9. Introduction to MS Access

9.1 What is MS Access?

Essentially, **MS Access** is a *database management system* (DBMS). Like other products in this category, Access:

- Stores and retrieves data,
- Presents information, and
- Automates repetitive tasks (such as maintaining accounts payable, performing inventory control, and scheduling).

With Access you can develop easy-to-use input forms as you have seen from other Windows applications. You can process your data and run powerful reports.

Access is also a powerful Windows application - probably the best end-user/developer product ever written:

- Brings the productivity of database management to the usability and consistency of Microsoft Windows. Because both Windows and Access are from Microsoft, the two products work very well together.
- Can work very well together with other MS products such as VB, VC++, .net etc.
- Runs on the Windows 95, Windows 98, Windows NT, 2000, or XP platform, so all the advantages of Windows are available in Access. You can cut, copy, and paste data from any Windows application to and from Access. You can create a form design in Access and paste it into the report designer.

Using ActiveX (formerly called *OLE* - Object Linking and Embedding) objects in Windows and Microsoft Office 2000 products (Excel, Word, PowerPoint, and Outlook),

- You can extend Access into a true database-operating environment by integrating it with these products.
- With the new Internet extensions, you can create forms that interact with data directly from the World Wide Web and translate your forms directly into data access pages for corporate intranets that work directly with your Internet browser.

Access is not only a database manager but also a **relational database manager**:

- Provides access to all types of data and allows the use of more than one database tables at a time.
- Can reduce the complexity of your data and make it easier to get your job done.
- Can link an Access table with mainframe or server data or use a table created in dBase or Excel.
- Can take the results of the link and combine the data with an Excel worksheet quickly and easily. If you use Microsoft Office 2000, there is complete interoperability between Access and Word, Excel, Outlook, and PowerPoint.

- Can easily manipulate Access data from your VB or VC applications.

MS Access has several versions: Access 2, Access 95, Access 97, Access 2000, and Access 2003. If you are upgrading to Access 2000 from earlier versions of Access, you should consider a few things. Earlier versions of Access databases must be converted to Access 2000 format before they are usable. After an Access 2.0 or Access 95 database is converted to Access 2000 format, it cannot be converted back; it's unusable by Access 2.0, 95, or 97.

You can, however, save Access 2000 database in Access 97 format. As an Access 2000 user, you can open and work with Access 2.0, 95, or 97 data by attaching to them as external databases, but you cannot modify any of the objects (forms, reports, queries, and so on) you find in them.

9.2 MS Access Usability Hierarchy

Figure 1 shows the original Microsoft marketing concept for Access. This simple figure conveys the message that Access is usable at all levels.

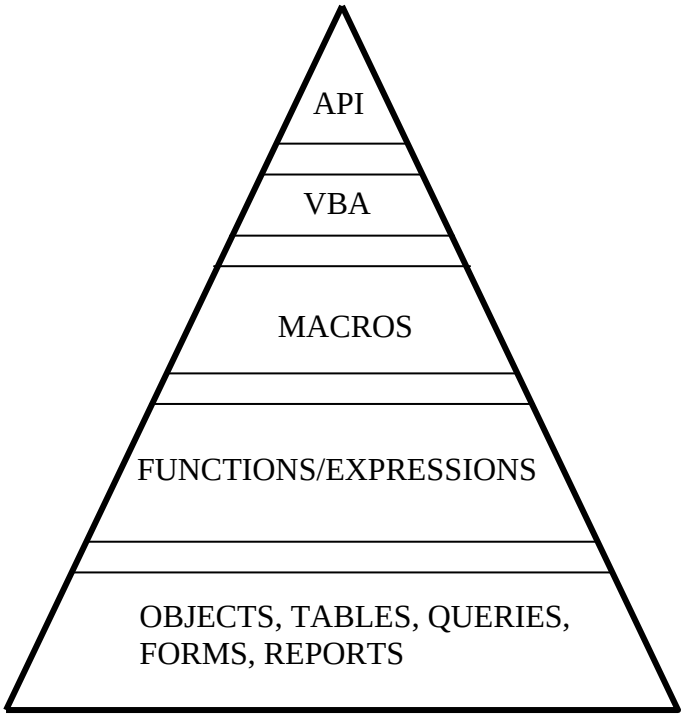

Figure 1. The Access usability hierarchy.

Beginning at the lowest level of the hierarchy and moving upward, you see:

- *Objects* listed first; these give the end user the capability of creating tables, queries, forms, and reports easily.

