a new level of data management sophistication and led the DP department to evolve into an information systems (IS) department. The responsibilities of the IS department were broadened to include:
A service function to provide end users with active data management support.
A production function to provide end users with specific solutions for their information needs through integrated application or management information systems.

The functional orientation of the IS department was reflected in its internal organizational structure. IS departments typically were structured as shown in Figure 15.2. As the demand for application development grew, the IS application development segment was subdivided by the type of supported system: accounting, inventory, marketing, and so on.
However, this development meant that the database administration responsibilities were divided. The application development segment was in charge of gathering database requirements and logical database design, whereas the database operations segment took charge of implementing, monitoring, and controlling the DBMS operations.

As the number of database applications grew, data management became an increasingly complex job, thus leading to the development of the database administration function. The person responsible for the control of the centralized and shared database became known as the database administrator (DBA).

The size and role of the DBA function varies from company to company, as does its placement within a company's organizational structure. On the organization chart, the DBA function might be defined as either a staff or line position. Placing the DBA function in a staff position often creates a consulting environment in which the DBA is able to devise the data administration strategy but does not have the authority to enforce it or to resolve possible conflicts.

There is no standard for how the DBA function fits in an organization's structure. In part, that is because the DBA function itself is probably the most dynamic of any organization's functions. In fact, the fast-paced changes in DBMS technology dictate changing organizational styles.

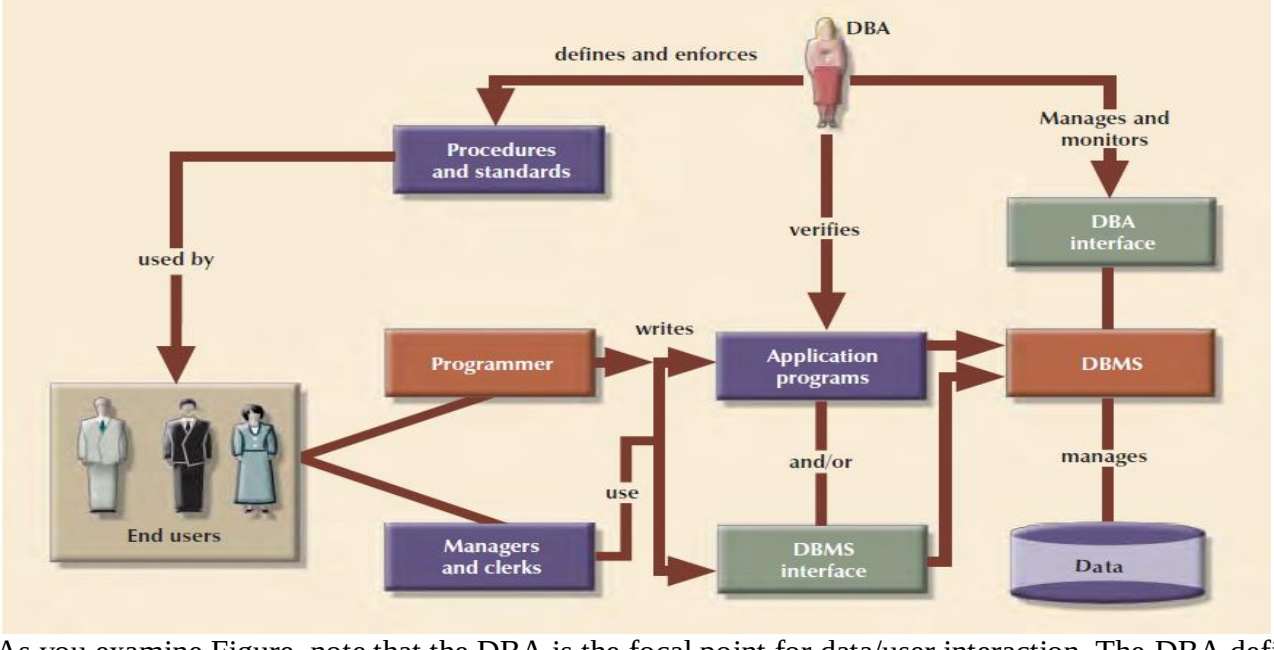
It is common practice to define the DBA function by dividing the DBA operations according to the Database Life Cycle (DBLC) phases. If that approach is used, the DBA function requires personnel to cover the following activities:
Database planning, including the definition of standards, procedures, and enforcement.
Database requirements gathering and conceptual design.
Database logical and transaction design.
Database physical design and implementation.
Database testing and debugging.
Database operations and maintenance, including installation, conversion, and migration.
Database training and support.
Data quality monitoring and management.

