

CS 200

Lecture 09

FileMaker vs SQL & Reports

Miscellaneous Notes

Abbreviations

- aka also known as
- DBMS DataBase Management System
- *mutatis mutantis* with the necessary changes having been made

Administrivia

Please read and highlight BEFORE lab

- Assignment 9
- This week's lecture slides

Reading

- Database Design (on learn.uwaterloo.ca)
Adapted from Access Database Design and Programming by Steven Roman

Today

- SQL vs FileMaker
- Reports in FileMaker
- Read and Reason Pearl

Please ask questions!

Databases–FileMaker

This is your second pass at databases

- The first time around, you got a rough idea of how they work
- This time round we'll

fill in some important details

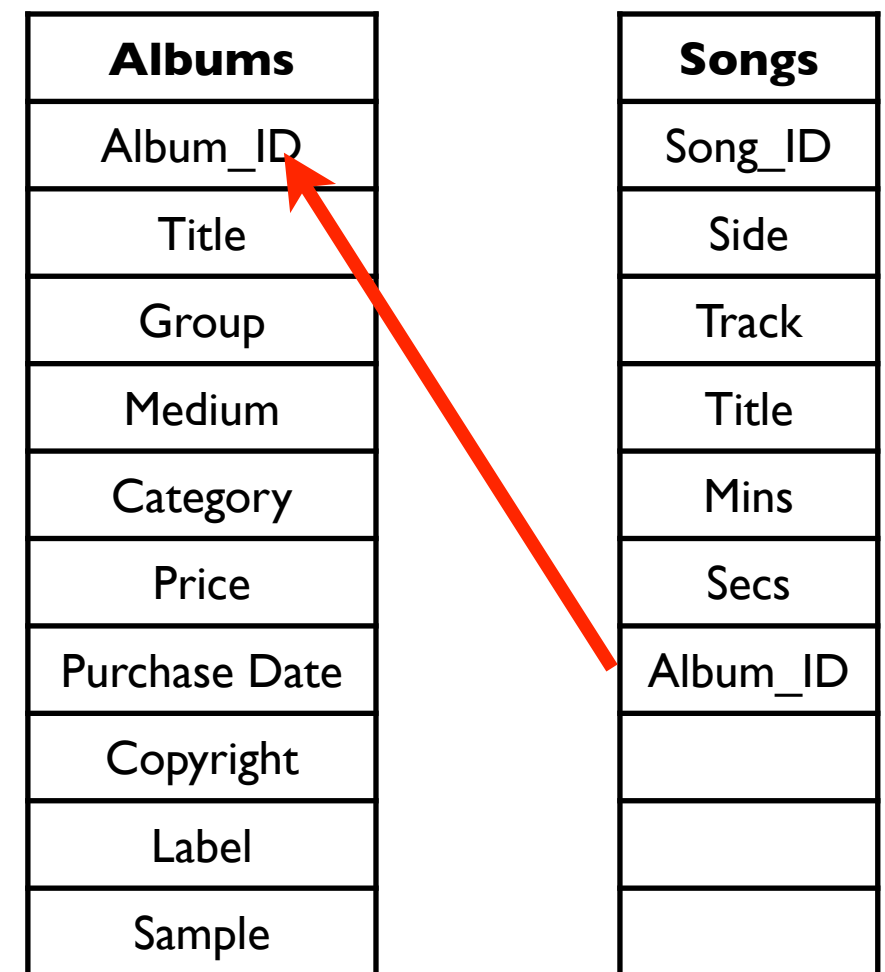
evaluate the power & flexibility of databases
and a GUI DBMS

Our strategy

- SQL as an application model for FileMaker
- so we'll “compare and contrast...” the two

Recall the Albums and Songs database

Arrows go FROM a foreign key TO a corresponding primary key (they DO NOT have to go between fields with the same name!)



FileMaker Terminology (1)

FileMaker File or Document

a collection of one or more database tables,
including field definitions

+ layouts (aka “views”)

+ scripts

Master Table

the file that accesses & displays data from
another file

one or more records in a
“related file” that is/are identified “via a relationship”

Related Table

a file containing related data you want to access in the master file

Match Fields

a field in the master file and a field in the related file
that contain values you want to use
to find matching records

aka “link fields”

FileMaker Terminology (2)

Master Record

A record in the master table for which you wish to find matching records in a related table.

Related Record

A record in the related file whose link field (according to the relationship used) contains a value equal to that of the link field of the master record.

Related Field

A field in a related record.

May be placed directly on a layout of the master table, or in the first row of a portal (also in a layout of the master table).

Portal

A layout object in the master file in which you place related fields.

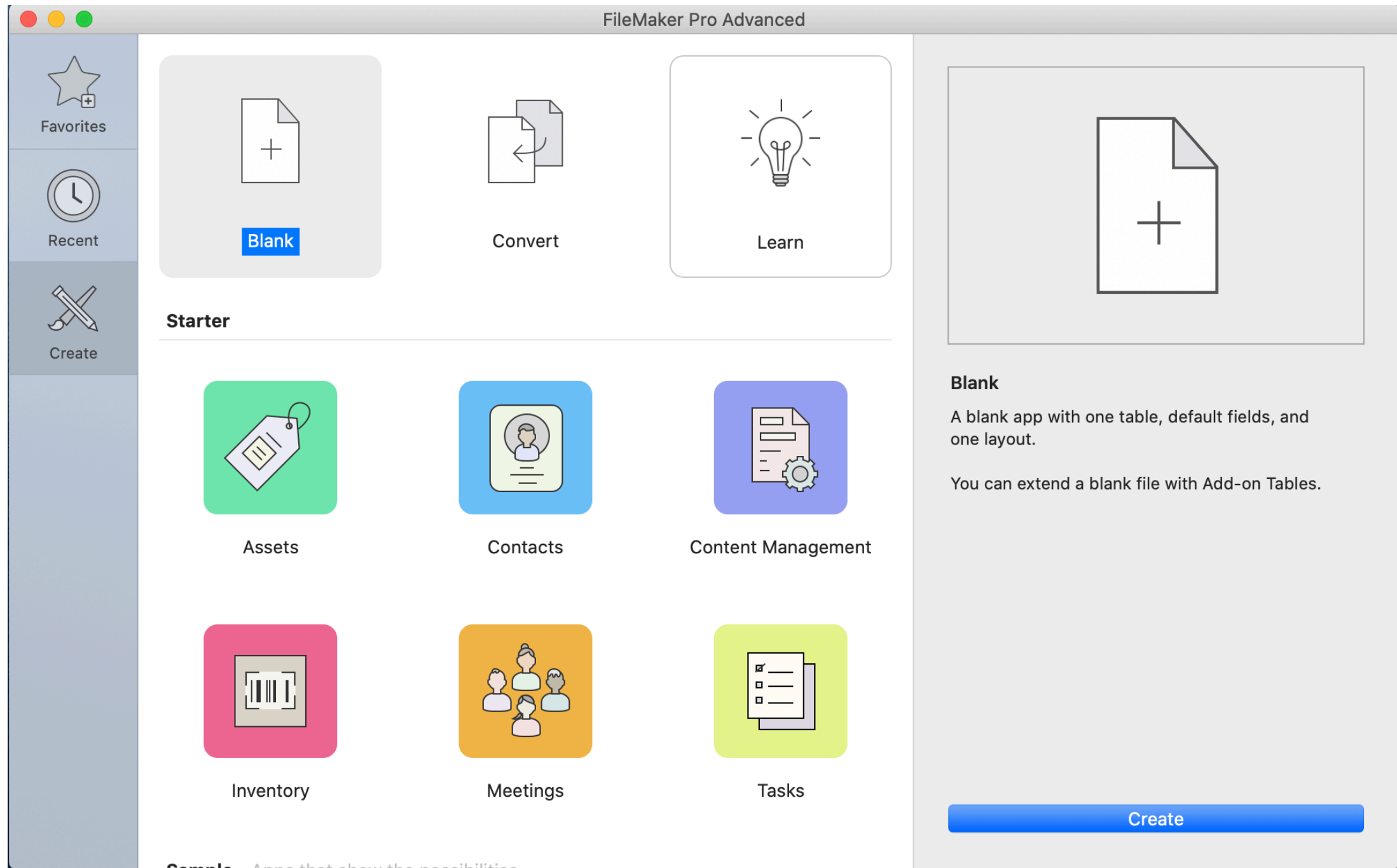
Use a portal when the relation involved is one-to-many.

(You don't need it when the relation involved is many to one.)

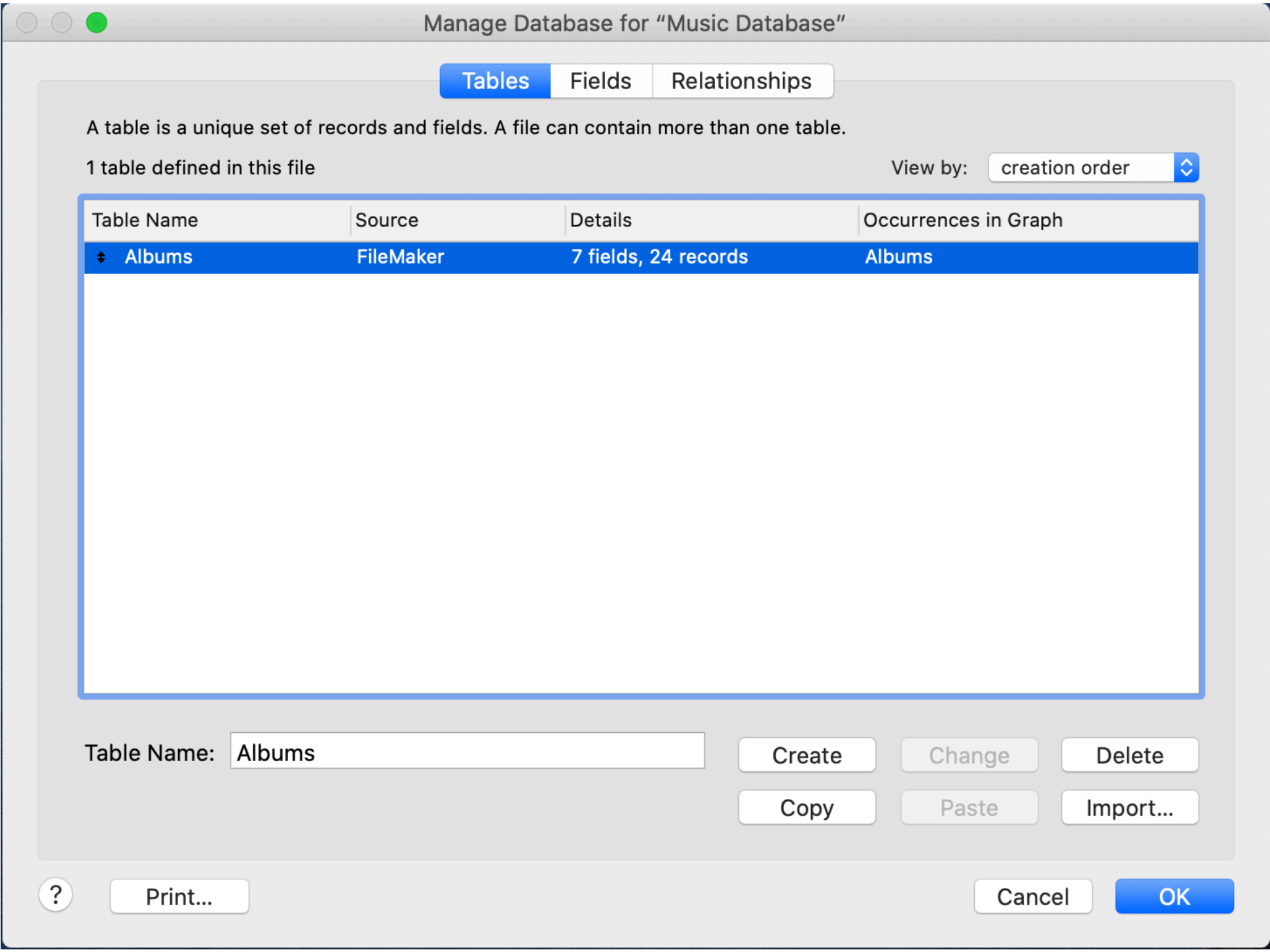
Creating A Database

Creation of a new database is similar to other applications

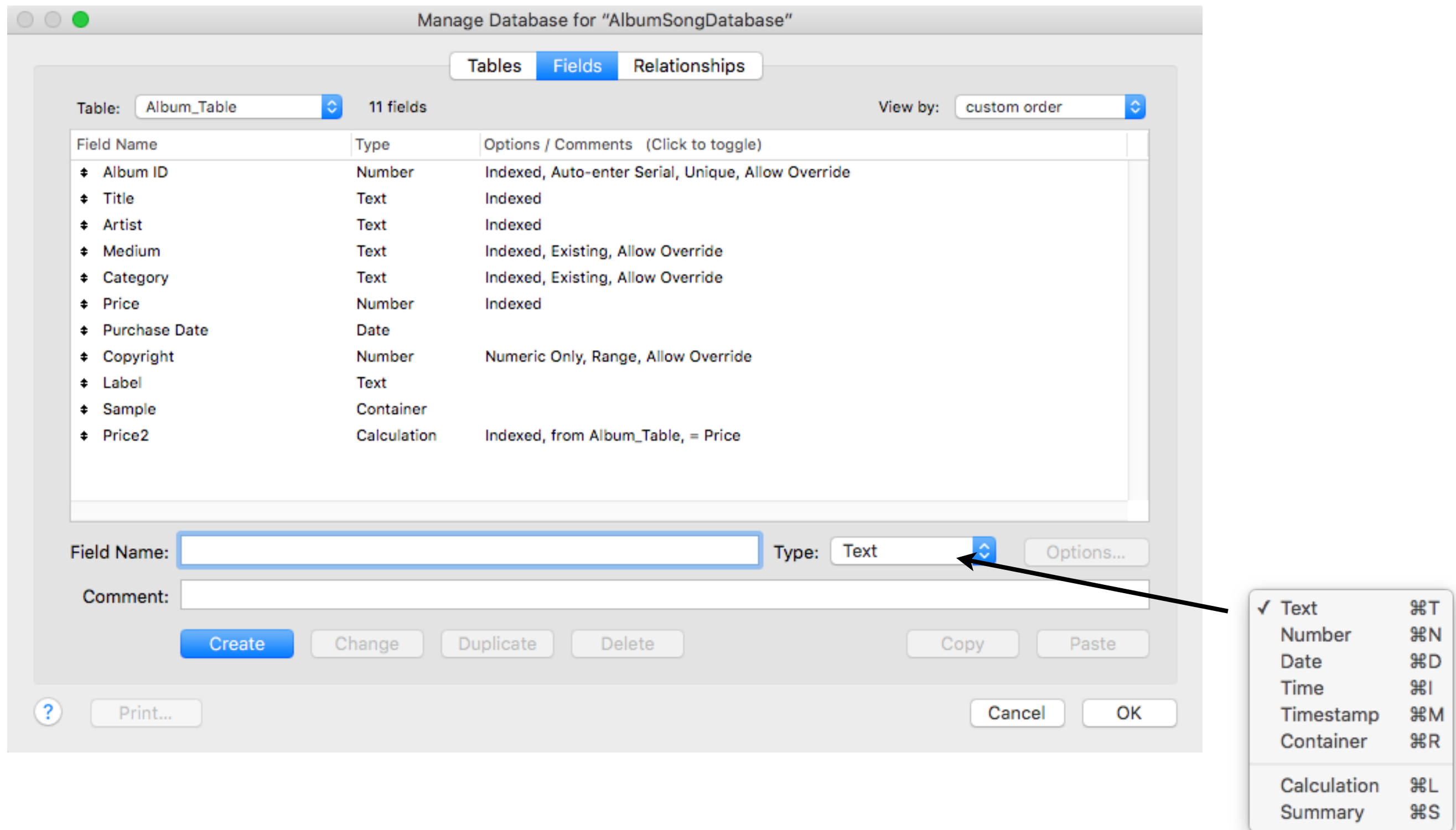
File: New Database



Creating a Table within our Database



Defining Fields



Manage Database for "AlbumSongDatabase"

Tables Fields Relationships

Table: Album_Table 11 fields View by: custom order

Field Name	Type	Options / Comments (Click to toggle)
Album ID	Number	Indexed, Auto-enter Serial, Unique, Allow Override
Title	Text	Indexed
Artist	Text	Indexed
Medium	Text	Indexed, Existing, Allow Override
Category	Text	Indexed, Existing, Allow Override
Price	Number	Indexed
Purchase Date	Date	
Copyright	Number	Numeric Only, Range, Allow Override
Label	Text	
Sample	Container	
Price2	Calculation	Indexed, from Album_Table, = Price

Field Name: Type: Text Options...

