Access Database Window and Overview

Database Window
The Access Database Window allows quick access to all the elements of the database. These elements include: a) tables of data, b) queries that generate new tables, c)宏s for automating tasks, and d) modules of Access Basic code.

Object View Modes
Each major category of Access object (e.g., tables, queries, forms) can be viewed in at least two modes: in normal mode (Open), the object displays actual data from the tables. In design mode, the internal structure of the object (e.g., table definitions, query contents, form design, report layout) can be edited.

Datasheet View
The easiest way to view actual data is in a datasheet window—the default display when a table is opened. Drag the splitter bars to change field display width and height. A single click on a column, followed by a second click and drag, is used to reorder the columns. Data itself is not affected.

Database Tabs
Clicking a tab selects the type of object to be created (New), to be run (Open) or to be edited (Design). Right click the mouse on empty area of a toolbar to see a list of toolbars associated with currently selected object. Choose “Customize” to change the buttons on a toolbar.

Right click the mouse on any Access object in the database window and a properties menu will appear. Actual menu contents depend on the type of object.

Context Sensitive Toolbars
All Access toolbars are context sensitive, meaning they change based on the type of object. Toolbars shown in the figure are moved by clicking and dragging on an area without a button. If the toolbar is not positioned over the top or bottom of the window, it becomes a tool box.

Navigation Buttons
The navigation buttons at the bottom of the table view make it easy to reposition the view within the window. Similar buttons can be added to various toolbars by choosing Custom from the toolbars properties menu, then choosing RecordButtons. Buttons can also be added to forms.

What’s New in 97?
Access 97 offers a number of enhancements to earlier versions (e.g., Access 2 and Access 3). Some of the most significant enhancements include:

Internet Support: Many Access objects can now be published directly to the Internet. Reports and tables, for example, can be saved as HTML files, making them easily accessible to anyone having a web browser. The new hyperlinks data type also allows direct hyperlinking to other documents to be embedded in data, forms, and reports. Email lists can also be exchanged with Outlook, the new Office 97 application that supports e-mail, scheduling, and group work.

Form Capabilities: Access forms can now be created using the familiar tab control that is widely used in Windows applications. Using the control, different portions of a form can be made visible depending upon which tab is pressed.

Interface Customization: The ability to customize the Access interface has been expanded. Users can now create both toolbars and associated menus, as well as customizing existing ones.

Office Assistant: Like all the Office 97 applications, the Office Assistant button is displayed while Access is in use. Left click the button for a list of topics relating to the current activity. Right click to hide the button or press Backspace.

Access Objects
An Access database consists of six fundamental types of objects:

- Tables: Data that is conceptually stored in rows and columns on disk. A database may contain many such tables. If that database also contains features for integrity checking and establishing relationships between tables, it is a relational database.

- Queries: Procedures intended to extract data, in tabular forms, from other tables. Access queries possess many of the characteristics of SQL Views and, once created, can be used in most places where tables are used (e.g., reports, forms).

- Forms: User-designed screen formats used to customize the user interface for a given Access database.

- Reports: User-generated output formats normally intended to go to the printer or a printer-like device (e.g., a FAX modem).

- Macros: Saved collections of Access commands that perform actions normally performed using the mouse or keyboard.

- Modules: Collections of Access Basic code (essentially identical to MS Visual Basic) that can be called by other database objects (e.g., forms).

Levels of Programming
Non-programming: Using the Wizards and the Access interface, along with predefined formats such as Autoforms, it is possible to accomplish many tasks.

Users may need to change object properties (which appear in property sheets accessed with a right mouse click on an object) to achieve additional customization. Knowledge of some Access Basic functions, such as converting an number to a string, may also be useful.

The names of these functions are generally displayed by build wizards, and can be examined using Help.

Macro-programming: Macros are like programs, except their “language” consists mainly of commands that can be issued by the user through the interface. However, non-programmers who know the Access interface can learn to use macros relatively easily. Macros are attached to objects, such as buttons, and may also be associated with events (e.g., opening a form or window), meaning they trigger when a specific event happens (e.g., a window opening).

Basic Programming: Programming in Access Basic requires significant study, but expands the range of possible customizations. Code is attached to objects and events (Event Procedures) or may be stand-alone code (Modules) accessible to all objects. Eventually, there is talk of merging Access and Visual Basic.
**Tables & Relationships**

**Table Design View: Setting Field Attributes and Table Integrity**

**Primary Key**
A table's primary key must be unique for each row. It may consist of a single field (attribute) such as the Customer ID in a customer table—or it may be a composite key (as shown below) consisting of several attributes. For reasons of performance and integrity, all Access tables should have a primary key, although they are not required.

To set a primary key, click mouse on one (or more, holding down Shift) field selector buttons, then click key icon on toolbar.

**Choose Design from View Menu with a Table selected**

Field names may be up to 64 characters long, and may include spaces. To signify a field name has spaces, it is generally placed within brackets, for example (Last Name).