- By using functions/expressions, simple processing can be performed to validate data, enforce a business rule, or display a number with a currency symbol.
- *Macros* allow for automation without programming.
- However, VBA (Visual Basic for Applications) code lets the user program complex processes.
- Finally, by using Windows API (Application Programming Interface) calls to functions or DLLs (Dynamic Link Libraries) written in other languages such as C, Java, or Visual Basic, a programmer can write interfaces to other programs and data sources. Similarly, the programmer can write the interfaces from other applications to connect to the Access database.

Access is a set of tools for end-user database management. Access has:
- a table creator,
- a form designer,
- a query manager,
- a data access page creator, and
- a report writer.

Access is also an environment for developing applications. Using macros or modules to automate tasks, you can create user-oriented applications as powerful as those created with programming languages —complete with the buttons, menus, and dialog boxes. By programming in Visual Basic for Applications (known as VBA), you can create programs as powerful as Access itself. In fact, many of the tools in Access (such as Wizards and Builders) are written in VBA.

9.3 What Access Offers?

(1) Relational database management

Access provides true *relational database managemen*t. Access includes:
- Definitions for primary and foreign keys, and has full referential integrity at the database engine level itself (which prevents inconsistent updates or deletions).
- Tables in Access have data-validation rules to prevent inaccurate data regardless of how data is entered, and every field in a table has format and default definitions for more productive data entry.
- Access supports all the necessary field types, including Text, Number, AutoNumber (counter), Currency, Date/Time, Memo, Yes/No, Hyperlink, and OLE objects. When values are missing in special processing, Access provides full support for null values.

The relational processing in Access fills many needs with its flexible architecture. It can be used as a stand-alone database management system, in a file-server configuration, or as a front-end client to products such as a SQL server. In addition,

Access features ODBC (Open Database Connectivity), which permits connection to many external formats, such as SQL/Server, Oracle, Sybase, or mainframe IBM DB/2.

The program provides complete support for transaction processing, ensuring the integrity of transactions. In addition, user-level security provides control over assigning user and group permissions to view and modify database objects.

(2) Ease-of-use wizards

A *Wizard* can turn hours of work into minutes. Wizards ask questions about content, style, and format, and then they build the object automatically. Access features nearly 100 Wizards to design:

- databases,
- applications,
- tables, forms, reports,
- graphs,
- mailing labels,
- controls, and
- properties.

(3) Importing, exporting, and linking external files

Access lets you import from or export to many common formats, including dBase, FoxPro, Excel, SQL Server, Oracle, Btrieve, many ASCII text formats (including fixed width and delimited), as well as data in HTML format.

Importing creates an Access table; exporting an Access table creates a file in the native file format you are exporting to.

Linking (formally known as *attachin*g) means that external data can be used without creating an Access table. You can link to dBase, FoxPro, Excel, ASCII, and SQL data. Linking to external tables and then relating them to other tables is a powerful capability; you can link to Access, FoxPro, dBase, and SQL server.

(4) Multiple-table queries and relationships

One of the most powerful features in Access is also the most important - the relationship that lets you link your tables graphically.

- You can even link tables of different file types (such as an Access table and a dBase table); when linked, your table's act as a single entity you can query about your data.
- You can select specific fields, define sorting orders, create calculated expressions, and enter criteria to select desired records. The results of a query can be displayed in a datasheet, form, or report.

- You do not have to set relationships in advance. Rather than set your relationships permanently, you can use a query window to set them when you need to for a specific purpose, such as a report.

(5) DDE and OLE capabilities

Through the capabilities of DDE (Dynamic Data Exchange) and OLE (Object Linking and Embedding), exciting new objects can be added to Access forms and reports.

- The objects that can be added include sound, pictures, graphs, and video clips.
- You can embed OLE objects (such as a bitmap picture) or documents from word processors (such as Word or WordPerfect), or link to a range of cells in an Excel spreadsheet.
- By linking these objects to records in your tables, you can create dynamic database forms and reports and share information between Windows applications.

(6) Built-in functions

Access contains more than 200 *functions* (small built-in programs that return a value) that perform tasks in a wide variety of categories. Access includes database, mathematics, business, financial, date, time, and string functions. You can use them to create calculated expressions in your forms, reports, and queries.

9.4 A Review of Database Concepts

(1) What is a database?

Database is a computer term for a collection of information concerning a certain topic or business application. Databases help you organize this related information in a logical fashion for easy access and retrieval.