Comment:

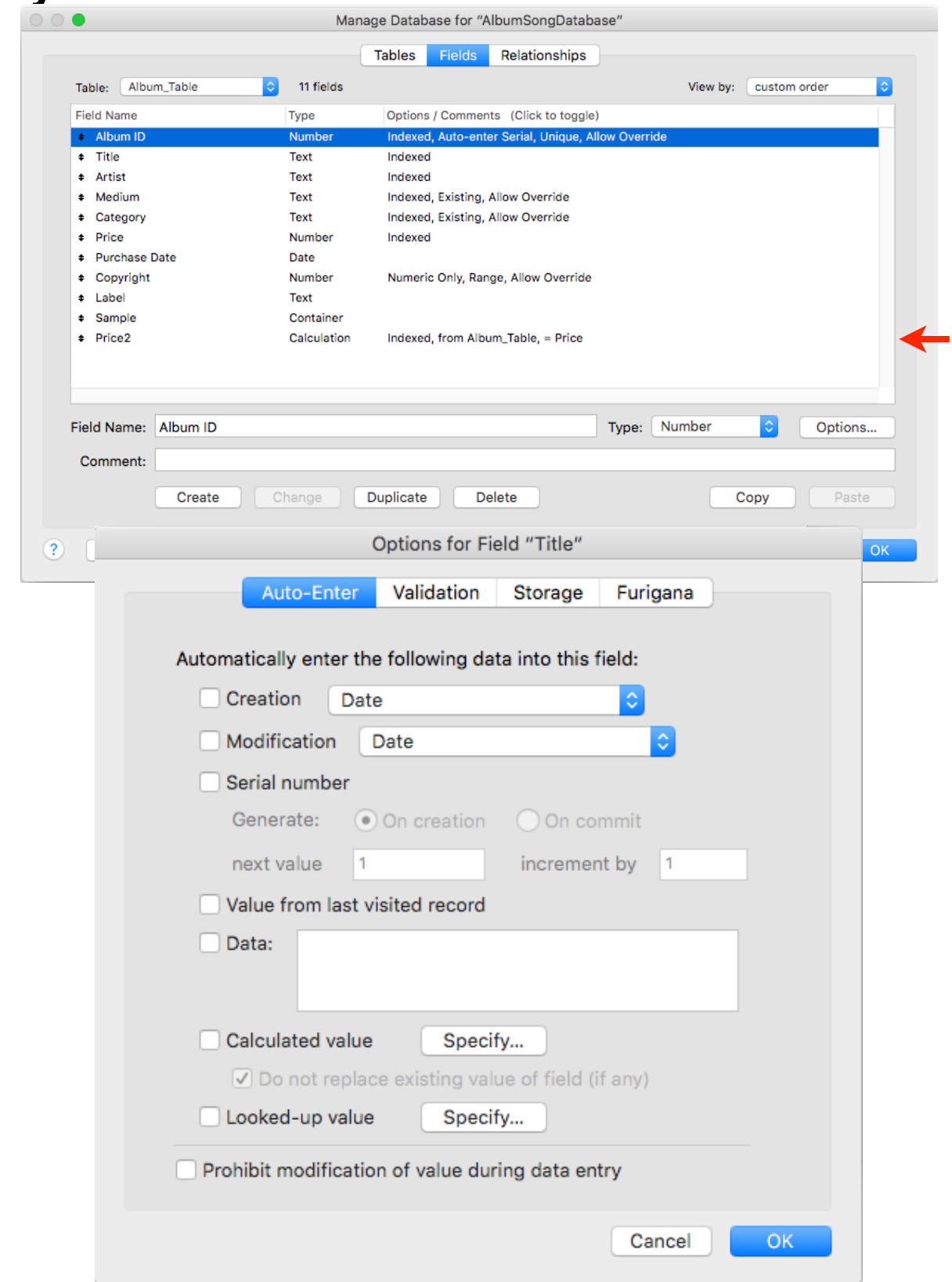
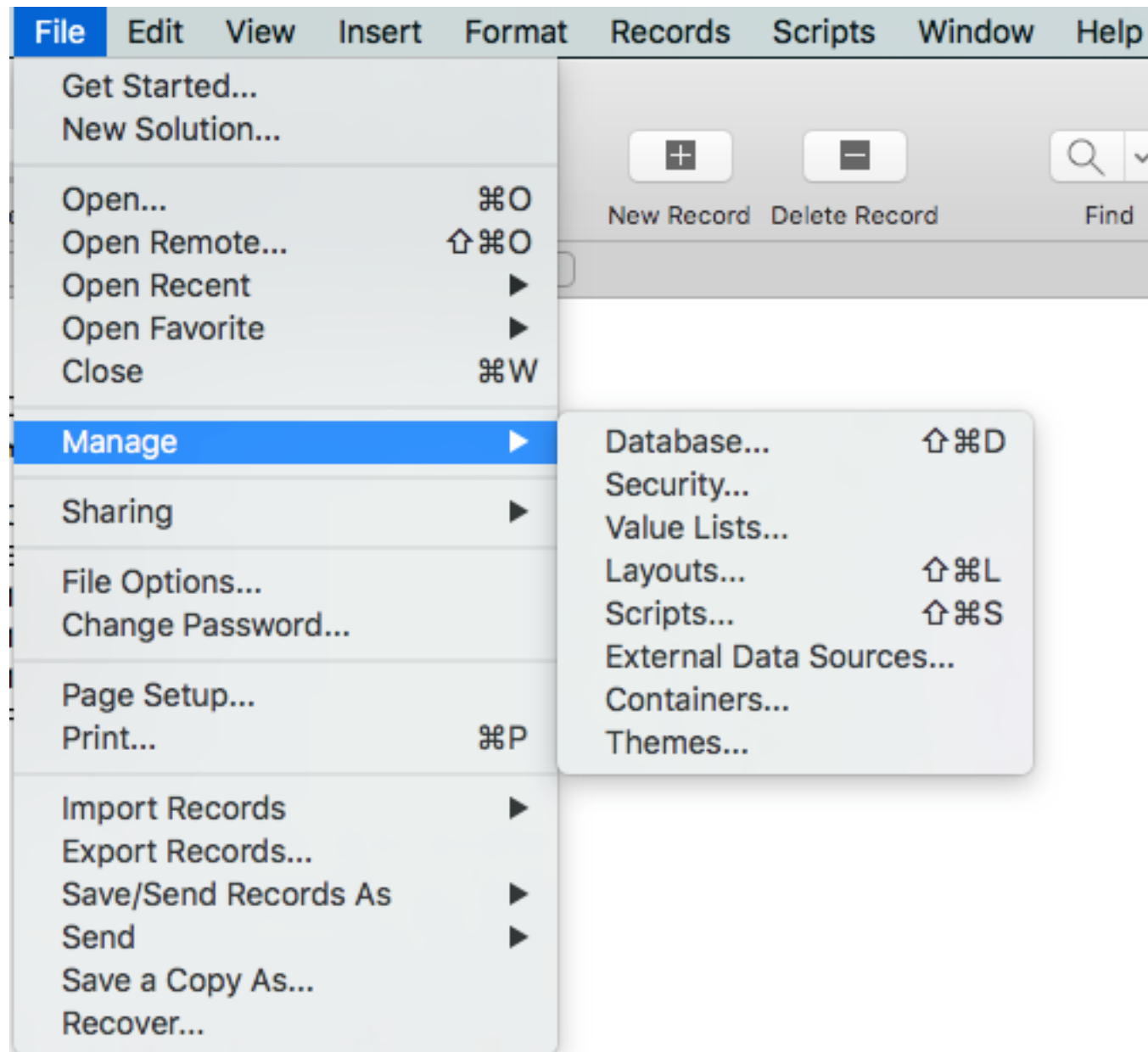
Create Change Duplicate Delete Copy Paste

? Print... Cancel OK

- ✓ Text ⌘T
- Number ⌘N
- Date ⌘D
- Time ⌘I
- Timestamp ⌘M
- Container ⌘R
- Calculation ⌘L
- Summary ⌘S

Data Validation in FileMaker (1)

You can't mistype something that's entered for you!



Uniquely Identifying Records

Primary Key

Options for Field "Album ID"

Auto-Enter Validation Storage Furigana

Automatically enter the following data into this field:

☐ Creation Date

☐ Modification Date

☒ Serial number

Generate: ☒ On creation ☐ On commit

next value 1 increment by 123

☐ Value from last visited record

☐ Data:

☐ Calculated value Specify...

☒ Do not replace existing value of field (if any)

☐ Looked-up value Specify...

☐ Prohibit modification of value during data entry

Cancel OK

Options for Field "Album ID"

Auto-Enter Validation Storage Furigana

Validate data in this field:

☐ Always ☒ Only during data entry

☒ Allow user to override during data entry

Require:

☒ Strict data type: Numeric Only

☒ Not empty ☒ Unique value ☐ Existing value

☐ Member of value list: <unknown>

☐ In range: to

☐ Validated by calculation Specify...

☐ Maximum number of characters: 1

☐ Display custom message if validation fails

Cancel OK

Data Validation in FileMaker

An Important Principle:

It's easier to catch & correct errors
when data are entered
than it is to find and correct them later

Options for Field "Title"

Auto-Enter Validation Storage Furigana

Validate data in this field:

☐ Always ☒ Only during data entry

☒ Allow user to override during data entry

Require:

☐ Strict data type: Numeric Only

☐ Not empty ☐ Unique value ☐ Existing value

☐ Member of value list: <unknown>

☐ In range: to

☐ Validated by calculation Specify...

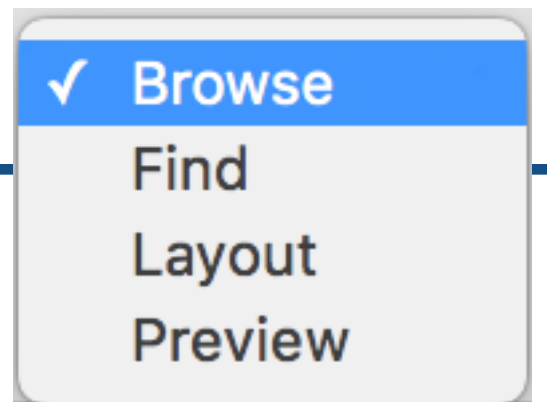
☐ Maximum number of characters: 1

☐ Display custom message if validation fails

Cancel OK

Modes in FileMaker

Browse



Find

Layout

Preview

Browse Mode

AlbumSongDatabase

13 / 24 Found (Unsorted)

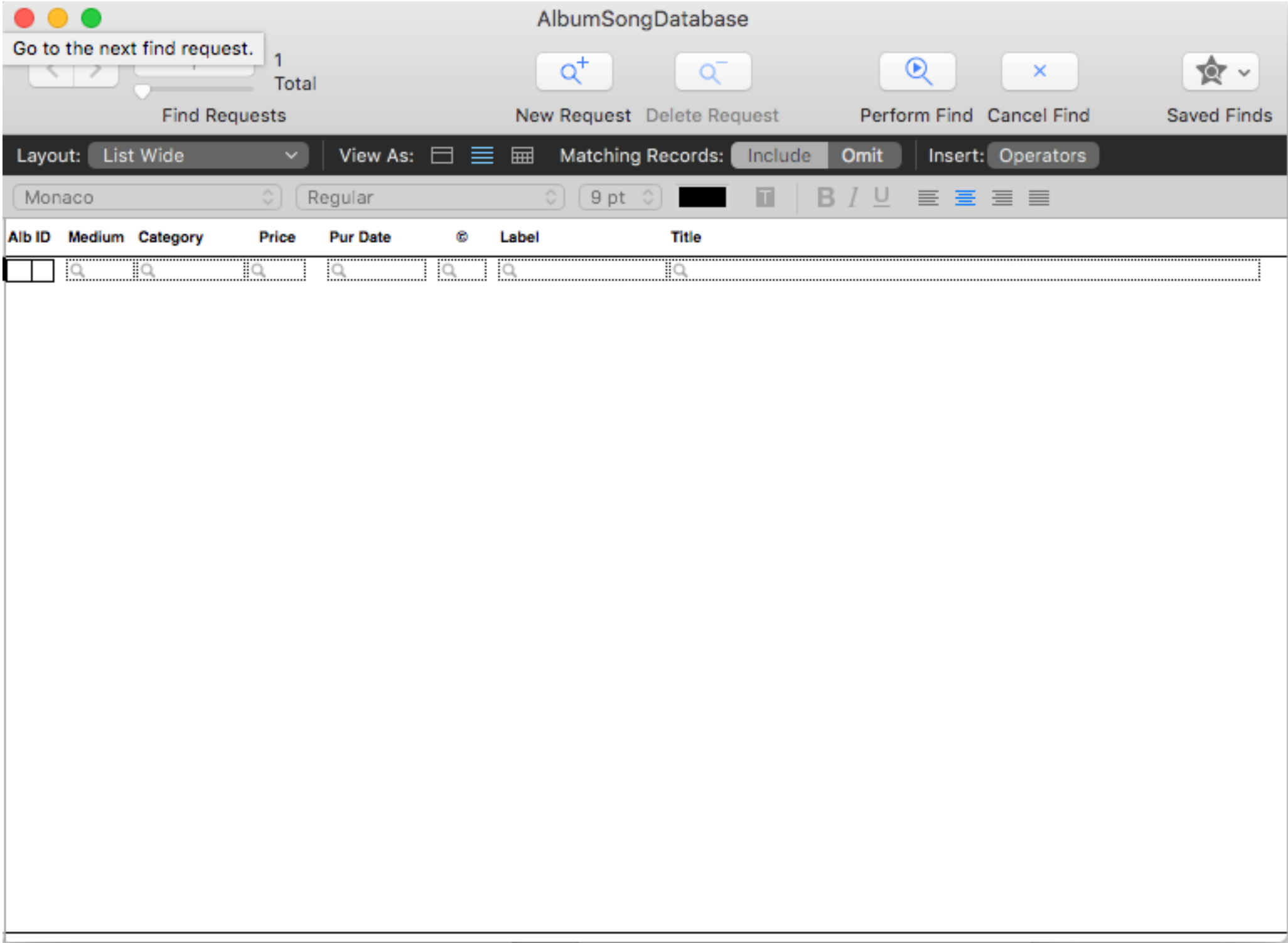
Records Find Sort Share

Layout: List Wide View As: Preview Edit Layout

Helvetica Regular 16 pt

Alb ID	Medium	Category	Price	Pur Date	©	Label	Title
3	CD	Easy	19.50	26 Jan 94	1992	Private Inc.	Dare to Dream
5	TP	Soft Rock	16.99	31 Mar 89	1987	MJJ Productions	Bad
6	TP	Sound Track	19.95	01 Jun 92	1990	The Really Useful	The Phantom of the Opera
7	TP	Sound Track	19.95	15 Jan 88	1987	The David Geffen	Les Miserables
9	CD	Folk	16.99	20 Dec 94	1987	Capitol Records	Over 60 Minutes With Lightfoot
12	LP	Easy	9.95	27 May 75	1973	A & M Records	Carpenters: The Singles 1969-1973
15	CD	Alternative	17.99	15 Dec 94	1993	Geffen Records	August and Everything After
16	CD	Hard Rock	9.99	26 Jan 88	1969	Atlantic Recording	Led Zeppelin II
17	CD	Hard Rock	9.99	26 Jan 88	1969	Altantic Recording	Led Zeppelin
2	CD	Hard Rock	29.95	15 Dec 94	1993	Warner Bros.	Live: Right here, right now
24	CD	Folk	19.54	30 Jan 94	1993	EMI	North Country
25	CD	Folk	25.29	18 Aug 95	1990	EMI	Fare Thee Well Love