**Access Data Types**
1. **Text:** Holds up to 255 characters. Length must be specified.
2. **Memo:** Stores blocks of text (up to 64K).
3. **Number:** Integer and real numbers. Integer length is either 1 byte (Byte), 2 bytes (Integer), 4 bytes (Long Integer), or 8 bytes (Long Integer, -2 billion to +2 billion). For real numbers, length is either 4 bytes (Float, giving about six significant digits) or 8 bytes (Double giving about 15 digits of precision). Double is the default. The Currency data type (see below) also can be used to hold numbers.
4. **Date/Time:** Date and time code taking 8 bytes of space.
5. **Currency:** Integer-based data type which provides 19 digits of precision (5 to the left of the decimal, 4 to the right) designed to minimize rounding errors.
6. **AutoNumber:** Unique integer assigned to each row, often used as a key field.
7. **Yes/No:** 1-bit logical field having only two values: yes/no, true/false, on/off, etc.
8. **OLE Object:** Embedded document image or pasted in from another application, such as a photograph or Excel worksheet.
9. **Hyperlink:** A field containing the URL (uniform resource locator) of a resource (e.g., HTML page) on the WWW.

**Lookup Fields**
The field type Lookup signifies a value that is chosen from a set of possible selections. These selections may either be manually specified by the user, or may be the set of values contained in the column of a table or query. A Lookup Wizard is provided to automate the creation of such fields.

**Relationship Tool: Referential Integrity Checking Between Tables**

Numbers on relationship lines indicate the type of the relationship. Most common is 1 to many (1:M), meaning the primary key of one table (the "one" side) matches a field or collection of fields in another (the "many" side).

To Create a Relationship:
1. Add the tables to be used in the relationship window.
2. Select field(s) to be related in the 1 side, usually they will be the primary key. Use Ctrl key to select more than one field.
3. Drag the mouse over to the table on the M side.
4. Enter the necessary information in the relationship dialog box (see example below).

**Relationships Using SQL**
Access provides another option for creating relationships between tables: the SQL CREATE TABLE statement. Such statements are issued through the Query-View Data Definition window (a design view must be present on the screen for the menu to be accessible). The SQL Access provides for the definition of:

1. **Primary keys:** single or multiple field primary keys
2. **Foreign keys:** single or multiple field foreign keys
3. **These keys provide default Delete, Update Restricted, Update Restricted referential integrity checking, and modifyable using the relationship tool. The Access SQL syntax differs slightly from most common databases.**

**Relationships and Integrity**
In a multi-table database, the validation settings for a single table do not guarantee that it will remain consistent with other tables in the database. Such consistency, e.g., ensuring sales records don't reference a customer number that doesn't exist, is called Referential Integrity. The relationship tool provides referential integrity checking by:

1. Ensuring that rows are not added to one table that reference a nonexistent key in another table.
2. Ensuring that a row in one table is not deleted if other tables reference that row.
3. Normally, deletion will be prevented unless Delete Restricted is selected, in which case all rows referencing the new key are also changed.

**Join Type**
Determines what rows are to be displayed when values that don't match are encountered. Often referred to as inner join, left join, and right join in SQL.
Access Queries

Query Design View: Creating a Table Extracted from Other Tables

Queries always produce a result table based on the query form or SQL statements supplied by the user. Once saved, queries can be used much like tables.

Create New Query or Design from View Menu with a Query Selected

Filters are similar to queries in their use of criteria, but that their purpose is to restrict the rows that appear in an existing table, rather than to create a new table.

The Example

The example provides illustrations of many of the capabilities of the query window. It queries database of a simulated video store asking the question:

What are the names of customers who have rented at least two films starring John Wayne
(listed in descending order by number of films)?

Relationship Pane

The relationship pane of the query design window shows the tables and queries referenced by a query, and the links between them. The relationship tool (Tools-Relationships) has been previously used to establish relationships between tables, links appear automatically. (A user, after a table is added, the user may have to set them manually (see previous page).

Field/Table Expressions

The field expression specifies the field and table/query associated with a given column of the query. A name and color preceding the expression specifies the column name in the query results table. The field may also contain fields (e.g., add them), in which case the field is referred to as a calculated field. If the formula box is not checked, the field will not appear in the results.

Where multiple tables are present, query referred to as a “Join”

Either tables or previously created queries may be included in a query

Group By expressions mean that output will be aggregated by this column

A Total row can be added by pressing the sum button on the toolbar

The >2 applies to the group, meaning customers whose group count is <2 are excluded from results

Total Type

If a total row is specified, output table aggregates data. The GROUP BY value for a column means that totals, counts, etc. are computed for each value of the column. If an aggregating function (e.g., SUM, COUNT, MAX, MIN) is specified, it is computed based on the groupings specified in the other columns (if no groupings present, aggregates represent all values).

Applying Criteria Expressions

Criteria are applied in two ways:

1. If no group clause is specified, or if WHERE expression specifies the criteria, the criteria is applied as specified.
2. If any other total expression is specified, the criteria is applied after groups have been formed. This is equivalent to the SQL HAVING clause.

Criteria Expressions

The criteria expressions are used to filter out rows from the query results. To be included in the output, all criteria in a given row must be met. If multiple rows of criteria are present, one of the rows must be met. Expressions use various test operators, such as >, <, and others (see below). If no operator is provided, the column must be equal to the value specified.