In a real manual file filing database system, you probably have in/out baskets and some type of formal filing method. Information is accessed manually by opening a file cabinet, taking out a file folder, and finding the correct piece of paper. Paper forms are used for input, per-haps with a typewriter. Information is found by sorting the papers manually or by copying desired information from many papers to another piece of paper.

A computer database is nothing more than an automated version of the filing and retrieval functions of a manual paper filing system. Computer databases store information in a structured format that you define. They can store data in a variety of forms, from simple lines of text (such as name and address) to complex data structures that include pictures, sounds, or video images.

A relational database management system (RDBMS) such as Access stores data in many related tables. The user can ask complex questions from one or more of these related tables, with the answers returning as forms and reports.

(2) Database terms

Microsoft Access follows traditional database terminology. The terms database, table, record, field, and value indicate a hierarchy from largest to smallest.

Databases

In Access, a **database** is the overall container for the data and associated objects. Database *objects* include:

- tables,
- queries,
- forms,
- reports,
- macros, and
- modules.

In some computer software products, the database is the object that holds the actual data; in Access, this is called a **table**.

Access can work with only one database at a time. Within a single Access database, however, you can have hundreds of tables, forms, queries, reports, pages, macros, and modules - all stored in a single file with the file extension .MDB (multiple database) or .ADP if you are using SQL Server.

Tables

A **table** is a container for raw data. When data is entered in Access, a table stores it in logical groupings of similar data (the Students table, for example, contains data about students) and the table's design organizes the information into rows and columns. Figure 2 is a typical Access table design; its *datasheet* (also known as a *browse table* or *table vie*w) displays multiple lines of data in neat rows and columns.