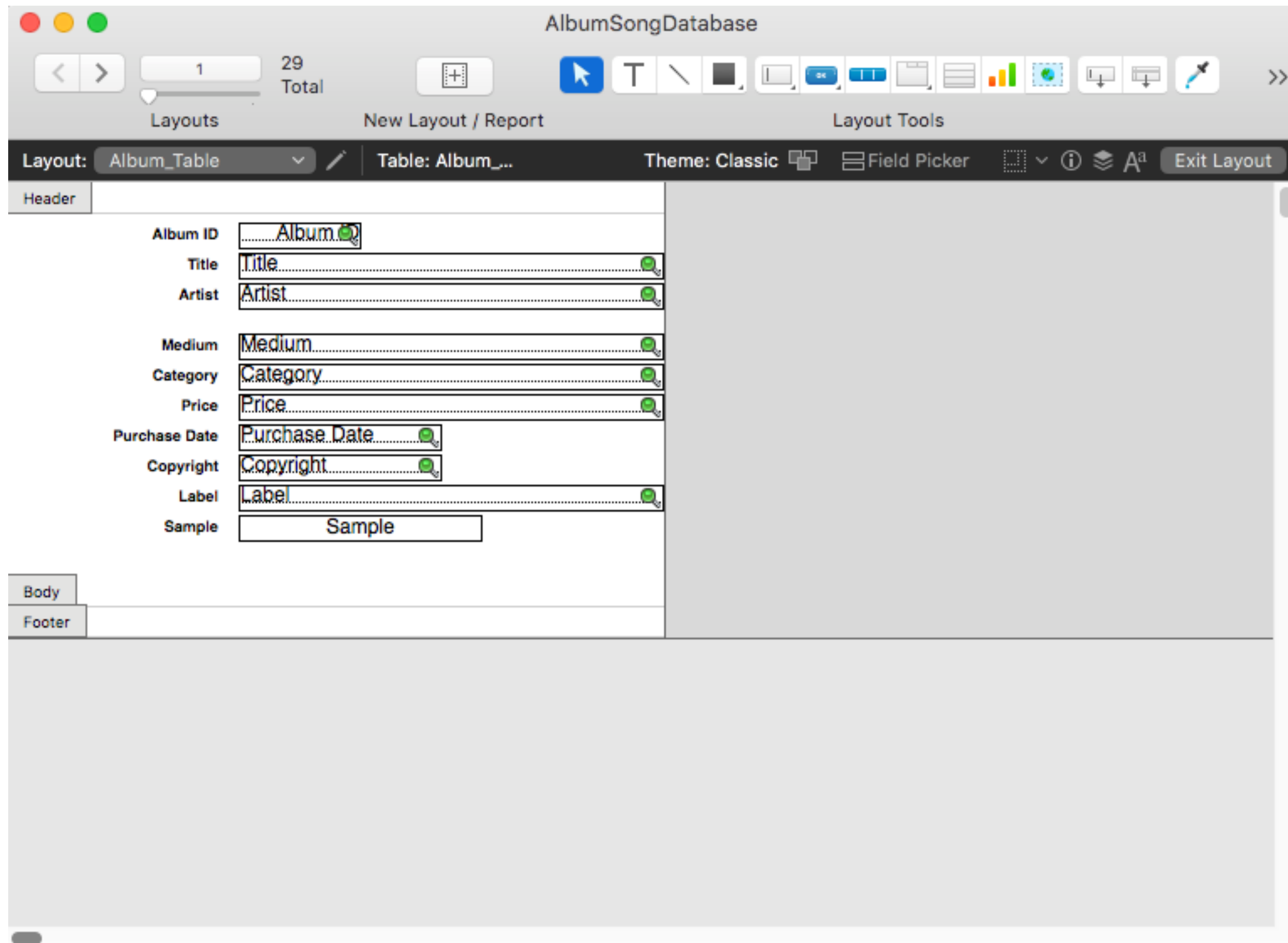
Find Mode



Preview Mode

Alb ID	Medium	Category	Price	Pur Date	©	Label	Title
3	CD	Easy	19.50	26 Jan 94	1992	Private Inc.	Dare to Dream
5	TP	Soft Rock	16.99	31 Mar 89	1987	MJJ Productions	Bad
6	TP	Sound Track	19.95	01 Jun 92	1990	The Really Useful	The Phantom of the Opera
7	TP	Sound Track	19.95	15 Jan 88	1987	The David Geffen	Les Miserables
9	CD	Folk	16.99	20 Dec 94	1987	Capitol Records	Over 60 Minutes With Lightfoot
12	LP	Easy	9.95	27 May 75	1973	A & M Records	Carpenters: The Singles 1969-1973
15	CD	Alternative	17.99	15 Dec 94	1993	Geffen Records	August and Everything After
16	CD	Hard Rock	9.99	26 Jan 88	1969	Atlantic Recording	Led Zeppelin II
17	CD	Hard Rock	9.99	26 Jan 88	1969	Altantic Recording	Led Zeppelin
2	CD	Hard Rock	29.95	15 Dec 94	1993	Warner Bros.	Live: Right here, right now
24	CD	Folk	19.54	30 Jan 94	1993	EMI	North Country
25	CD	Folk	25.29	18 Aug 95	1990	EMI	Fare Thee Well Love

Layout Mode



Creating a New Layout

New Layout/Report

Show records from: Album_Table Layout Name: Layout #30


Computer Touch Device Printer

? [Device Icons] Cancel Finish


New Layout 2

New Layout/Report


Show records from: Album_Table Layout Name: Layout #30




Computer




Touch Device



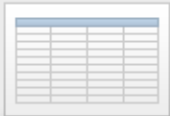
Printer



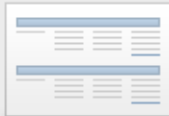
Form





List



Table




Report


?   Cancel Finish

New Layout/Report


Show records from: Album_Table Layout Name: Layout #30




Computer




Touch Device




Printer




Labels





Vertical Labels



Envelopes



Report

?   Cancel Continue

Data Validation (3) — Pop-up Menus / Drop-down Lists

T

And there are radio buttons and checkboxes...

which also allow users to choose from a value list
but display the choice differently

▼ Field

Display data from
Album_Table::Category

Placeholder text (when field is empty)
[Empty text box]

☒ Show placeholder in Find mode

Control style Pop-up Menu

Values from ☒ Album Category List

☒ Include arrow to show and hide list
☐ Allow entry of other values
☒ Allow editing of value list
☒ Override data formatting with value list

A drop-down list...

Category Easy Listening

- Alternative
- Blues
- Classical
- Country
- Easy Listening
- Folk
- Hard Rock
- Hits
- Jazz
- Medley
- Pops
- Soft Rock

A pop-up menu...

Category Folk

- Alternative
- Blues
- Classical
- Country
- Easy Listening
- ☒ Folk
- Hard Rock

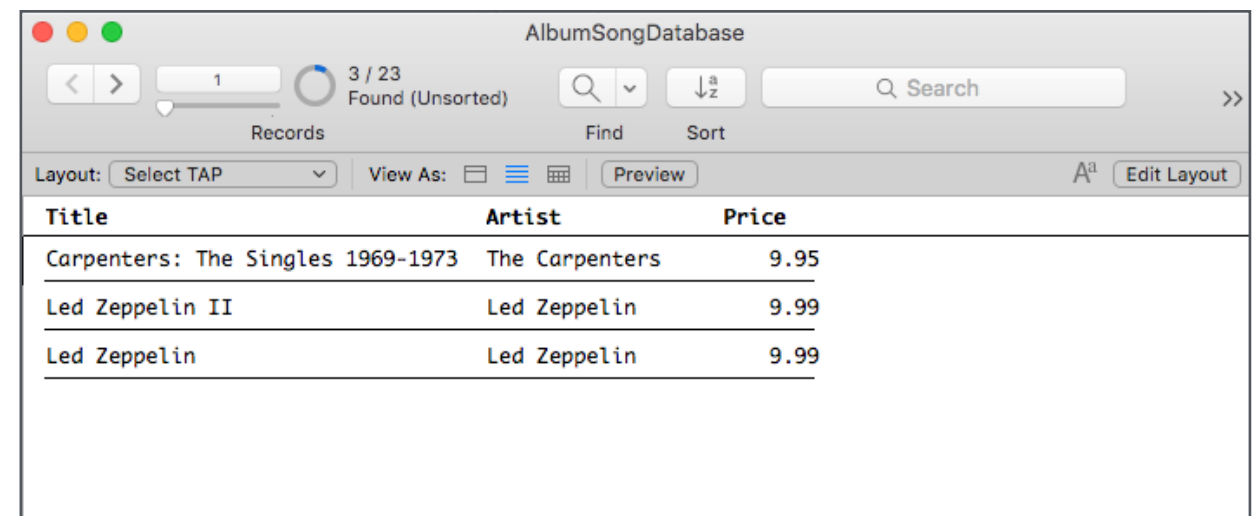
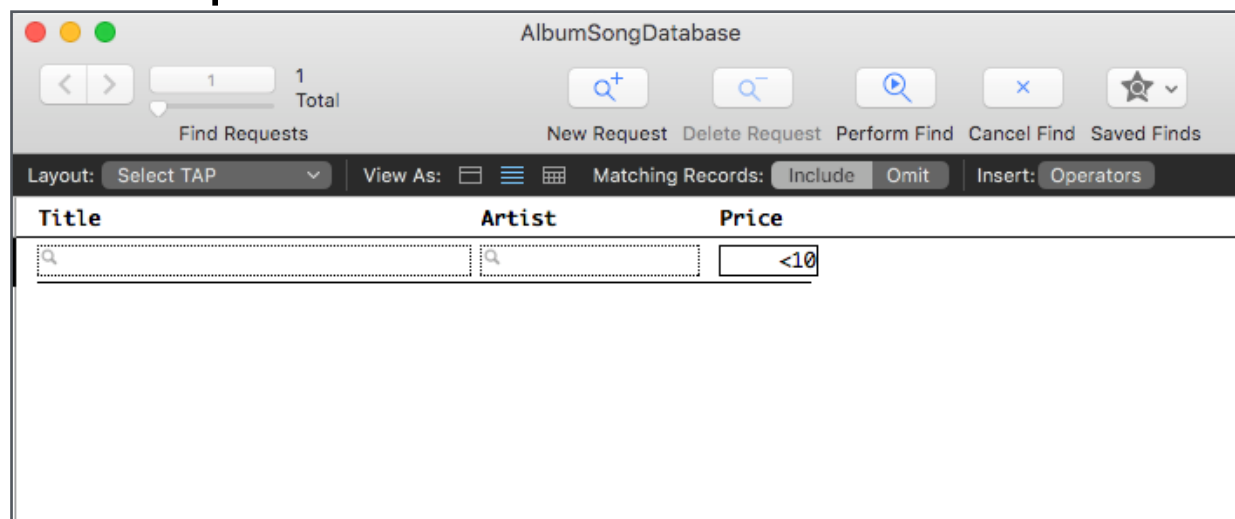
Simple One-Table Queries (2)

In SQL:

- **select** Title, Artist **from** Albums **where** Price < 10.00

In FileMaker:

- ~~make another new layout~~
- ~~choose, position, label, & format fields~~
- enter find mode & type the condition (“**query by example**”)
- then perform the find



In each vs the other ...

- what's different? better? worse? easier? harder? can't be done?

Organization of a Report Layout

At the top of every page	Header	printed once on each page
Repeated for Every Record	BODY	printed once for each group
At the bottom of every page	Footer	printed once on each page

Simple One-Table Queries (1)

In SQL:

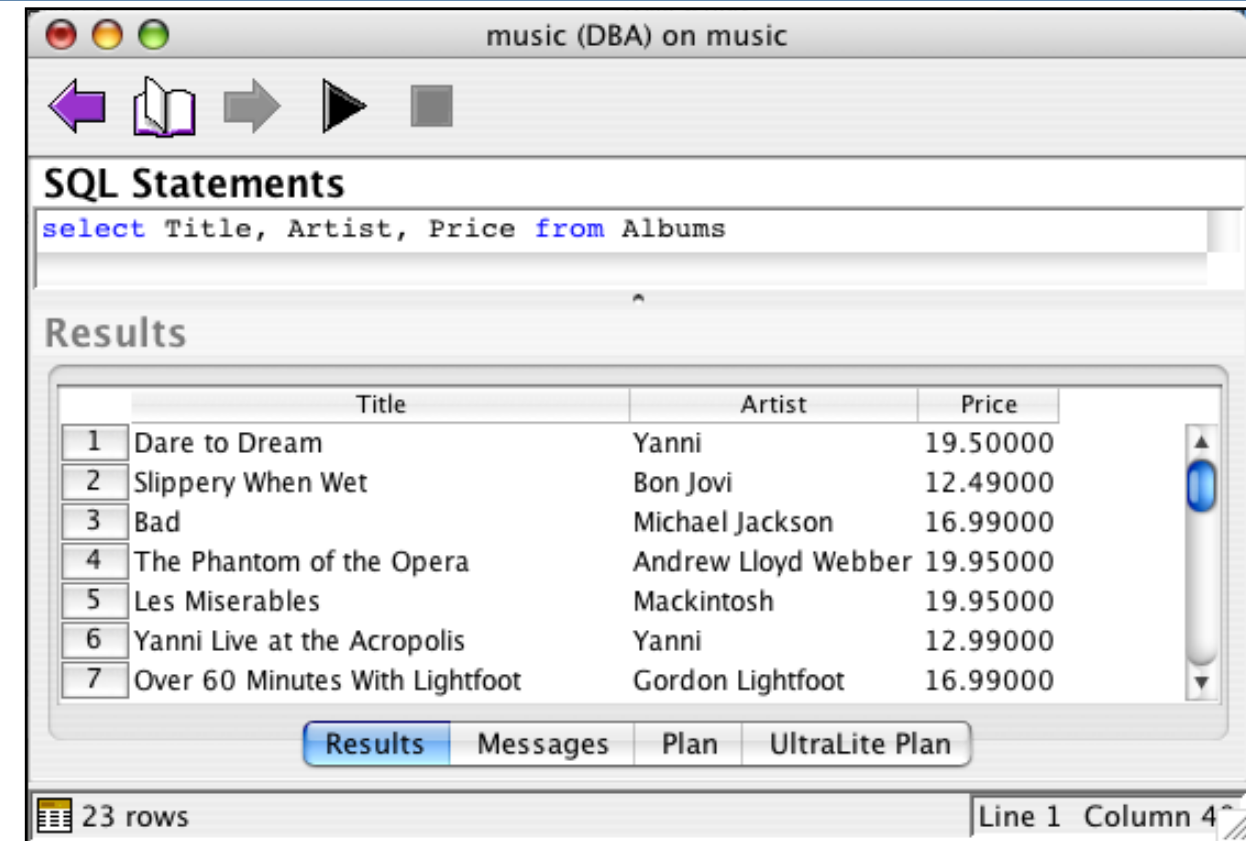
- **select** Title, Artist, Price **from** Albums

In FileMaker:

- make a new layout
- choose, position, label and format fields
- enter browse mode

In each vs the other ...

- what's different?
- what's better?
- what's worse?
- what's easier?
- what's harder?
- what can't be done?



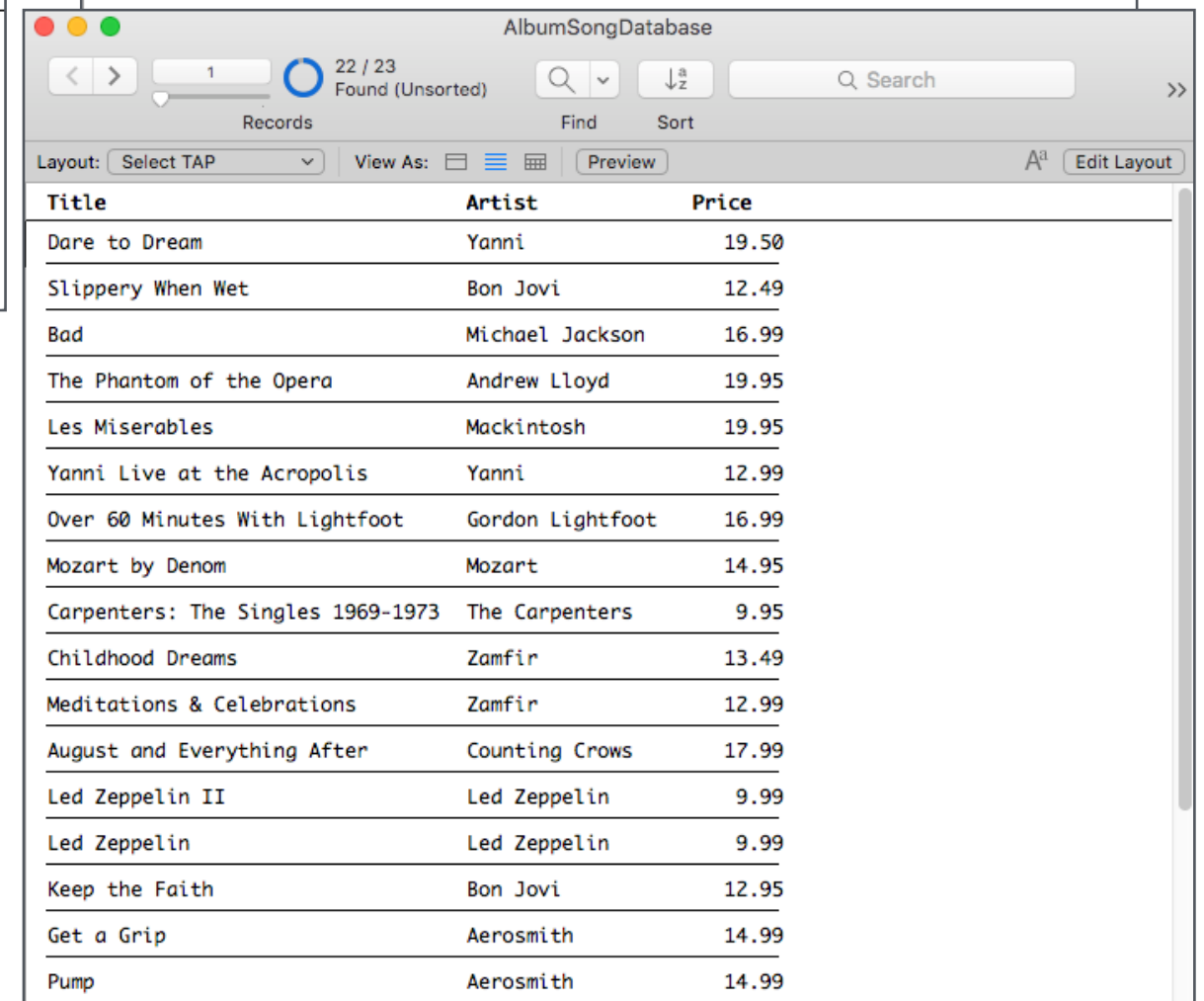
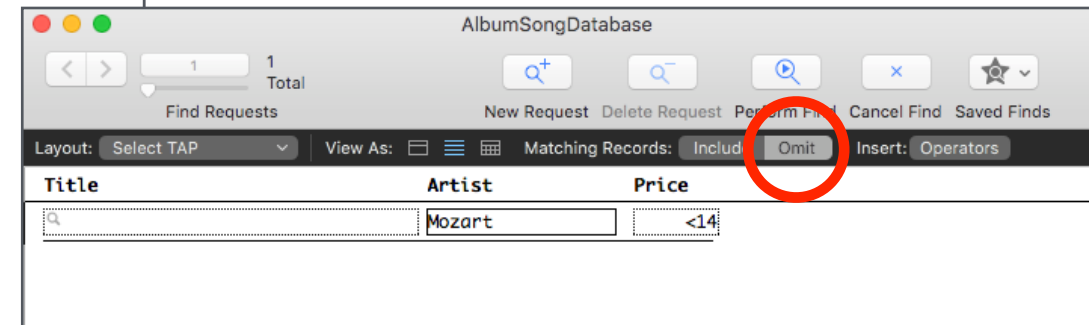
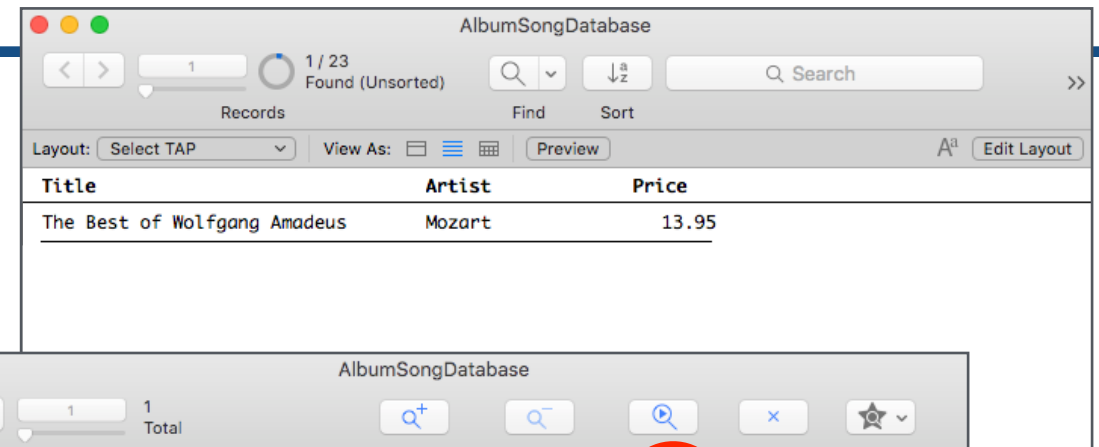
The screenshot shows a database application window titled "AlbumSongDatabase". It has a toolbar with navigation icons and a search bar. Below the toolbar is a section labeled "Records" showing a table with 13 rows of data. The table has columns for Title, Artist, and Price. The data is sorted by Price in descending order.