Types of Query

The query design window creates what is referred to as a Select query (because it translates directly to an SQL select statement). Other query types include:

Crosstab Query: a single table query that aggregates an area value (e.g., totals, counts) based upon up to three other field values.

Action Queries: make or modify tables
Make Table: creates a table instead of a dataset
Update: changes values in a table based on the update criteria and values
Append: adds rows to a table, usually from another table
Delete: removes rows from a table
SQL Specific: use SQL dialect
Union: takes two tables/queries with similar field structure and combines them, eliminating duplicates rows
Data Definition: SQL data modifying queries, such as CREATE TABLE and INSERT statements
Pass Thru: SQL queries that are passed on to an SQL server, instead of being processed by Access

Aggregating Functions

Selection criteria specify what information will appear in the results table. They are applied in two ways: 1) if the query groups data, the results table is constructed and the criteria are then used to remove undesired rows, or 2) if the query is not grouped, or the column contains the Where in the total row, the criteria are applied before the results table is constructed.

The functions available for testing include:

Standard Comparison Operators: The normal test operators <, <=, >, >= (not equal)
BETWEEN: Used to specify a value is in a range of two values
LIKE: Used to conduct a wildcard test (e.g., LIKE % is true for all strings beginning in G) Logical: Operators for combining tests, such as OR (reverses the result of the test), OR (true if test is either side is true), AND (true if both tests are true) and XOR (true if one, and only one, test is true)
Special Functions: Access Basic functions (e.g., IN, LEFT, LEN) may be incorporated. Use of non-standard functions, (e.g., Access Basic), may make it difficult to change queries to pass through.

Selection Criteria

Aggregating functions apply to an entire table or to defined groups that have been defined for the table (items with GROUP BY selected in the query for the Total row).

Access aggregating functions are:

Sum: Computes and average of specified numeric and date fields in table or group
Min, Max: Minimum and maximum value of specified numeric and date fields in table or group
Count: the number of different values of any specified fields combination in the table or group
StdDev, Var: The standard deviation and variance of specified numeric or date field in table or group
First, Last: Returns first or last value as record set returned by query. Meets only unless order is specified.

In addition, the total row may contain:

Group By: defines columns as part of a grouping expression, used in created subtotals, averages, etc.
Expression: Permits more complicated expressions, with more than one argument.
Where: Used to specify that criteria rows should be applied to individual records, not the group as a whole.
**Forms & Reports**

**Forms & Data Entry Screens and Looking Up Information**

- **Forms & Properties**: Virtually every item placed on a form is controlled by a collection of properties. These properties, accessed by a right-click control, are (1) Name (what it is called), (2) Size (how it looks), and (3) Data (how it relates to tables/queries in the database).
- **Events**: What happens when an object is selected or changed.
- **Edit boxes**: Create by dragging fields from field name box to form and then sizing.
- **Record Selector Bar**: Selects the active record in a Multiple Form view.
- **Query-Based Subform Example**: A subform based on a query with a single record value.
- **Control Group**: A group of controls can be created by placing the controls within a group frame. Only one radio button in a group can be on, while any checkbox in a group can be either on or off.
- **Event Procedures**: By attaching event procedures to controls, a more customized interface can be created.
- **Navigation buttons**: Can be used to control the active record in a form. The *Record* menu can also be used to set filters and search for values.
- **Choose New or Open a Form in the Database Window**
- **Choose New or Open a Report from the Database Window**

**Wizards**

- Creating custom forms in Access requires considerable knowledge of Visual Basic programming. For less experienced developers, the *Create Wizard*’s button will walk the user through many form creation tasks without need for programming expertise.

**Record Source**

- A record has a *Record Source* property that identifies the table or query that is associated with the form.

**View Type**

- Forms have three different view types: Single Form (shown), Multiple Form shows multiple records as separate forms and a Datasheet, displaying rows/columns in a grid. If a form has subforms, only Single Form and Datasheet views are available. How a form appears can be adjusted with the *Default View* and Views Allowed property.

**Subforms**

- Multiple rows from tables or queries besides the record source can be displayed as subforms. A subform is created by dragging and dropping a form icon to the target form. Access attempts to link the object on common fields.

**Button**

- Objects that include Macros. Access Basic Modules, Forms, and Queries can be attached to the On Click property of a button.

**Reports: Outputting Information to the Printer**

- **Reports & Groups**: Designing reports is very similar to designing forms, with the same concept of placing various objects on a design view. Reports also incorporate the concept of Grouping, which involves clustering data together, usually to get summary statistics such as subtotals, counts, averages, minimums or maximums. The report design tool in Access is named, meaning that headers, footers, groups, and actual data are separated vertically.

**Sample Report Preview**

- In general, grouping is done based on specifying a common base. A subreport lists customer names. Define with View-Sorting and Grouping.
- **Subgroup Header**: For each customer, rentals are grouped by month.
- **Detail**: Information printed for each item. Subreports can be used.
- **Group Footer**: Appears after each customer group.
- **Page Footer**: Bottom of each page.