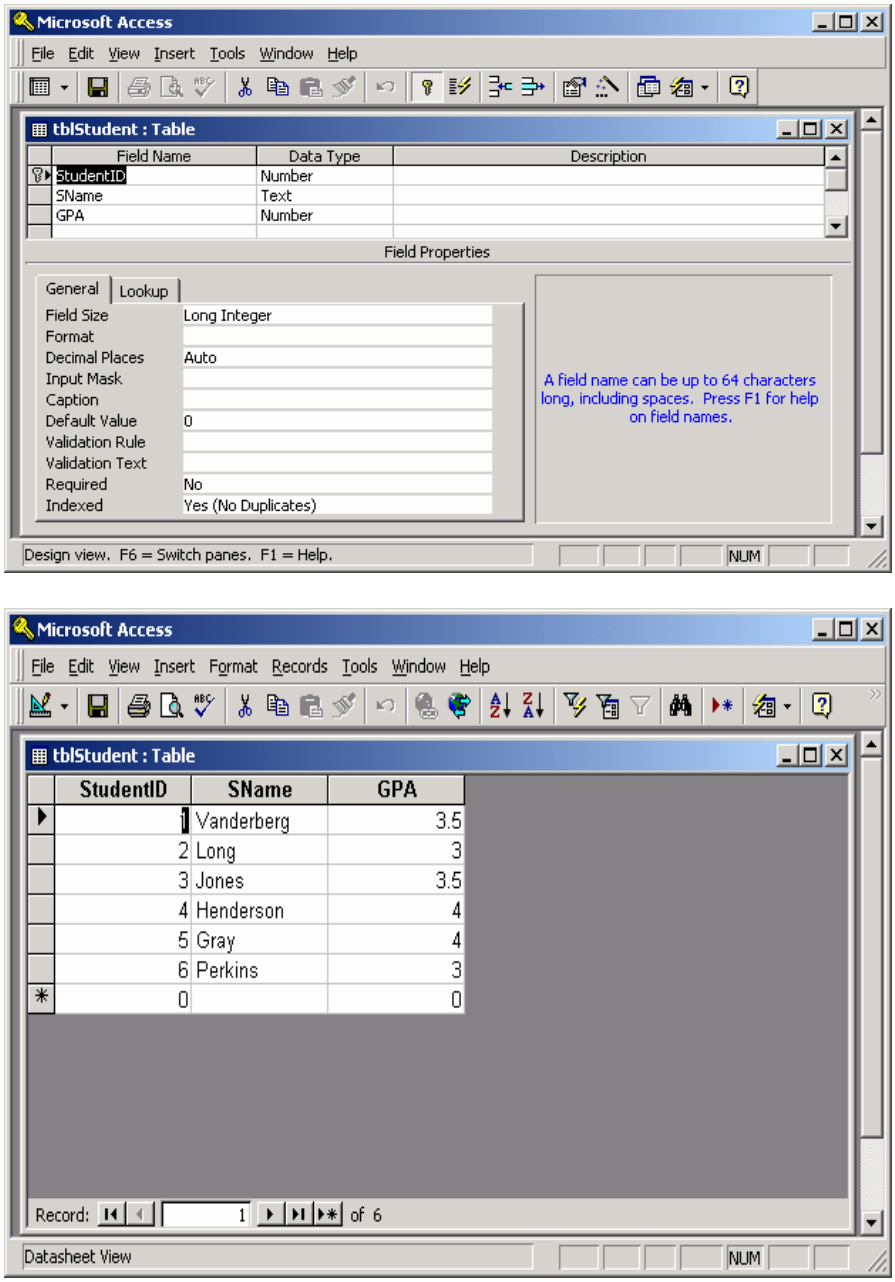

Figure 2. A database table design and datasheet.

Records and fields

As shown in Figure 2, the datasheet is divided into rows called ***records*** and columns called ***fields***.

- The data shown in the table has columns of similar information, such as StudentID, Sname, GPA; these columns of data items are fields.

- Each field is identified as a certain type of data (Text, Number, Date, and so on) and has a specified length. Each field has a name that identifies its category of information.

  The rows of data within a table are its records.

- Each row of information is considered a separate entity that can be accessed or sequenced as desired.
- All the fields of information concerning a certain student are contained within a specific record.

  Values

At the intersection of a row (record) and a column (field) is a ***value*** —the actual data element. For example, Long, the Student Name of the second record is a data value.

(3) Why use more than one table?

A database contains one or more tables (that is, logical groupings of similar data). Most applications that are developed in Access have several related tables to present the information efficiently. An application that uses multiple tables can usually manipulate data more efficiently than it could with one large table.

Multiple tables simplify data entry and reporting by decreasing the input of redundant data. By defining two tables for an application that uses customer information, for example, you don't need to store the customer's name and address every time the customer purchases an item.

(4) Database Objects and Views

If you are new to databases (or are even an experienced database user), before starting to use Access you need to review and make sure that you understand some key Access concepts. The Access database contains seven objects, which consist of the data and tools you need to use Access:

Table	Holds the actual data (uses a datasheet to display the raw data)
Query	Lets you search, sort, and retrieve specific data
Form	Lets you enter and display data in a customized format
Report	Lets you display and print formatted data, including calculations and totals
Pages	Lets you publish live forms to a corporate intranet
Macro	Gives you easy-to-use commands to automate tasks without programming
Module	Program written in VBA

Datasheets:

Datasheets are one of the many ways by which data can be viewed. Although not a database object, a datasheet displays a list of records from a table in a format commonly known as a browse screen or *table vie*w. A datasheet displays data as a series of rows and columns (comparable to a spreadsheet). A datasheet simply displays the information from a table in its raw form. This spreadsheet format is the default mode for displaying all fields for all records.

Query:

A ***query*** is used to extract information from a database. A query can select and define a group of records that fulfill a certain condition.

- You can use queries before printing a report so that only the desired data is printed.
- Forms can also use a query so that only certain records (that meet the desired criteria) appear onscreen.
- Queries can be used within procedures that change, add, or delete database records.

An example of a query is when a WVU professor tries to retrieve the specified student records with the name, course, and date when the course was taken. Apparently, we need to use a query because we cannot obtain all the information we need from one table. Instead of asking the question in actual English, the professor would use a method known as QBE, which stands for Query by Example. Figure 3 is a typical query screen in Access.

When you enter instructions into the QBE window, the query translates the instructions and retrieves the desired data. In this example, the query first combines data from the Student, the Course, and the StudentCourse tables. Then it retrieves the required fields. Access then filters the records, selecting only those in which the value of DateTaken is later than 9/1/2001. It sorts the resulting records first by student ID and then by student name within the student IDs that are alike. Finally, the records appear onscreen in a datasheet.