Title	Artist	Price
Dare to Dream	Yanni	19.50
Bad	Michael Jackson	16.99
The Phantom of the Opera	Andrew Lloyd	19.95
Les Miserables	Mackintosh	19.95
Over 60 Minutes With Lightfoot	Gordon Lightfoot	16.99
Carpenters: The Singles 1969-1973	The Carpenters	9.95
August and Everything After	Counting Crows	17.99
Led Zeppelin II	Led Zeppelin	9.99
Led Zeppelin	Led Zeppelin	9.99
Charlie Parker Plays Standard	Charlie Parker	15.00
Live: Right here, right now	Van Halen	29.95
North Country	The Rankin Family	19.54
Fare Thee Well Love	The Rankin Family	25.29

One-Table Queries (and)

How about...

select Title, Artist **from** Albums
where (Price < 14.00) **and** (Artist = 'Mozart') ?

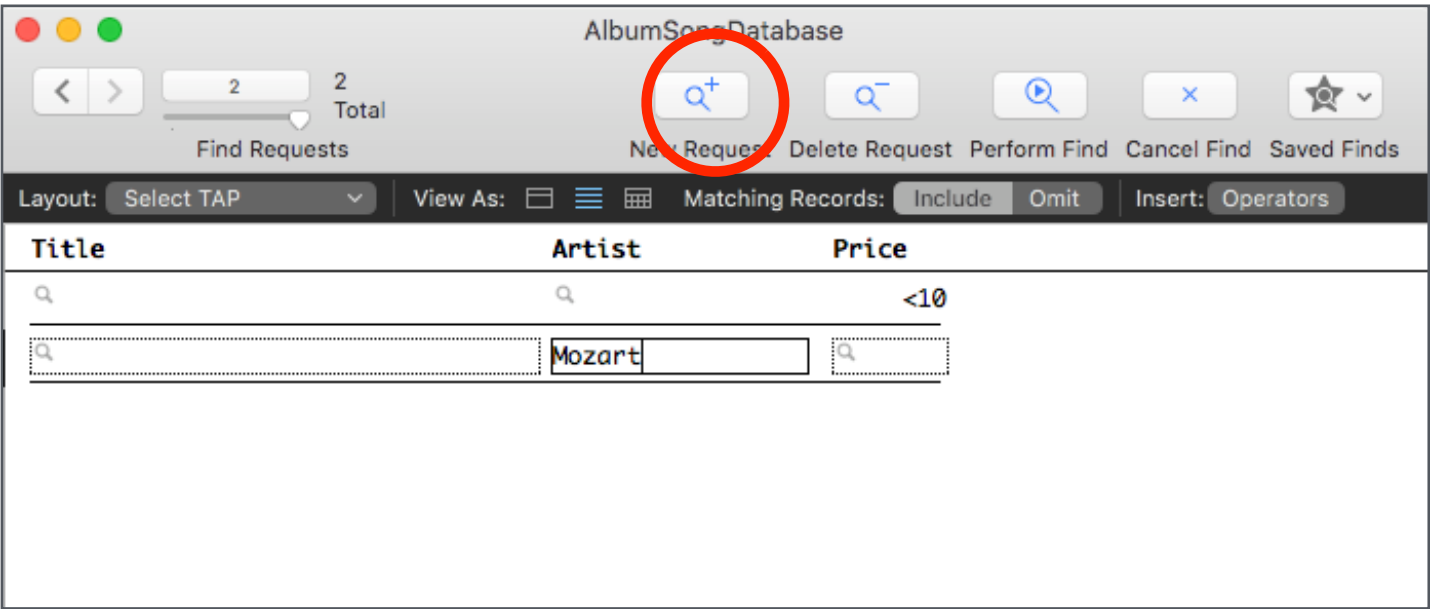


Hmm ... what's the "Omit" check box do?
 (Read and Remember...)

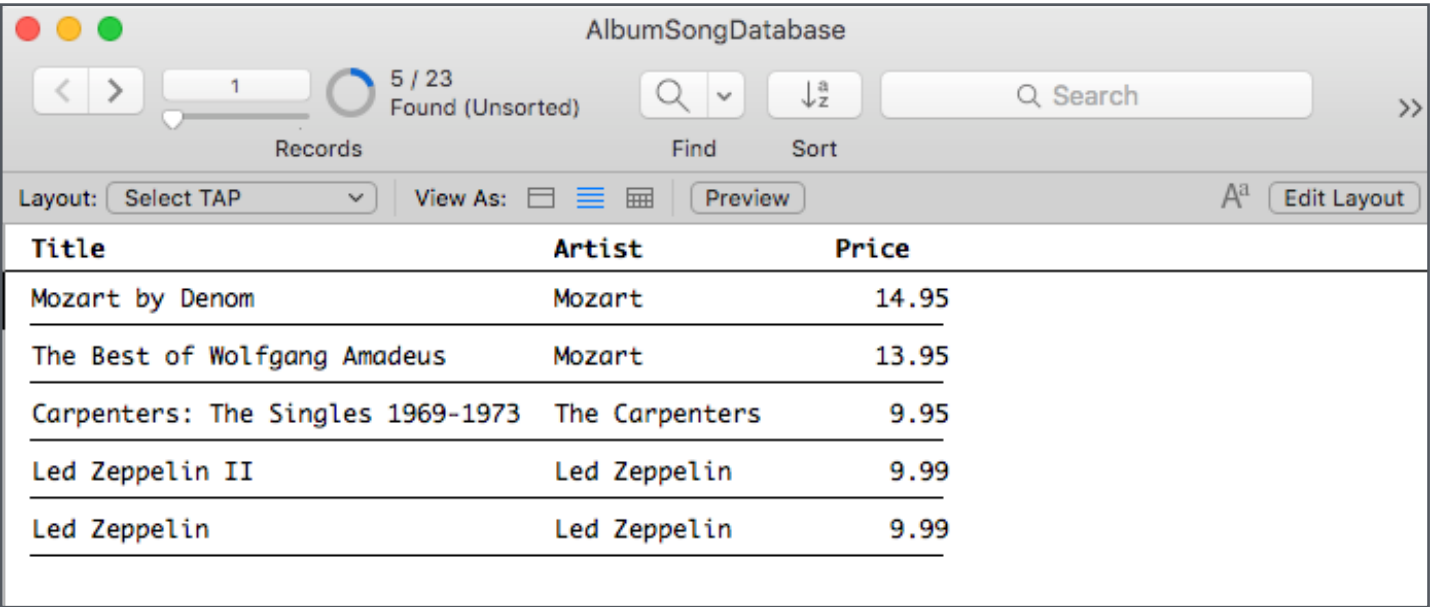
One-Table Queries (or)

How about

```
select Title, Artist from Albums
where (Price < 10.00) or (Artist = 'Mozart') ?
```



FileMaker calls each line of a Find a “request”

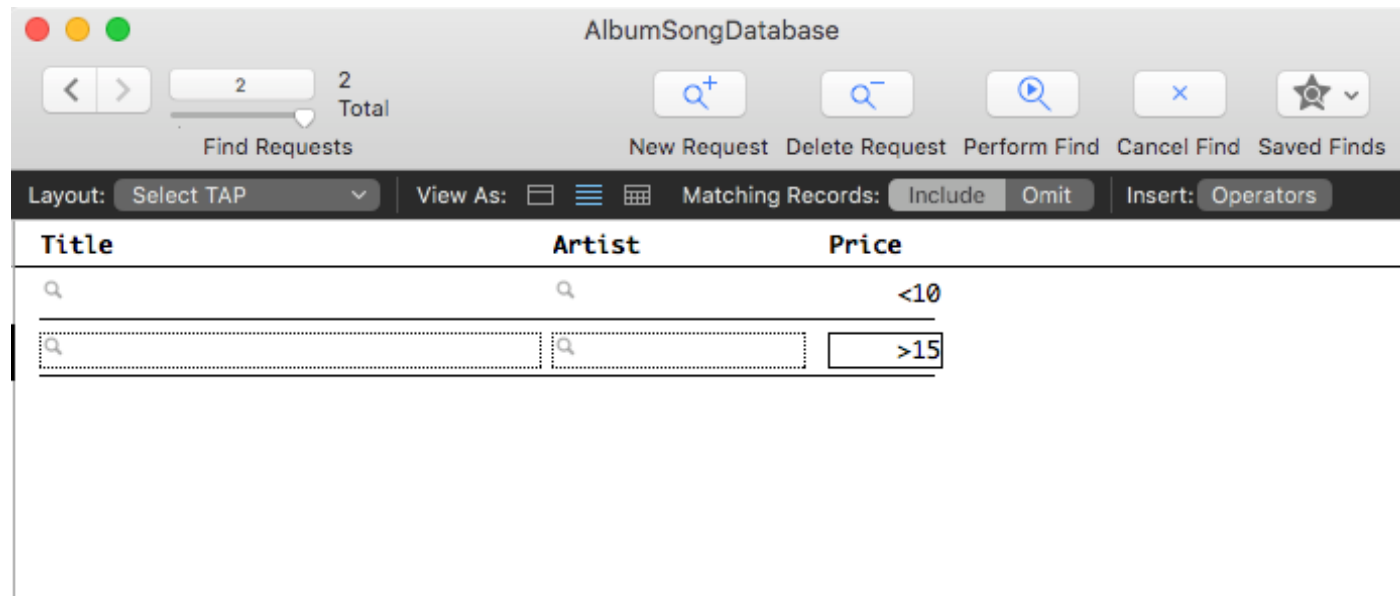


In SQL I didn't have to display Price to use it in a query; must I in FileMaker?

One-Table Queries (Using a Field Twice – or)

How about

select Title, Artist **from** Albums
where (Price < 10.00) **or** (Price > 15) ?



The screenshot shows the AlbumSongDatabase interface with a list of albums. The table has columns 'Title', 'Artist', and 'Price'. The 'Price' column has a filter set to '<10' and '>15'. A red arrow points to the price 16.99 in the row for 'Bad' by Michael Jackson.

Title	Artist	Price
Carpenters: The Singles 1969-1973	The Carpenters	9.95
Led Zeppelin II	Led Zeppelin	9.99
Led Zeppelin	Led Zeppelin	9.99
Bad	Michael Jackson	16.99
Over 60 Minutes With Lightfoot	Gordon Lightfoot	16.99
August and Everything After	Counting Crows	17.99
Dare to Dream	Yanni	19.50
North Country	The Rankin Family	19.54
The Phantom of the Opera	Andrew Lloyd	19.95
Les Miserables	Mackintosh	19.95
Fare Thee Well Love	The Rankin Family	25.29
Live: Right here, right now	Van Halen	29.95

Are there any SQL queries that FileMaker can't do?

How about $(a < b)$ or $[(c < d) \text{ and } (e < f)]$?

Roughly speaking, there's a theorem that you can express all boolean expressions with all or's or with all and's

In the above example, $(a < b)$ or $[(c < d) \text{ and } (e < f)] = (a < b)$ or $((c \geq d) \text{ or } (e \geq f))$

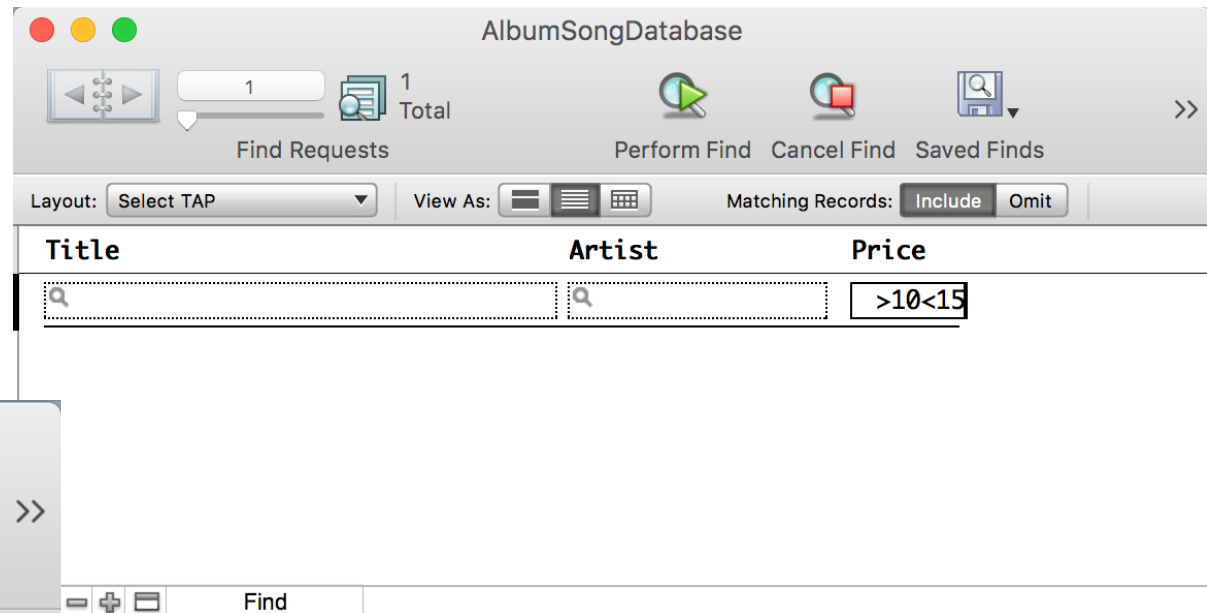
But what about sub-selects??? Recall

select ... from ... where (... (select ... from ... where ...) ...)