There is a growing trend toward specialization in the data management function. For example, the organization charts used by some of the larger corporations make a distinction between a DBA and the data administrator (DA). The DA, also known as the information resource manager (IRM), usually reports directly to top management and is given a higher degree of responsibility and authority than the DBA, although the two roles overlap some.

The DA is responsible for controlling the overall corporate data resources, both computerized and manual. Thus, the DA's job description covers a larger area of operations than that of the DBA because the DA is in charge of controlling not only the computerized data but also the data outside the scope of the DBMS. The placement of the DBA within the expanded organizational structure may vary from company to company. Depending on the structure's components, the DBA might report to the DA, the IRM, the IS manager, or directly to the company's CEO.

9. Summaries DBA activities with suitable diagram.
Ans:
The preceding discussion should not lead you to believe that there are universally accepted DA and DBA administrative standards. As a matter of fact, the style, duties, organizational placement, and internal structure of both functions vary from company to company. For example, many companies distribute DA duties between the DBA and the manager of information systems. For simplicity and to avoid confusion, the label DBA is used here as a general title that
encompasses all appropriate data administration functions. Having made that point, let's move on to the DBA's role as an arbitrator between data and users.

The arbitration of interactions between the two most important assets of any organization, people and data, places the DBA in the dynamic environment portrayed in Figure below



As you examine Figure, note that the DBA is the focal point for data/user interaction. The DBA defines and enforces the procedures and standards to be used by programmers and end users during their work with the DBMS. The DBA also verifies that programmer and end-user access meets the required quality and security standards.

Database users might be classified by the:
Type of decision-making support required (operational, tactical, or strategic).
Degree of computer knowledge (novice, proficient, or expert).
Frequency of access (casual, periodic, or frequent).

Those classifications are not exclusive and usually overlap. For example, an operational user can be an expert with casual database access. Nevertheless, a typical top-level manager might be a strategic novice user with periodic database access. On the other hand, a database application programmer is an operational expert and frequent database user. Thus, each organization employs people whose levels of database expertise span an entire spectrum. The DBA must be able to interact with all of those people, understand their different needs, answer questions at all levels of the expertise scale, and communicate effectively.

The DBA activities portrayed in Above Figure suggest the need for a diverse mix of skills. In large companies, such skills are likely to be distributed among several people who work within the DBA function. In small companies, the skills might be the domain of just one individual. The skills can be divided into two categories—managerial and technical—as summarized in Table below

MANAGERIAL	TECHNICAL
Broad business understanding	Broad data-processing background
Coordination skills	Systems Development Life Cycle knowledge
Analytical skills	Structured methodologies: Data flow diagrams Structure charts Programming languages
Conflict resolution skills	Database Life Cycle knowledge
Communications skills (oral and written)	Database modeling and design skills Conceptual Logical Physical
Negotiation skills	Operational skills: Database implementation, data dictionary management, security, and so on
Experience: 10 years in a large DP department	

10. What are the desired DBA skills ?

11. Explain DBA activities and services.

12. Explain DBA's technical role .

Ans:

In large companies, such skills are likely to be distributed among several people who work within the DBA function. In small companies, the skills might be the domain of just one individual. The skills can be divided into two categories—managerial and technical

DBA ACTIVITY		DBA SERVICE
Planning		End-user support
Organizing		Policies, procedures, and standards
Testing	of	Data security, privacy, and integrity
Monitoring		Data backup and recovery
Delivering		Data distribution and use

DBA must perform two distinct roles. The DBA's managerial role is focused on personnel management and on interactions with the end-user community. The DBA's technical role involves the use of the DBMS—database design, development, and implementation—as well as the production, development, and use of application programs.

The DBA's Managerial Role::

As a manager, the DBA must concentrate on the control and planning dimensions of database administration.

Therefore, the DBA is responsible for:

Coordinating, monitoring, and allocating database administration resources: people and data.

Defining goals and formulating strategic plans for the database administration function.

1)End-User Support:

The DBA interacts with the end user by providing data and information support services to the organization's departments. Because end users usually have dissimilar computer backgrounds, end-user support services include:

Gathering user requirements.