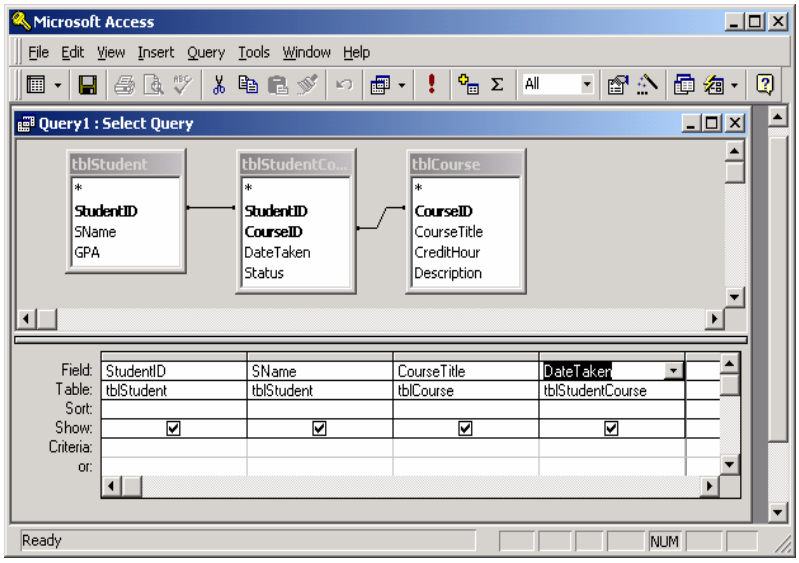

Figure 3. A typical query.

These selected records are known as a ***dynaset*** —a *dynamic set* of data that can change according to the raw data in the original tables.

After you run a query, the resulting dynaset can be used in a form that can be displayed onscreen in a specified format or print on a report. In this way, user access can be limited to the data that meets the criteria in the dynaset.

Data-entry and display forms:

Data-entry forms help users get information into a database table in a quick, easy, and accurate manner. Data-entry and display forms provide a more structured view of the data than does a datasheet. From this structured view, database records can be viewed, added, changed, or deleted. Entering data through the data-entry forms is the most common way to get the data into the database table. Figure 4 is a typical form.

Data-entry forms can be used to restrict access to certain fields within the table. You can also use these forms to check the validity of your data before you accept it into the database table.

Most users prefer to enter information into data-entry forms rather than datasheet tables; data-entry forms can be made to resemble familiar paper documents. Forms make data entry self-explanatory by guiding the user through the fields of the table being updated.

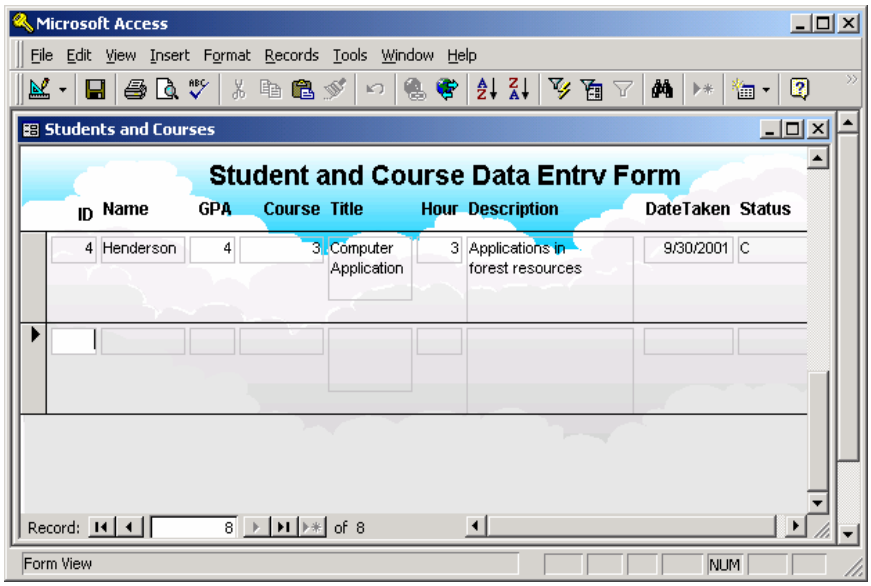

Figure 4. A typical data-entry form.

Reports

Reports present your data in printed format. You can create several different types of reports within a database management system. For example, your report can list all records in a given table, such as a student table. You can also create a report that lists only the students who meet a given criterion, such as all those who have the GPA 3.5 and above. You do this by incorporating a query into your report design.

Your reports can combine multiple tables to present complex relationships among different sets of data. When you design your database tables, keep in mind all the types of information you want printed. Doing so ensures that the information you require in your various reports is available from within your database tables.

References

Prague, C. and M. Irwin. 1999. Microsoft Access 2000 Bible. IDG Books Worldwide, Inc. Foster City, CA.

Ullman, J. and J. Widow. 1997. A first course in database systems. Prentice Hall. Upper Saddle River, New Jersey.