One-Table Queries (Using a Field Twice – and)

Suppose I want to use Price twice in a single “request”?

```
select Title, Artist from Albums
where (Price > 10.00) and (Price < 15)
order by Price ?
```



AlbumSongDatabase

10 / 23 Found (Unsorted)

Records

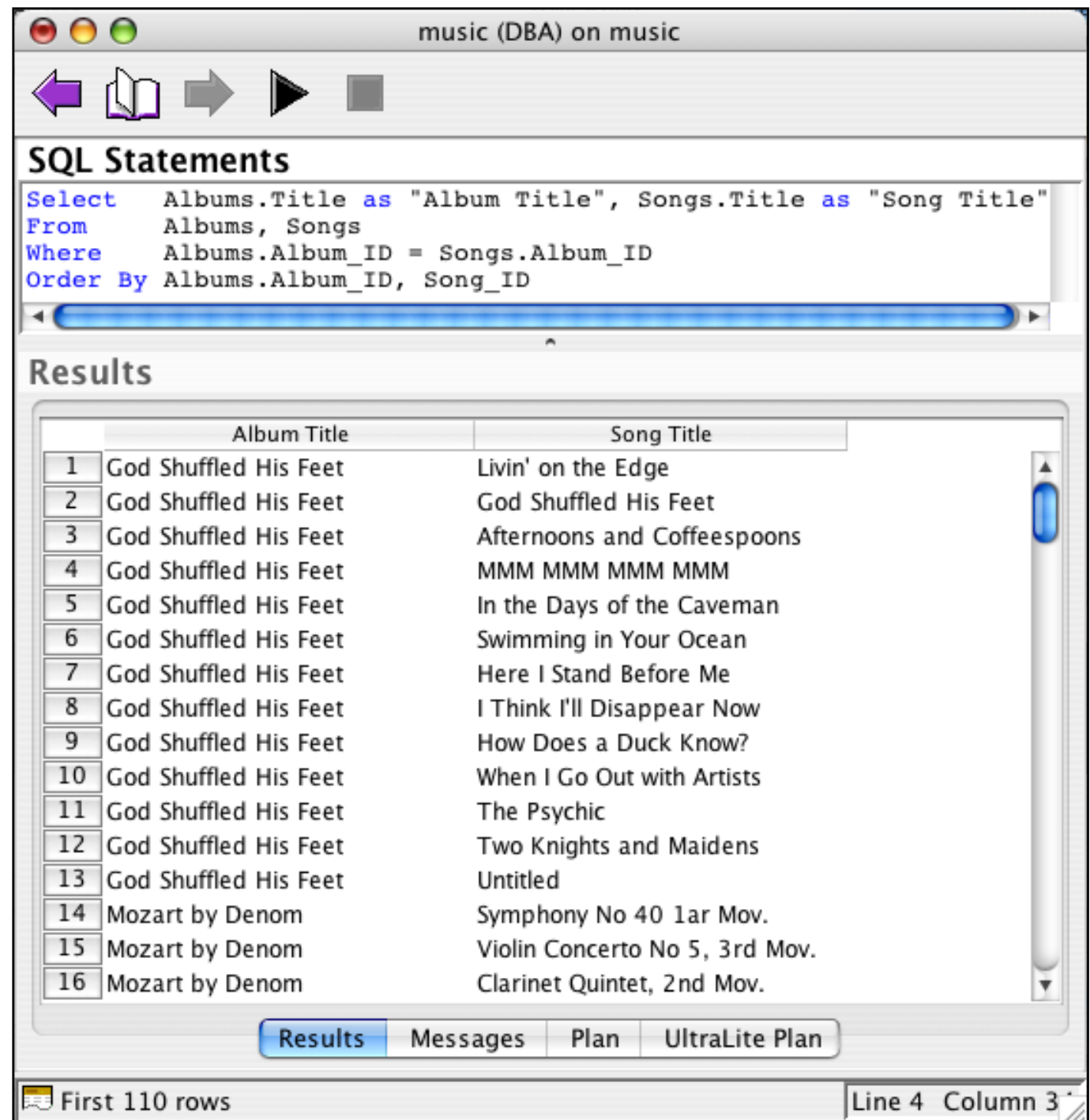
Layout: Select TAP View As: Table Preview Aa Edit Layout

Title	Artist	Price
Slippery When Wet	Bon Jovi	12.49
Yanni Live at the Acropolis	Yanni	12.99
Mozart by Denom	Mozart	14.95
The Best of Wolfgang Amadeus	Mozart	13.95
Childhood Dreams	Zamfir	13.49
Meditations & Celebrations	Zamfir	12.99
Keep the Faith	Bon Jovi	12.95
Get a Grip	Aerosmith	14.99
Pump	Aerosmith	14.99
God Shuffled His Feet	Crash Test	14.50

100 Browse

Two Table Queries/Joins in SQL

Select Albums.Title as "Album Title", Songs.Title as "Song Title"
From Albums, Songs
Where Albums.Album_ID = Songs.Album_ID
Order By Albums.Album_ID, Song_ID



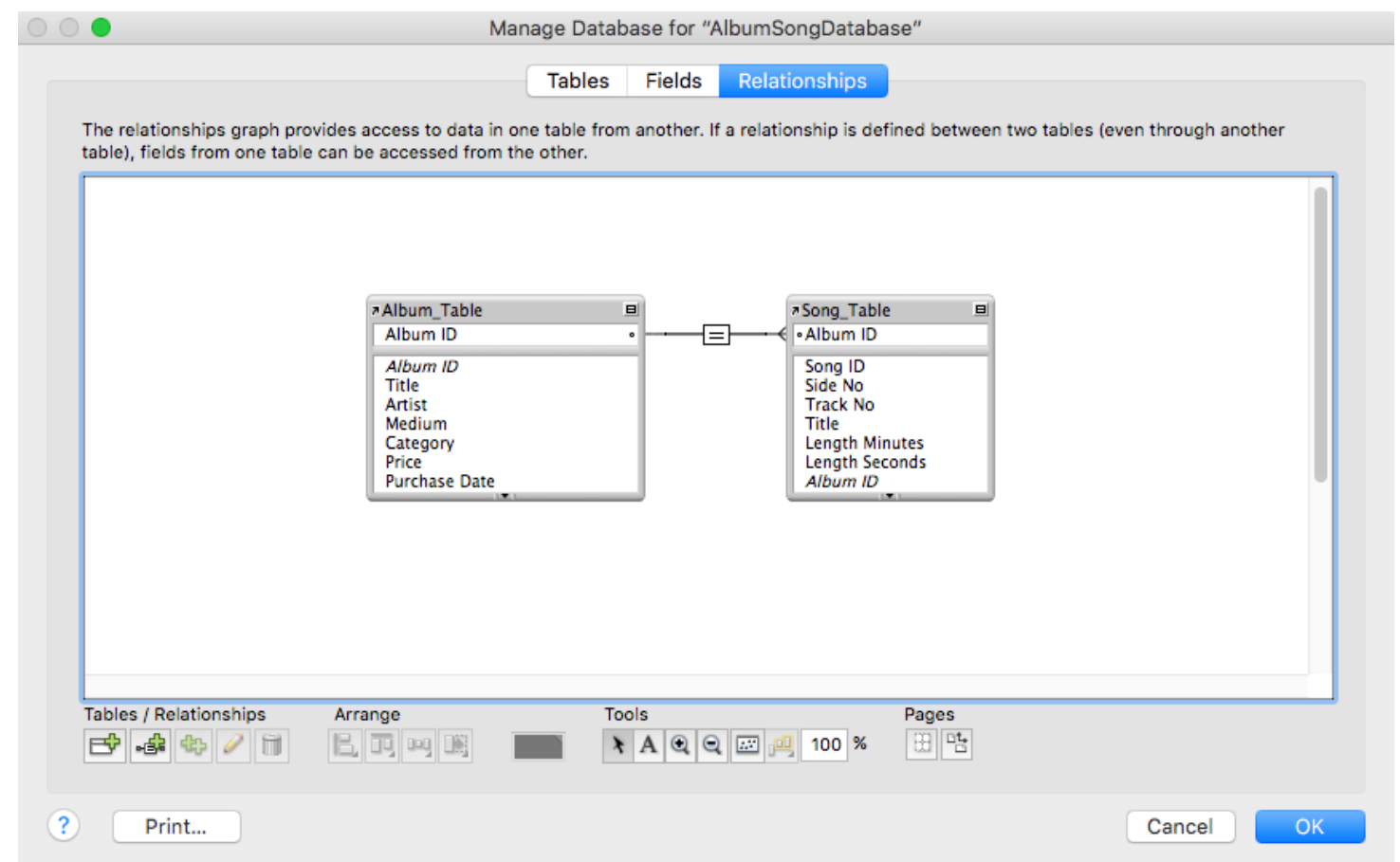
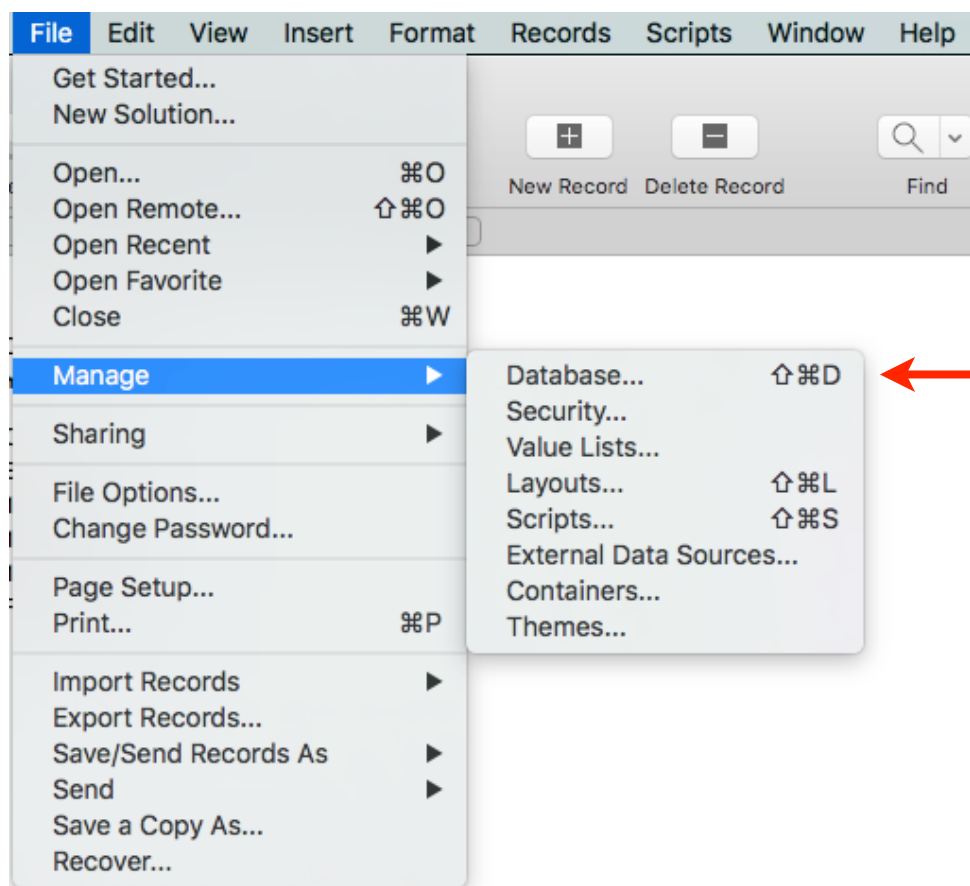
Two-Table Queries/Joins in FileMaker (From the **Songs** Table)

From the Songs Table

... **where** Songs.Album ID = Albums.Album ID

Songs is the “**master table**” in FileMaker-speak

This is a “**many-to-one**” relationship from Song to Album in FileMaker-speak



The Result (Made to Look Like SQL Output)

Song Table														
Songs Data							Albums Data							
Alb#	Sng#	Side	Track	Mins	Secs	Title	Alb#	Title	Artist	Med	Category	Price	Purchased	Label
1	250	1	1	5	10	God Shuffled His Feet	1	God Shuffled His Feet	Crash Test Dummies	CD	Soft Rock	14.50	15/12/1994	1993 BMG Music Canada
1	251	1	2	3	56	Afternoons and	1	God Shuffled His Feet	Crash Test Dummies	CD	Soft Rock	14.50	15/12/1994	1993 BMG Music Canada
1	252	1	3	3	55	MMMMMMMMMMMM	1	God Shuffled His Feet	Crash Test Dummies	CD	Soft Rock	14.50	15/12/1994	1993 BMG Music Canada
1	253	1	4	3	40	In the Days of the Caveman	1	God Shuffled His Feet	Crash Test Dummies	CD	Soft Rock	14.50	15/12/1994	1993 BMG Music Canada
1	216	1	5	6	07	Livin' on the Edge	1	God Shuffled His Feet	Crash Test Dummies	CD	Soft Rock	14.50	15/12/1994	1993 BMG Music Canada
1	254	1	5	3	49	Swimming in Your Ocean	1	God Shuffled His Feet	Crash Test Dummies	CD	Soft Rock	14.50	15/12/1994	1993 BMG Music Canada
1	255	1	6	3	06	Here I Stand Before Me	1	God Shuffled His Feet	Crash Test Dummies	CD	Soft Rock	14.50	15/12/1994	1993 BMG Music Canada
1	256	1	7	4	52	I Think I'll Disappear Now	1	God Shuffled His Feet	Crash Test Dummies	CD	Soft Rock	14.50	15/12/1994	1993 BMG Music Canada
1	257	1	8	3	42	How Does a Duck Know?	1	God Shuffled His Feet	Crash Test Dummies	CD	Soft Rock	14.50	15/12/1994	1993 BMG Music Canada
1	258	1	9	3	43	When I Go Out with Artists	1	God Shuffled His Feet	Crash Test Dummies	CD	Soft Rock	14.50	15/12/1994	1993 BMG Music Canada
1	259	1	10	3	47	The Psychic	1	God Shuffled His Feet	Crash Test Dummies	CD	Soft Rock	14.50	15/12/1994	1993 BMG Music Canada
1	260	1	11	3	24	Two Knights and Maidens	1	God Shuffled His Feet	Crash Test Dummies	CD	Soft Rock	14.50	15/12/1994	1993 BMG Music Canada
1	261	1	12	1	42	Untitled	1	God Shuffled His Feet	Crash Test Dummies	CD	Soft Rock	14.50	15/12/1994	1993 BMG Music Canada
2	262	1	1	5	28	Poundcake	2	Live: Right here, right now	Van Halen	CD	Hard Rock	29.95	15/12/1994	1993 Warner Bros. Record
2	263	1	2	4	52	Judgement Day	2	Live: Right here, right now	Van Halen	CD	Hard Rock	29.95	15/12/1994	1993 Warner Bros. Record
2	264	1	3	5	22	When It's Love	2	Live: Right here, right now	Van Halen	CD	Hard Rock	29.95	15/12/1994	1993 Warner Bros. Record
2	265	1	4	5	08	Spanked	2	Live: Right here, right now	Van Halen	CD	Hard Rock	29.95	15/12/1994	1993 Warner Bros. Record
2	266	1	5	4	37	Ain't Talkin' 'Bout Love	2	Live: Right here, right now	Van Halen	CD	Hard Rock	29.95	15/12/1994	1993 Warner Bros. Record
2	267	1	6	6	21	In 'N' Out	2	Live: Right here, right now	Van Halen	CD	Hard Rock	29.95	15/12/1994	1993 Warner Bros. Record
2	268	1	7	4	49	Dreams	2	Live: Right here, right now	Van Halen	CD	Hard Rock	29.95	15/12/1994	1993 Warner Bros. Record
2	269	1	8	4	50	Man on a Mission	2	Live: Right here, right now	Van Halen	CD	Hard Rock	29.95	15/12/1994	1993 Warner Bros. Record
2	270	1	9	5	14	Ultra Bass	2	Live: Right here, right now	Van Halen	CD	Hard Rock	29.95	15/12/1994	1993 Warner Bros. Record
2	271	1	10	9	38	Pleasure Dome/Drum solo	2	Live: Right here, right now	Van Halen	CD	Hard Rock	29.95	15/12/1994	1993 Warner Bros. Record
2	272	1	11	6	39	Panama	2	Live: Right here, right now	Van Halen	CD	Hard Rock	29.95	15/12/1994	1993 Warner Bros. Record
2	273	1	12	5	14	Love Walks In	2	Live: Right here, right now	Van Halen	CD	Hard Rock	29.95	15/12/1994	1993 Warner Bros. Record
2	274	1	13	5	21	Runaround	2	Live: Right here, right now	Van Halen	CD	Hard Rock	29.95	15/12/1994	1993 Warner Bros. Record
2	275	2	1	6	13	Right Now	2	Live: Right here, right now	Van Halen	CD	Hard Rock	29.95	15/12/1994	1993 Warner Bros. Record
2	276	2	2	4	58	One Way to Rock	2	Live: Right here, right now	Van Halen	CD	Hard Rock	29.95	15/12/1994	1993 Warner Bros. Record

Of course, you'd almost never actually DO this in FileMaker, since you can make much more readable and attractive layouts.

Two-Table Queries/Joins in FileMaker

(From the **Albums** Table)

But from the Album Table's point of view (it's now the “**master table**”)

...**where** Albums.Album ID = Songs.Album ID

This is a “**one-to-many**” relationship from Albums to Songs

Could I create the preceding layout in the Albums table?