Building end-user confidence.
Resolving conflicts and problems.
Finding solutions to information needs.
Ensuring quality and integrity of data and applications.
Managing the training and support of DBMS users.
2)Policies, Procedures, and Standards:
A prime component of a successful data administration strategy is the continuous enforcement of the policies, procedures, and standards for correct data creation, usage, distribution, and deletion within the database. The DBA must define, document, and communicate the policies, procedures, and standards before they can be enforced. Basically:
Policies are general statements of direction or action that communicate and support DBA goals.
Standards describe the minimum requirements of a given DBA activity; they are more detailed and specific than policies. In effect, standards are rules that are used to evaluate the quality of the activity. For example, standards define the structure of application programs and the naming conventions programmers must use.
Procedures are written instructions that describe a series of steps to be followed during the performance of a given activity. Procedures must be developed within existing working conditions, and they must support and enhance that environment.
3)Data Security, Privacy, and Integrity
The security, privacy, and integrity of the data in the database are of great concern to DBAs who manage current DBMS installations. Technology has pointed the way to greater productivity through information management.Technology has also resulted in the distribution of data across multiple sites, thus making it more difficult to maintain data control, security, and integrity.
4)Data Backup and Recovery
When data are not readily available, companies face potentially ruinous losses. Therefore, data backup and recovery procedures are critical in all database installations. The DBA must also ensure that the data in the database can be fully recovered in case of physical data loss or loss of database integrity.

The DBA's Technical Role::
The DBA's technical role requires a broad understanding of DBMS functions, configuration, programming languages, data modeling and design methodologies, and so on. For example, the DBA's technical activities include the selection,installation, operation, maintenance, and upgrading of the DBMS and utility software, as well as the design,development,implementation, and maintenance of the application programs that interact with the database.
Many of the DBA's technical activities are a logical extension of the DBA's managerial activities. For example, the DBA deals with database security and integrity, backup and recovery, and training and support. Thus, the DBA's dual role might be conceptualized as a capsule whose technical core is covered by a clear managerial shell.

The technical aspects of the DBA's job are rooted in the following areas of operation:
Evaluating, selecting, and installing the DBMS and related utilities.
Designing and implementing databases and applications.
Testing and evaluating databases and applications.
Operating the DBMS, utilities, and applications.
Training and supporting users.
Maintaining the DBMS, utilities, and applications.

1)Evaluating, Selecting, and Installing the DBMS and Utilities:
One of the DBA's first and most important technical responsibilities is selecting the database management system,utility software, and supporting hardware to be used in the organization. Therefore, the DBA must develop and execute a plan for evaluating and selecting the DBMS, utilities, and hardware. That plan must be based primarily on the
organization's needs rather than on specific software and hardware features. The DBA must recognize that the search is for solutions to problems rather than for a computer or DBMS software. Put simply, a DBMS is a management tool and not a technological toy.
2)Designing and Implementing Databases and Applications:
The DBA function also provides data-modeling and design services to end users. Such services are often coordinated with an application development group within the data-processing department. Therefore, one of the primary activities of a DBA is to determine and enforce standards and procedures to be used. Once the appropriate standards and procedures framework are in place, the DBA must ensure that the database-modeling and design activities are performed within the framework. The DBA then provides the necessary assistance and support during the design of the database at the conceptual, logical, and physical levels.
3)Testing and Evaluating Databases and Applications:
The DBA must also provide testing and evaluation services for all of the database and end-user applications. Those services are the logical extension of the design, development, and implementation services described in the preceding section. Clearly, testing procedures and standards must already be in place before any application program can be approved for use in the company.
4)Operating the DBMS, Utilities, and Applications:
DBMS operations can be divided into four main areas:
System support.
Performance monitoring and tuning.
Backup and recovery.
Security auditing and monitoring.
System support activities cover all tasks directly related to the day-to-day operations of the DBMS and its applications.These activities include filling out job logs, changing tape, and verifying the status of computer hardware, disk packages, and emergency power sources. System-related activities include periodic, occasional tasks such as running special programs and resource configurations for new and/or upgraded versions of database applications.
5)Training and Supporting Users:
Training people to use the DBMS and its tools is included in the DBA's technical activities. In addition, the DBA provides or secures technical training in the use of the DBMS and its utilities for the applications programmers.Applications programmer training covers the use of the DBMS tools as well as the procedures and standards required for database programming.
6)Maintaining the DBMS, Utilities, and Applications:
The maintenance activities of the DBA are an extension of the operational activities. Maintenance activities are dedicated to the preservation of the DBMS environment.