The Result — First Formatted to Look Like SQL

One to Many

AlbID	Album Title	Artist	SngID	Side	Track	Title
3	Dare to Dream	Yanni	1	1	1	Once Upon a Time
3	Dare to Dream	Yanni	2	1	2	A Love for Life
3	Dare to Dream	Yanni	3	1	3	Nice to Meet You
3	Dare to Dream	Yanni	4	1	4	So Long My Friend
3	Dare to Dream	Yanni	5	1	5	You Only Live Once
3	Dare to Dream	Yanni	6	1	6	To the One Who Knows
3	Dare to Dream	Yanni	7	1	7	Face in the Photograph
3	Dare to Dream	Yanni	8	1	8	Felitsa
3	Dare to Dream	Yanni	9	1	9	Desire
3	Dare to Dream	Yanni	10	1	10	Aria
3	Dare to Dream	Yanni	11	1	11	A Night to Remember
3	Dare to Dream	Yanni	12	1	12	In the Mirror

Album fields.

Song fields.

But notice the use of a portal.

A layout that's more natural for FileMaker, and easier to read.

AlbumSongDatabase

12 / 23 Found (Sorted)

Records

Layout: Album w/S1 View As: Edit Layout

Title: Dare to Dream

Artist: Yanni

Category: Easy Listening Price: 19.50 Album ID: 3

Label: Private Inc. Purchased: 26 Jan 94

Medium: CD Sample: Copyright: 1992

SngID	Side	Track	Title
1	1	1	Once Upon a Time
2	1	2	A Love for Life
3	1	3	Nice to Meet You
4	1	4	So Long My Friend
5	1	5	You Only Live Once
6	1	6	To the One Who Knows
7	1	7	Face in the Photograph
8	1	8	Felitsa
9	1	9	Desire
10	1	10	Aria
11	1	11	A Night to Remember
12	1	12	In the Mirror

Multi-Key (Two-Table) Queries/Joins

From last week's University sample database

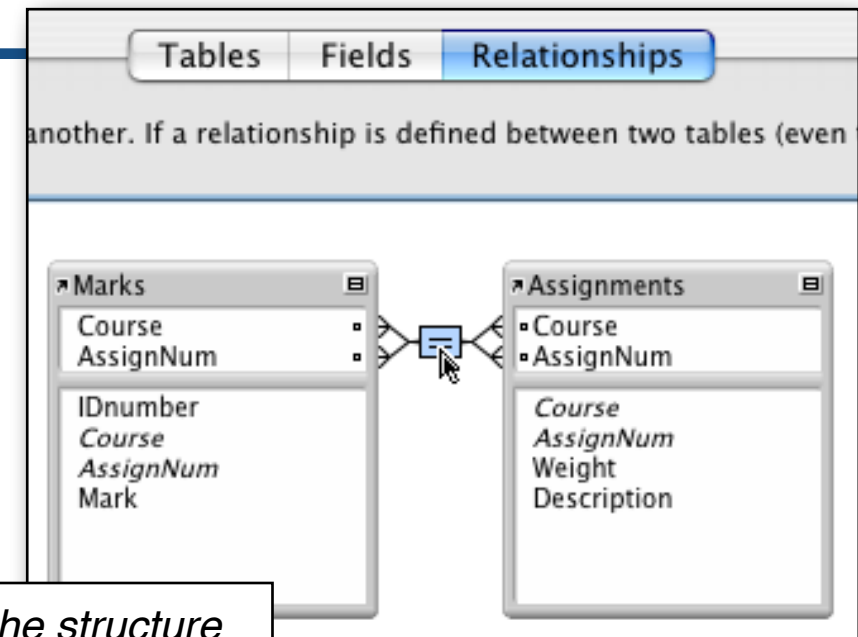
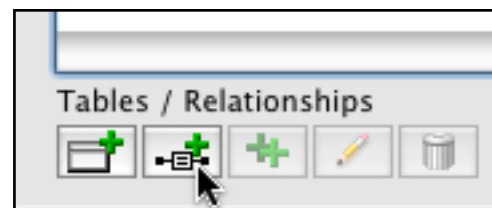
Mark		Assignme
StudNum		Course
Course		AssignNum
AssignNum		Weighting
Mark		Description
		Date Due

List of assignment due dates for student 99001122

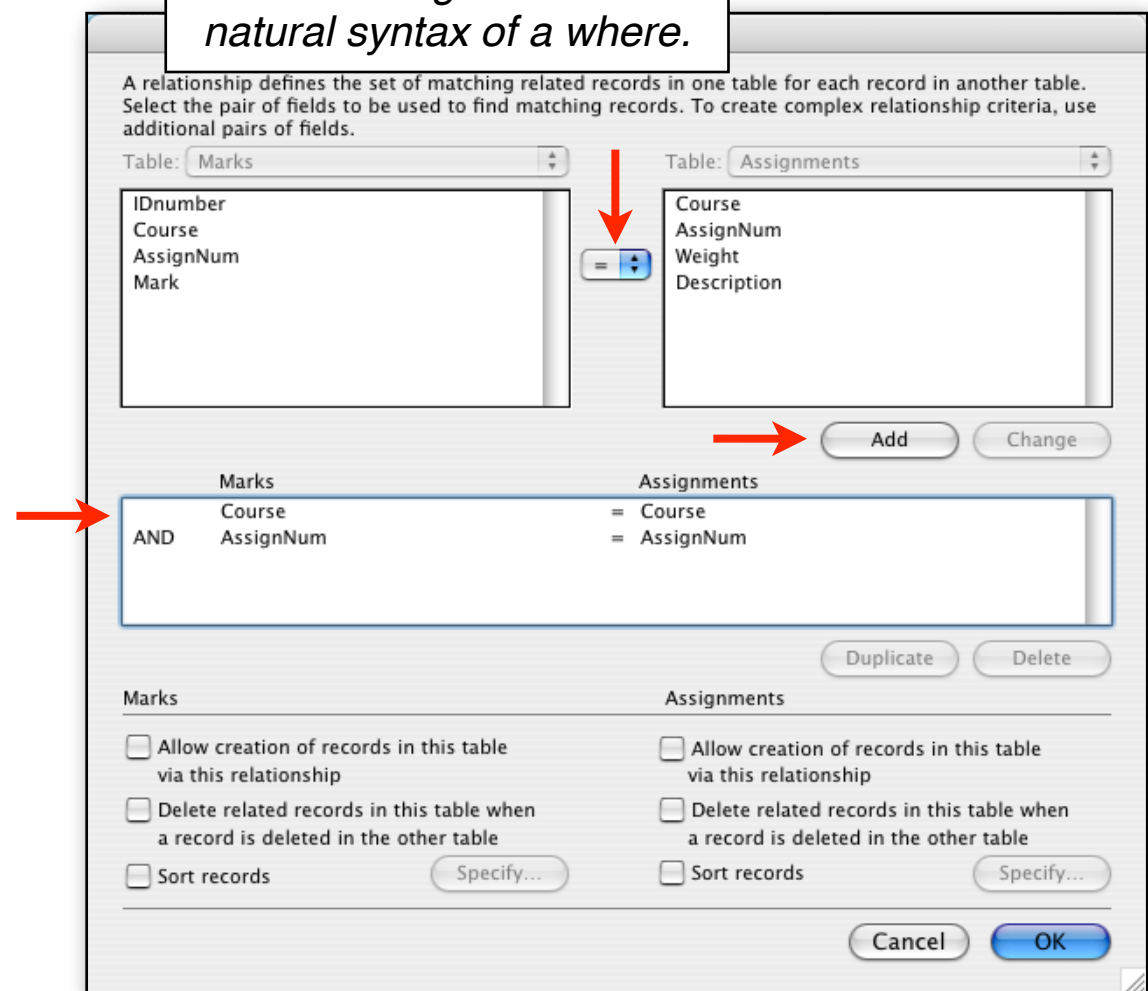
```
select M.StudNum, M.Course, M.AssignNum,
       Date Due
from   Mark M, Assignment A
where  ( M.StudNum = 99001122 )
       and ( M.Course = A.Course )
       and ( M.AssignNum = A.AssignNum )
```

How is this done in FileMaker?

grab a field in one table, drag it to a field in another or use buttons, selected fields, and popups



Notice how the structure of this dialog reflects the natural syntax of a where.



Referential Integrity

For every foreign key

- there is a record in the referenced table having that primary key
- eg for every Album_ID value appearing in a Song record *there is an Album with that Album_ID*.

A — “Cascading deletes”

- if you delete an album, the related songs are also automatically deleted

B — auto-creation of related song records

- just by typing into related fields on a layout
- the foreign key is automatically set, too
- be smart: auto-enter the song’s pKey

C — like B, but from Songs to Albums

D — like A, but from Songs to Albums

- would not be smart here ...

Edit Relationship

A relationship defines the set of matching related records in one table for each record in another table. Select the pair of fields to be used to find matching records. To create complex relationship criteria, use additional pairs of fields.

Table: Album_Table

- Album ID
- Title
- Artist
- Medium
- Category
- Price
- Purchase Date
- Copyright

Table: Song_Table

- Song ID
- Side No
- Track No
- Title
- Length Minutes
- Length Seconds
- Album ID
- SongInSeconds

Album_Table = Song_Table

Album ID = Album ID

Album_Table

- ☐ Allow creation of records in this table via this relationship
- ☐ Delete related records in this table when a record is deleted in the other table
- ☐ Sort records

Song_Table

- ☐ Allow creation of records in this table via this relationship
- ☒ Delete related records in this table when a record is deleted in the other table
- ☐ Sort records

Buttons: Add, Change, Duplicate, Delete, Cancel, OK

FileMaker vs SQL — Two-Table Joins

Are there 2-table SQL queries that can't be done in FileMaker ?

Can these?

select * from Albums, Songs

select * from Albums, Songs **where** Album_ID < Songs_ID

How about using a table twice in an SQL join (eg “select ... from Song as S1, Song as S2”)?

In Filemaker, create “copies” of a table in FileMaker’s relationships dialog when you would list the table > once in the corresponding SQL where clause.

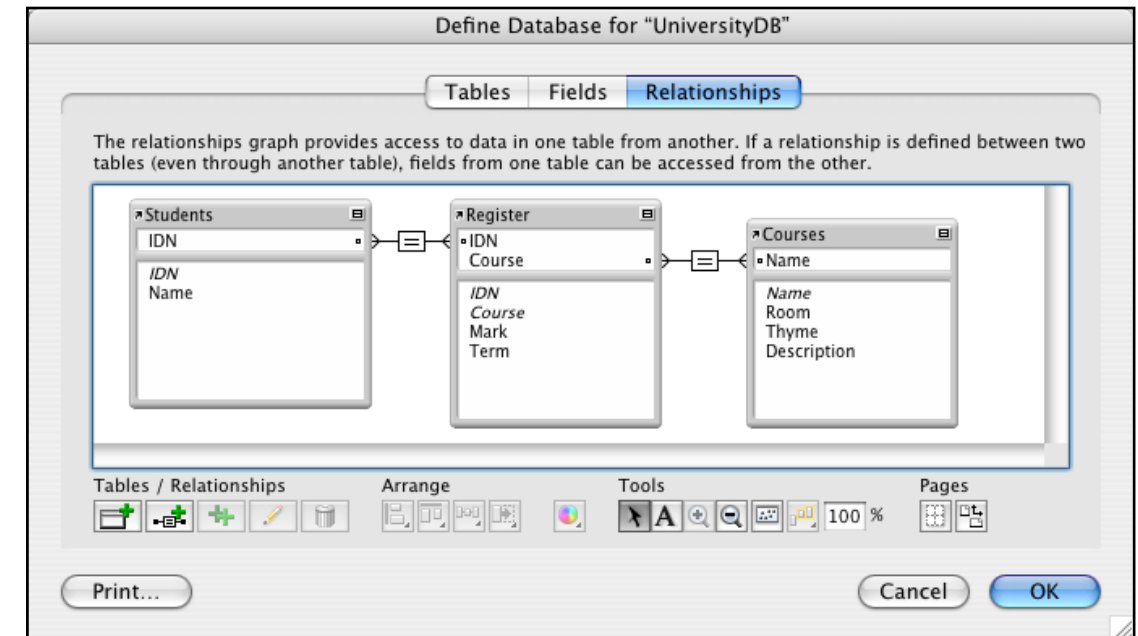


Are there 2-table FileMaker queries that can't be done in SQL ?

Three-Table Queries/Joins in FileMaker

From Last Week's Lecture

Students		Registe		Courses
IDN		IDN		Name
Name		Course		Room
		Term		Time
		Mark		Description



List the rooms in which students have lectures

```

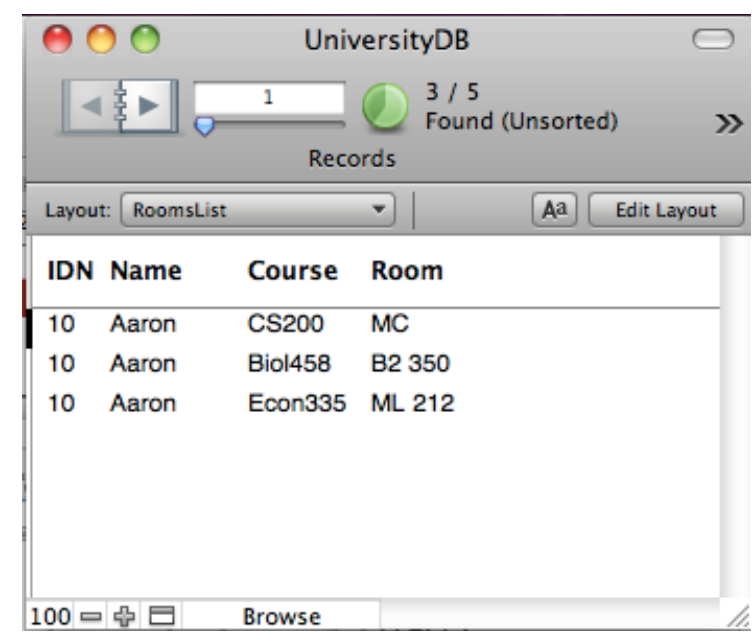
select  S.IDN, S.Name, R.Course, C.Room
from    Students S, Register R, Courses C
where   (S.IDN = R.IDN)
and     (R.Course = C.Name)
order by S.Name, C.Course

```

Three Query Search (2)

Here's what we want for each student...

with Courses as the master table
(+ a query for Aaron)



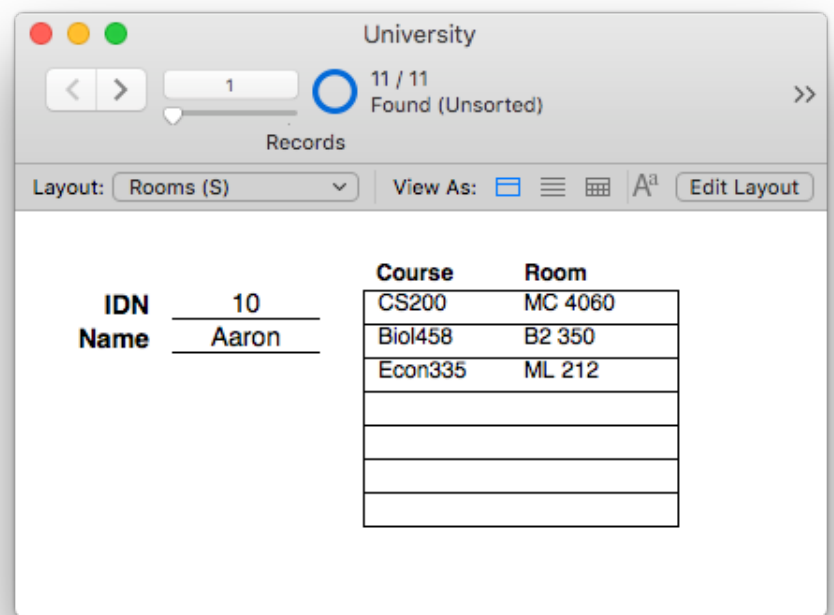
UniversityDB

Records: 3 / 5 Found (Unsorted)

Layout: RoomsList

IDN	Name	Course	Room
10	Aaron	CS200	MC
10	Aaron	Biol458	B2 350
10	Aaron	Econ335	ML 212

with Students as the master table



University

Records: 11 / 11 Found (Unsorted)

Layout: Rooms (S)

View As: [Table Icon] [List Icon] [Grid Icon]

IDN	Name	Course	Room
10	Aaron	CS200	MC 4060
		Biol458	B2 350
		Econ335	ML 212

Hmm ... in a Students layout, how do you access Courses fields?

Thus

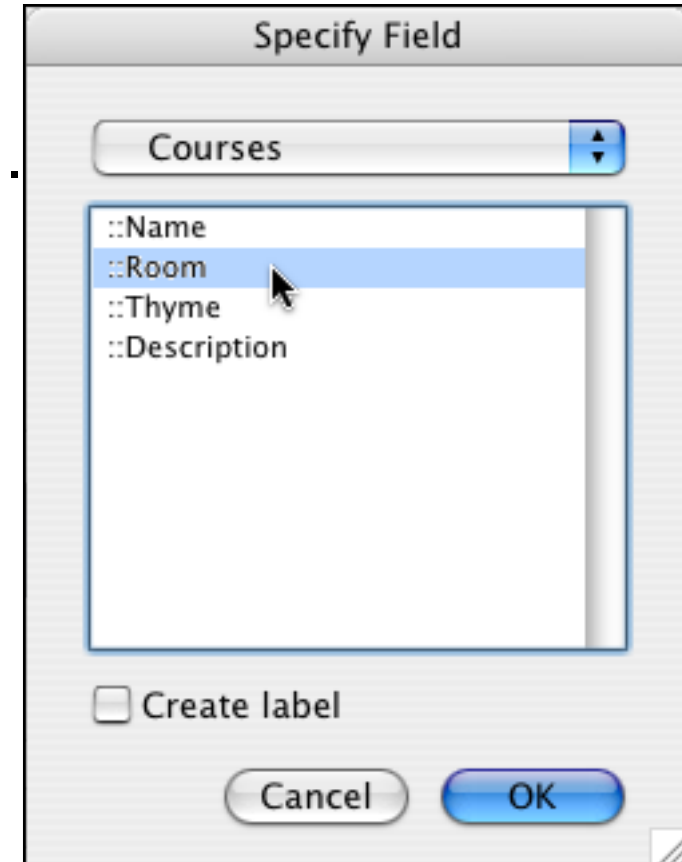
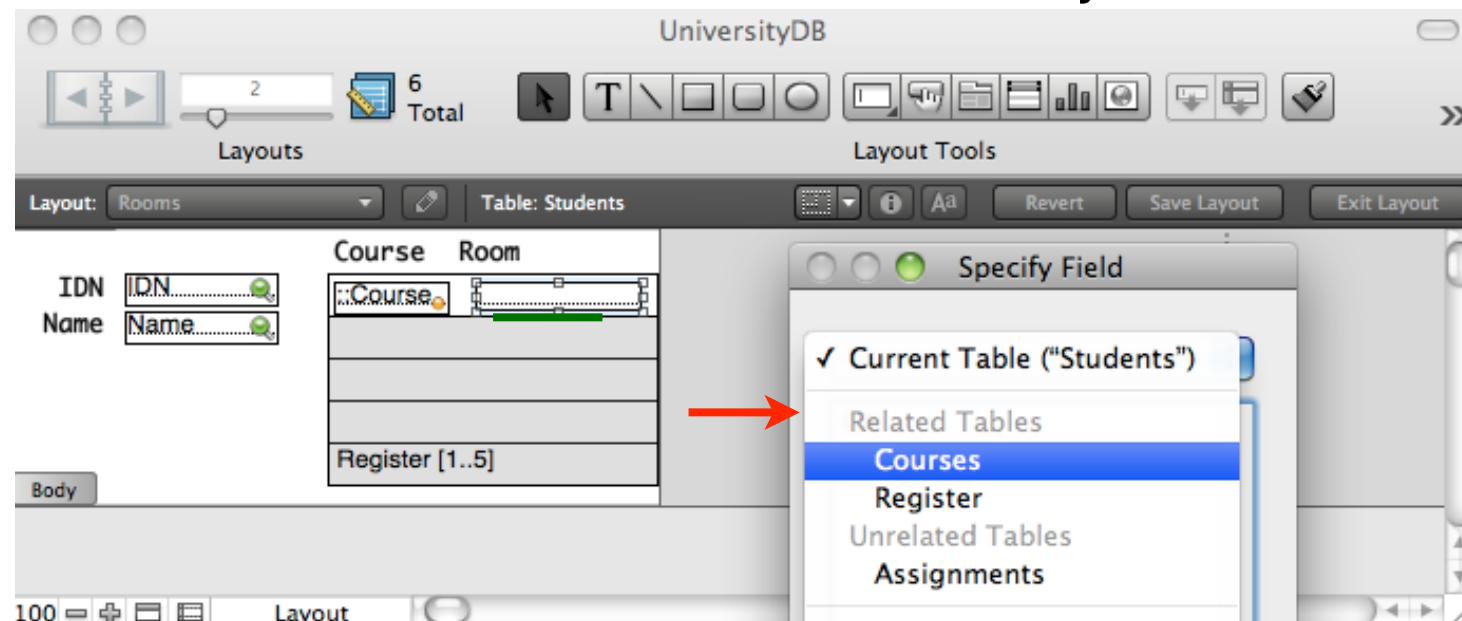
you can relate (link) A to B, relate B to C,
then on a layout in A use fields from C as well as B

If you position the field in a portal, FileMaker will show all the related values

If you position the field outside a portal, FileMaker will show you the first related value it finds

which is just what you want if the relationship is many-to-one
but “wrong” if the relationship is one-to-many

however, FileMaker doesn't care — it just does what you tell it to...



Study Questions

What about 4-table joins? 5-table joins? etc

Which is more powerful: SQL or FileMaker?

Which is easier to use: SQL or FileMaker?

If SQL is the definition of a (truly) “relational database” ...

is FileMaker a relational database?

if it isn't, why do so many people buy FileMaker?

Reports in FileMaker

Reports are something SQL barely does

- a possible reason for preferring FileMaker
- (though note that you can purchase “report generators” that hook to SQL DBMSs)

A report is just a list of records

- ie field values in each of those records
- and possibly in linked records from linked tables

You lay out how you want those fields arranged

- FileMaker prints that layout repeatedly, once for each record in the “found set”
- usually you don’t want to report on every record, so you do a query first; what’s printed is data from records in the “found set”

But usually you’d like to

- order the records
- and/or to group them
- and print summary information about each group, eg
 - the number of records in each group
 - the average / total / etc of some field

Groups

And usually some of the information is the same within a group

- it would be nice to only print it once
- (eg the Album Title is the same for all the songs on an album)

So...

We'd like a way to

“group” records and

“do something” once for each group

What's a “group” in FileMaker?

- sort on some field's value
- each sequence of records with the same field value is a group

What does it mean to “do something” for each group?

print once

the fields that don't change and/or

summary (“**aggregate**”) information

between the records for one group

and the records for the next group

Organization of a Report Layout

At the top of every page	Header	printed once on each page
Precedes the first leading subsummary	Leading Grand Summary	printed once
Precedes every change in the sorted field's value	Leading SubSummary	
Repeated for Every Record	BODY	printed once for each group
Follows every change the sorted field's value	Trailing SubSummary	
Follows the last trailing subsummary	Trailing Grand Summary	printed once
At the bottom of every page	Footer	printed once on each page

Warning

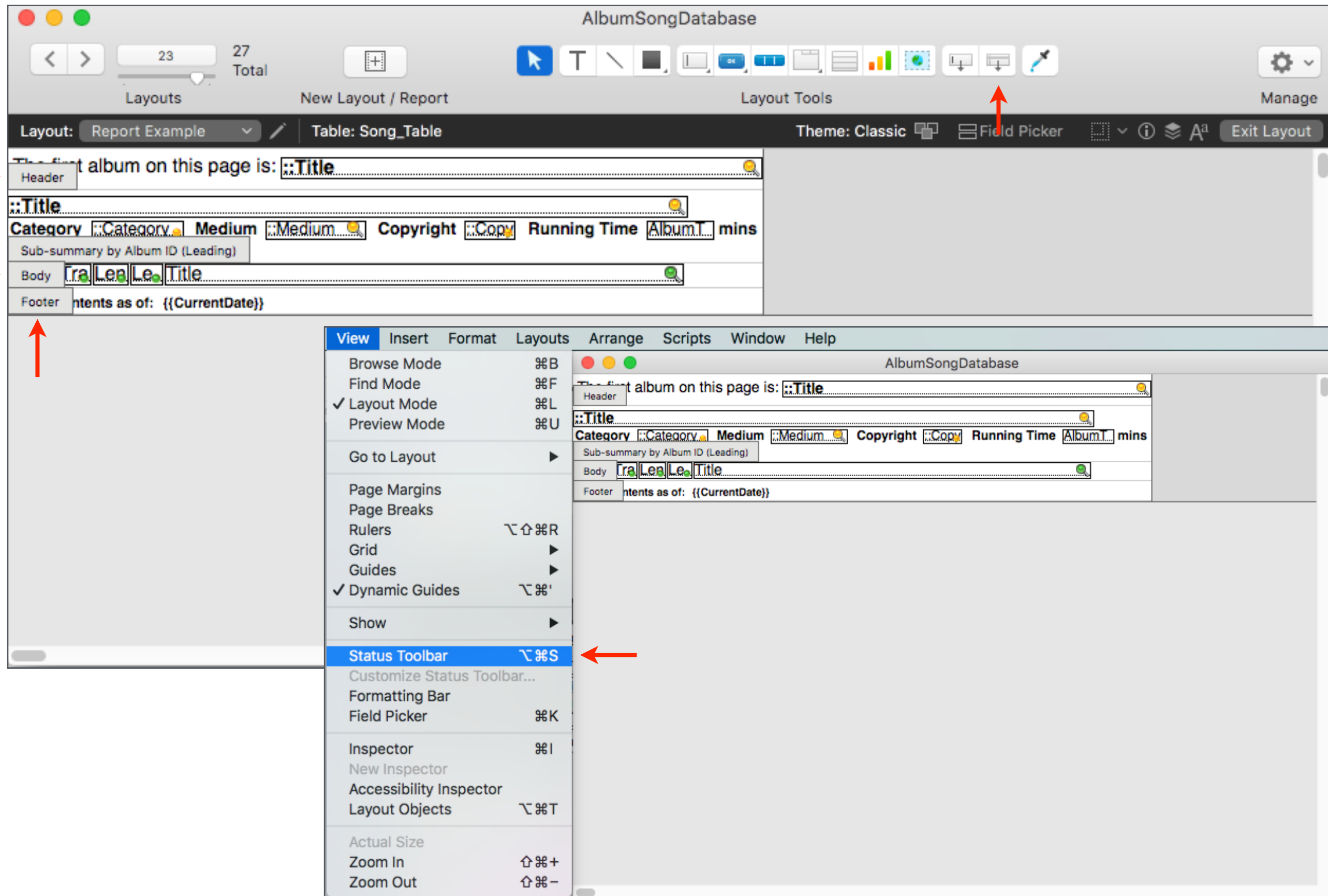
In FileMaker . . .

- Each sub-summary part is associated with a “break field”
whose distinct values define groups
But using the sub-summary does not cause a sort to be done on the break field
so as to create the groups!
— you must do that yourself, separately
- Browse mode only shows sub-summaries ***if it's sorted by the break field***
And you must have sorted by the relevant break field

Remember “Group By” in SQL?

- it told SQL what field(s) to group records by
when using an aggregate function [eg count() and sum()]
- it's the same idea in FileMaker
except that sorting serves as both Order By & Group By
- SQL aggregate functions = FileMaker summary fields

Example of a Report Layout



The Resulting Report

The screenshot shows a macOS-style window titled "AlbumSongDatabase". At the top, there are navigation controls: left and right arrows, a "Records" counter showing "5" of "309 Total (Sorted)", a "Find" button with a magnifying glass, a "Sort" button with a down arrow and "a-z", and a "Search" input field. Below this is a "Layout" dropdown set to "Report Example", a "View As" section with icons for list, table, and grid views, a "Preview" button, and an "Edit Layout" button. The main content area displays the first album on the page: "God Shuffled His Feet". It lists the album's category as "Soft Rock", medium as "Medium", and CD format. The copyright is "1993" and the running time is "50.8833 mins". A table of tracks follows, with columns for Side, Track, Mins, Secs, and Title. The tracks are: 1 1 5 10 God Shuffled His Feet, 1 2 3 56 Afternoons and Coffeespoons, 1 3 3 55 MMM MMM MMM MMM, 1 4 3 40 In the Days of the Caveman, 1 5 6 07 Livin' on the Edge, 1 5 3 49 Swimming in Your Ocean, 1 6 3 06 Here I Stand Before Me, 1 7 4 52 I Think I'll Disappear Now, 1 8 3 42 How Does a Duck Know?, 1 9 3 43 When I Go Out with Artists, 1 10 3 47 The Psychic, 1 11 3 24 Two Knights and Maidens, and 1 12 1 42 Untitled. Below this, the next album is "Live: Right here, right now", categorized as "Hard Rock", with a running time of "141.266 mins". Its tracks are: 1 1 5 28 Poundcake, 1 2 4 52 Judgement Day, 1 3 5 22 When It's Love, 1 4 5 08 Spanked, 1 5 4 37 Ain't Talkin' 'Bout Love, 1 6 6 21 In 'N' Out, 1 7 4 49 Dreams, 1 8 4 50 Man on a Mission, 1 9 5 14 Ultra Bass, 1 10 9 38 Pleasure Dome/Drum solo, 1 11 6 39 Panama, 1 12 5 14 Love Walks In, 1 13 5 21 Runaround, and 2 1 6 13 Right Now. At the bottom, it says "Album contents as of: Thursday, 04 April 2018".

Side	Track	Mins	Secs	Title
1	1	5	10	God Shuffled His Feet
1	2	3	56	Afternoons and Coffeespoons
1	3	3	55	MMM MMM MMM MMM
1	4	3	40	In the Days of the Caveman
1	5	6	07	Livin' on the Edge
1	5	3	49	Swimming in Your Ocean
1	6	3	06	Here I Stand Before Me
1	7	4	52	I Think I'll Disappear Now
1	8	3	42	How Does a Duck Know?
1	9	3	43	When I Go Out with Artists
1	10	3	47	The Psychic
1	11	3	24	Two Knights and Maidens
1	12	1	42	Untitled

Side	Track	Mins	Secs	Title
1	1	5	28	Poundcake
1	2	4	52	Judgement Day
1	3	5	22	When It's Love
1	4	5	08	Spanked
1	5	4	37	Ain't Talkin' 'Bout Love
1	6	6	21	In 'N' Out
1	7	4	49	Dreams
1	8	4	50	Man on a Mission
1	9	5	14	Ultra Bass
1	10	9	38	Pleasure Dome/Drum solo
1	11	6	39	Panama
1	12	5	14	Love Walks In
1	13	5	21	Runaround
2	1	6	13	Right Now

Multi-Level Reports – Subgroups

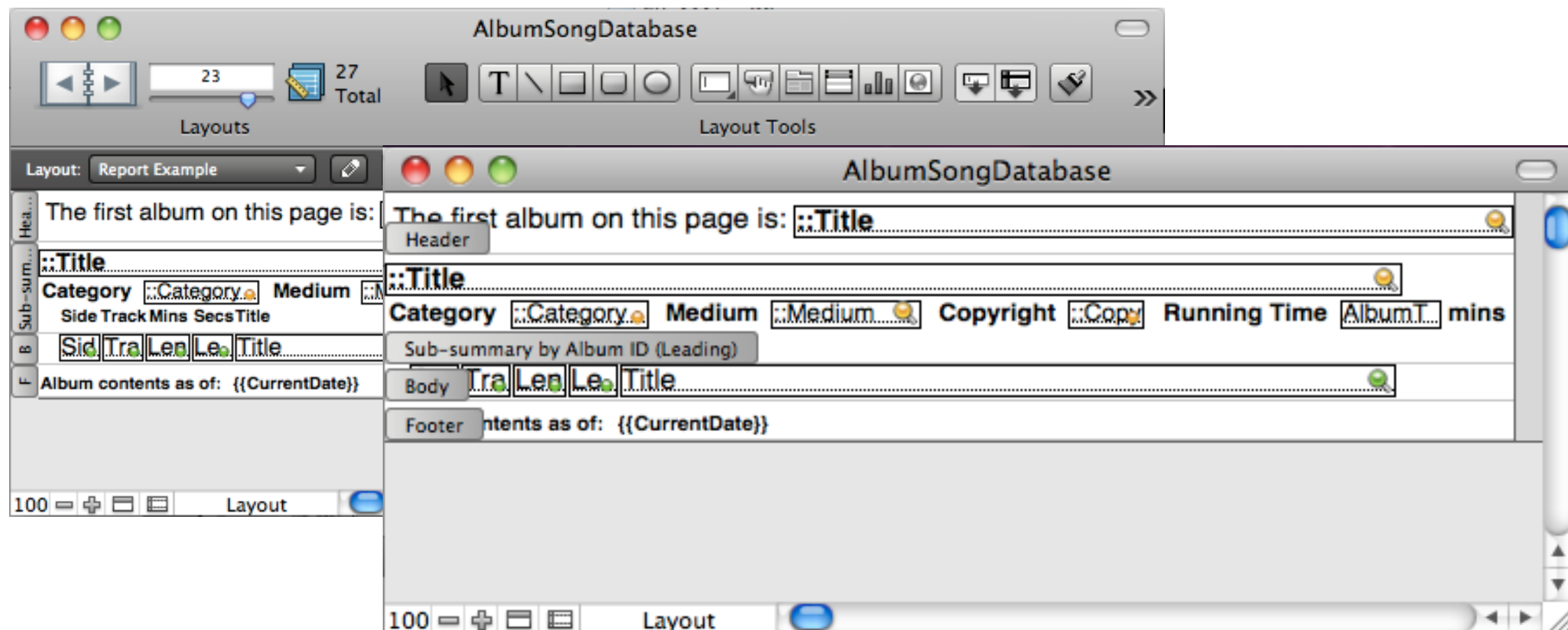
Suppose you want to break a group into subgroups

and print some summary information for each subgroup?