14. Different Database Administration Tools.

Ans:

SYSTEM COMPONENT	SECURITY VULNERABILITY	SECURITY MEASURES
People	• User sets a blank password. • Password is short or includes birth date. • User leaves office door open all the time. • User leaves payroll information on screen for long periods of time.	• Enforce complex password policies. • Use multilevel authentication. • Use security screens and screen savers. • Educate users about sensitive data. • Install security cameras. • Use automatic door locks.
Workstation and Servers	• User copies data to flash drive. • Workstation is used by multiple users. • Power failure crashes computer. • Unauthorized personnel can use computer. • Sensitive data stored in laptop computer. • Data lost due to stolen hard disk/laptop. • Natural disasters—earthquake, flood, etc.	• Use group policies to restrict use of flash drives. • Assign user access rights to workstations. • Install uninterrupted power supplies (UPSs). • Add security lock devices to computers. • Implement a "kill" switch for stolen laptops. • Create and test data backup and recovery plans. • Insure system against natural disasters—use co-location strategies.
Operating System	• Buffer overflow attacks. • Virus attacks. • Root kits and worm attacks. • Denial of service attacks. • Trojan horses. • Spyware applications. • Password crackers.	• Apply OS security patches and updates. • Apply application server patches. • Install antivirus and antispyware software. • Enforce audit trails on the computers. • Perform periodic system backups. • Install only authorized applications. • Use group policies to prevent unauthorized installs.
Applications	• Application bugs—buffer overflow. • SQL injection, session hijacking, etc. • Application vulnerabilities—cross-site scripting, nonvalidated inputs. • E-mail attacks: spamming, phishing, etc. • Social engineering e-mails.	• Test application programs extensively. • Built safeguards in code. • Do extensive vulnerability testing in applications. • Install spam filter/antivirus for e-mail system. • Use secure coding techniques (see *www.owasp.org*). • Educate users about social engineering attacks.
Network	• IP spoofing. • Packet sniffers. • Hacker attacks. • Clear passwords on network.	• Install firewalls. • Virtual Private Networks (VPN). • Intrusion Detection Systems (IDS). • Network Access Control (NAC). • Network activity monitoring.
Data	• Data shares are open to all users. • Data can be accessed remotely. • Data can be deleted from shared resource.	• Implement file system security. • Implement share access security. • Use access permission. • Encrypt data at the file system or database level.

14. Different Database Administration Tools.

Ans:

DATABASE ADMINISTRATION TOOLS::

1)The Data Dictionary:

a data dictionary was defined as “a DBMS component that stores the definition of data characteristics and relationships.” You may recall that such “data about data” are called metadata. The DBMS data dictionary provides the DBMS with its self-describing characteristic.

Two main types of data dictionaries exist: integrated and standalone. An integrated data dictionary is included with the DBMS. For example, all relational DBMSs include a built-in data dictionary or system catalog that is frequently accessed and updated by the RDBMS. Other DBMSs, especially older types, do not have a built-in data dictionary; instead, the DBA may use third-party standalone data dictionary systems.

Data dictionaries can also be classified as active or passive. An active data dictionary is automatically updated by the DBMS with every database access, thereby keeping its access information up to date. A passive data dictionary is not updated automatically and usually requires running a batch process. Data dictionary access information is normally used by the DBMS for query optimization purposes.

The data dictionary’s main function is to store the description of all objects that interact with the database. Integrated data dictionaries tend to limit their metadata to the data managed by the DBMS. Standalone data dictionary systems are usually more flexible and allow the DBA to describe and manage all of the organization’s data, whether or not they are computerized. Whatever the data dictionary’s format, its existence provides database designers and end users with a much-improved ability to communicate. In addition, the data dictionary is the tool that helps the DBA resolve data conflicts.

If the data dictionary can be organized to include data external to the DBMS itself, it becomes an especially flexible tool for more general corporate resource management. The management of such an extensive data dictionary thus makes it possible to manage the use and allocation of all of the organization’s information, regardless of whether the information has its roots in the database data. That is why some managers consider the data dictionary to be a key element of information resource management. And that is also why the data dictionary might be described as the information resource dictionary.

2)CASE Tools:

CASE is the acronym for computer-aided systems engineering. A CASE tool provides an automated framework for the Systems Development Life Cycle (SDLC). CASE uses structured methodologies and powerful graphical interfaces. Because they automate many tedious system design and implementation activities, CASE tools play an increasingly important role in information systems development.

CASE tools are usually classified according to the extent of support they provide for the SDLC. For example,front-end CASE tools provide support for the planning, analysis, and design phases; back-end CASE tools provide support for the coding and implementation phases. The benefits associated with CASE tools include:

A reduction in development time and costs.

Automation of the SDLC.
Standardization of systems development methodologies.
Easier maintenance of application systems developed with CASE tools.

One of the CASE tools' most important components is an extensive data dictionary, which keeps track of all objects created by the systems designer.A CASE data dictionary also describes the relationships among the components of the system.

TABLE 15.5 CASE Tools

COMPANY	PRODUCT
Casewise	Corporate Modeler Suite
Computer Associates	ERwin
Embarcadero Technologies	ER/Studio
Microsoft	Visio
Oracle	Designer
IBM	System Architect
Sybase	Power Designer
Visible	Visible Analyst