eg separately for side 1 and side 2 of an album

It works just as you'd expect

sort first by the outer group, then by the inner
put a (another) sub-summary part between the
outer sub-summary part & the body part, and
set its break field to be the second sort key



The Resulting Two-Level Report

At the top of every page	Header
Precedes the first leading subsummary	Leading Grand Summary
Precedes every change in the primary sort field's value	Leading Outer SubSummary
Precedes every change in the secondary sort field's value	Leading Inner SubSummary
Repeated for every record	BODY
Follows every change in the secondary sort field's	Trailing Inner SubSummary
Follows every change in the primary sort field's value	Trailing Outer SubSummary
Follows the last trailing subsummary	Trailing Grand Summary
At the bottom of every page	Footer

God Shuffled His Feet									
Category	Soft Rock		Medium CD	Copyright 1993		Total Running Time 50.88 mins			
Side	Track	Mins	Secs	Title					
1	Minutes this side: 50.88								
1	5	10	God Shuffled His Feet						
2	3	56	Afternoons and Coffeespoons						
3	3	55	MMM MMM MMM MMM						
4	3	40	In the Days of the Caveman						
5	6	07	Livin' on the Edge						
5	3	49	Swimming in Your Ocean						
6	3	06	Here I Stand Before Me						
7	4	52	I Think I'll Disappear Now						
8	3	42	How Does a Duck Know?						
9	3	43	When I Go Out with Artists						
10	3	47	The Psychic						
11	3	24	Two Knights and Maidens						
12	1	42	Untitled						
Live: Right here, right now									
Category	Hard Rock		Medium CD	Copyright 1993		Total Running Time ? mins			
Side	Track	Mins	Secs	Title					
1	Minutes this side: 73.55								
1	5	28	Poundcake						
2	4	52	Judgement Day						
3	5	22	When It's Love						
4	5	08	Spanked						
5	4	37	Ain't Talkin' 'Bout Love						
6	6	21	In 'N' Out						
7	4	49	Dreams						
8	4	50	Man on a Mission						
9	5	14	Ultra Bass						
10	9	38	Pleasure Dome/Drum solo						
11	6	39	Panama						
12	5	14	Love Walks In						
13	5	21	Runaround						
2	Minutes this side: 67.71								
1	6	13	Right Now						
2	4	58	One Way to Rock						
3	5	22	Why Can't This Be Love						
4	5	39	Give to Live						
5	5	50	Finish What Ya Started						
6	5	00	Best of Both Worlds						
7	11	37	316						
8	7	58	You Really Got Me/Cabo Wabo						
9	5	41	Won't Get Fooled Again						
10	4	26	Jump						
11	4	59	Top of the World						

Reports — Some Details

Use the Format menu to control the appearance of data values

If a field appears in a Header

the value for the **first** record on the page is used

similarly for the footer, *mutatis mutandis*

Use the Define Fields dialog box

to create a summary field (SQL aggregate function)

that you place in a grand summary or sub-summary part

Generalizing

If I select a field on a layout

- FileMaker grays out inappropriate Format menu items
- selecting one of the active menu items
lets me change the appearance of the selected field

What happens if nothing is selected & I select a Format menu item? what does it mean?

Why is this an important question?

Indexing in FileMaker

**Remember SQL's Create Index command?
Here's how FileMaker does it**

FileMaker will automatically index fields

- to implement “Unique” or “Existing” data validation on the matched field in a related table when the field is used to create a value list provided you haven't manually forced indexing off

Otherwise, by default:

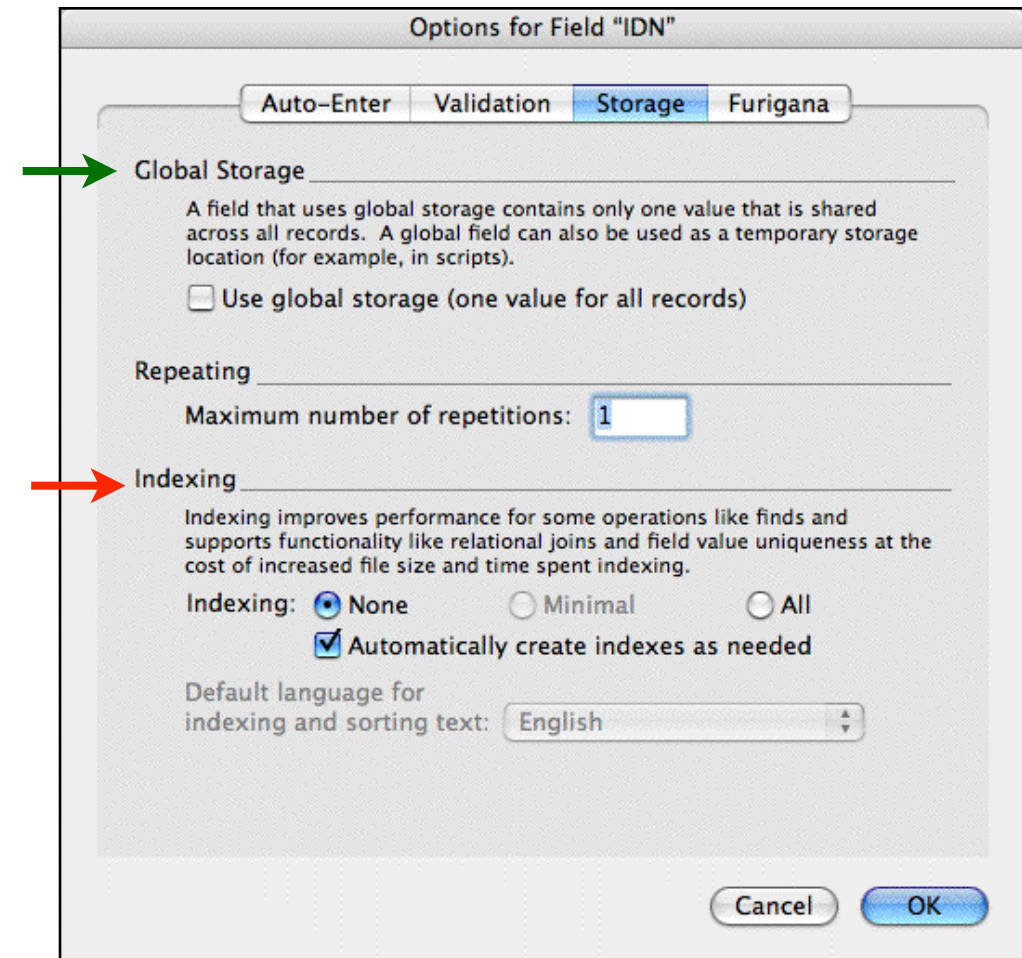
- “Automatically turn indexing on if needed”

In FileMaker

- it's unlikely you'll ever need to manually turn indexing on but you may want to turn it off to save file space because FileMaker never will!
- Other databases make up their own rules

(By the way, FileMaker doesn't use indices for sorting)

And while we're here



Formats in FileMaker

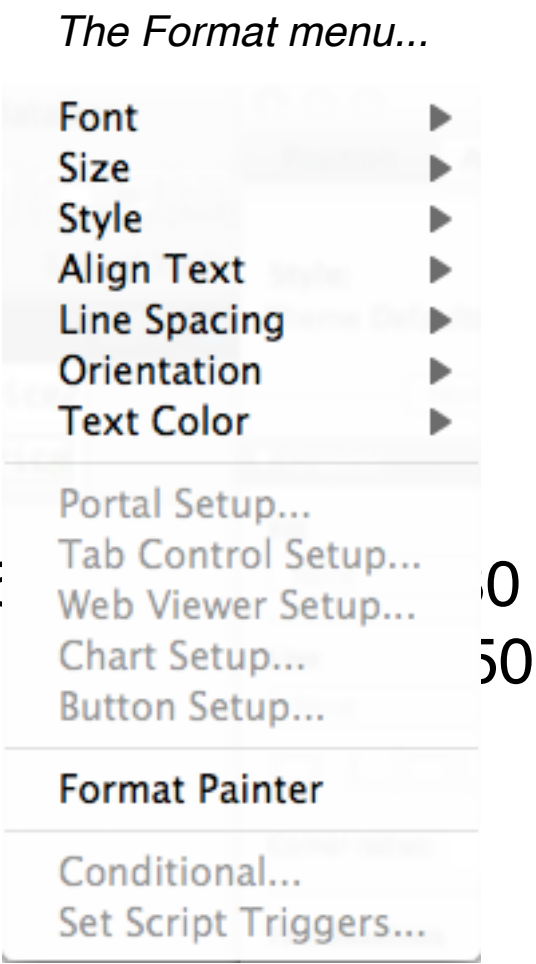
Note especially the difference between

- how a data value appears on a form
eg 3.14
- and what's stored in the database

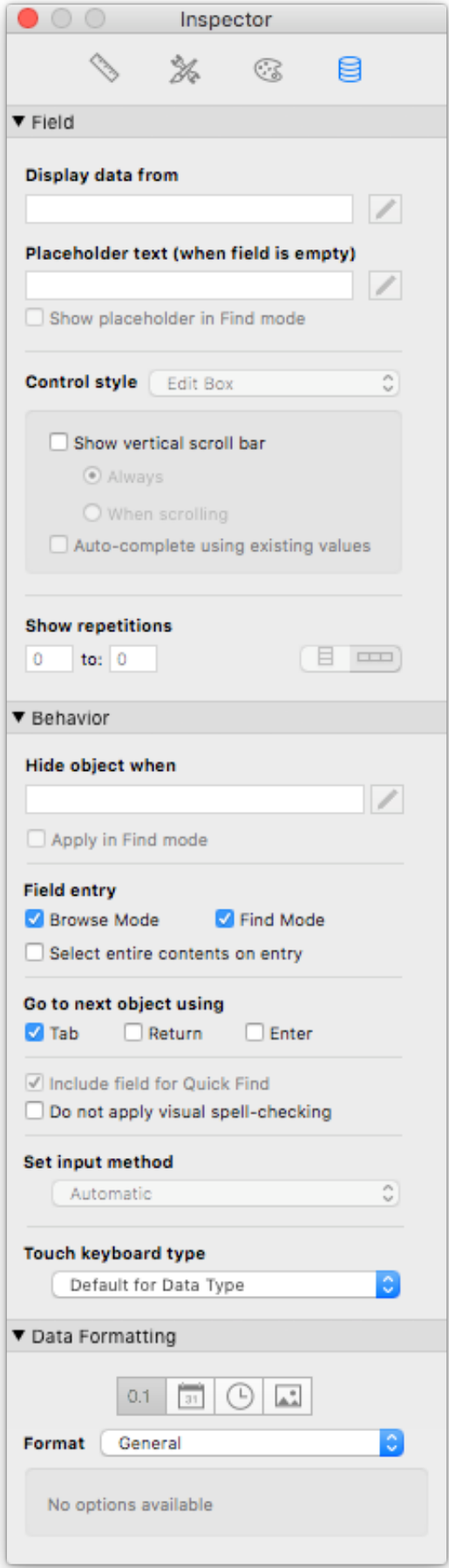
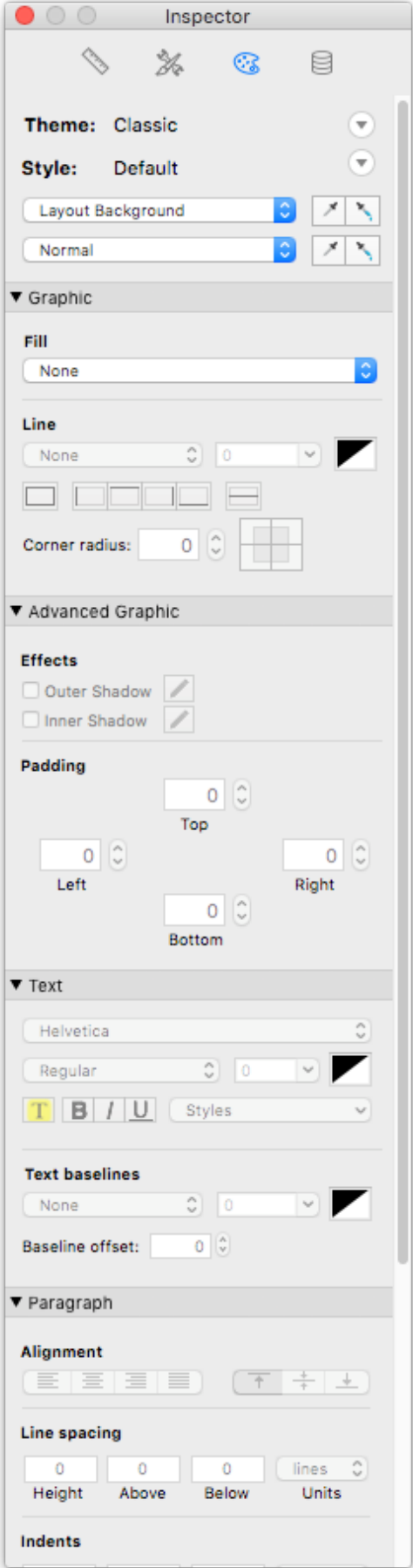
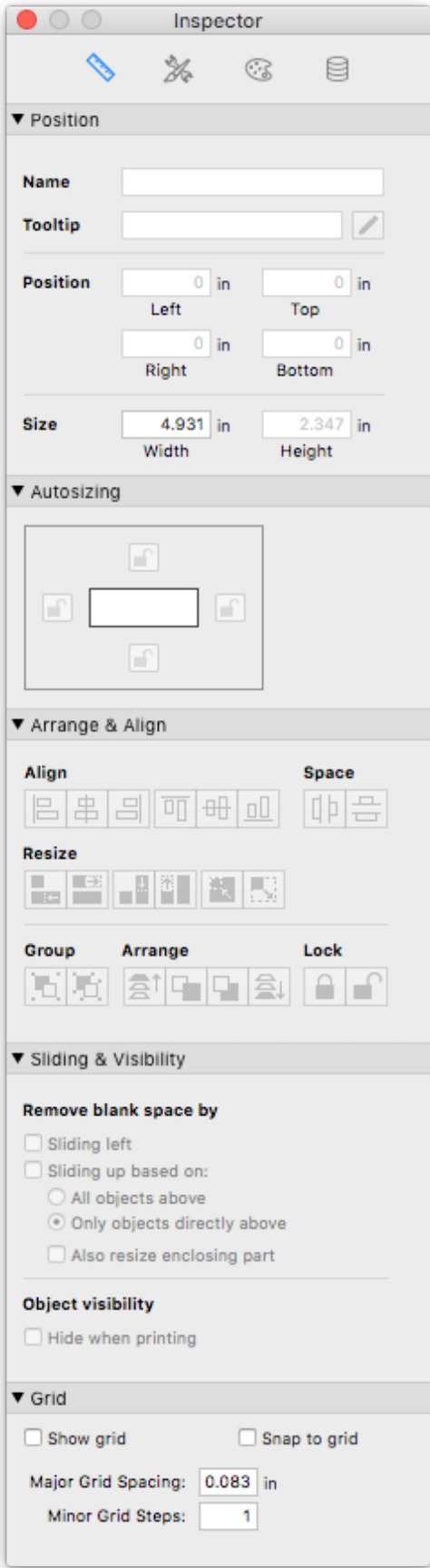
eg

3.141592653589793238462643383279502884197169399375105
7816406286208998628034825342117067982148086513282306
582

& note the menu items that control the appearance of each data type



The Inspector



Things That Might Confuse You in FileMaker

You can define as many layouts at you want

- these are also called “views” of the data (SQL-speak)
- give them meaningful names!!!

You don't have to include all fields on all layouts

- defining a new field doesn't cause it to appear on all layouts
- by default, a new field is placed on the “current layout,” although there's a preference to prevent that

(Incidentally, FileMaker allows you to userid-/password-protect a table, layouts, etc, and to access a database over the internet (there's a more expensive version tuned for this.)

In FileMaker

- data entry options are associated with a field's definition
- the appearance of a field is specified on the layout, and can vary
- other databases may choose different conventions

You can only see sub-summaries

- when in Preview Mode or Browse Mode
***and** if you have sorted by the relevant break field(s)*
- doing both — and remembering to do both — is a pain
- FileMaker macros are handy for automating this (next week...)

Summing Up

SQL joins vs FileMaker joins (“relationships”)

- FileMaker is now built on top of an SQL engine
- but does FileMaker’s GUI provide a way to *generate and display* all possible SQL selects?

FileMaker features typical of GUI-flavoured DBMS’s

- forms with
 - formatting of displayed values
 - data validation
 - input widgets (radio buttons, check boxes, pop-ups, etc)
 - point-and-click-to-open (next week)
 - query by example
- reports and
 - formatting of displayed values
 - sorting
 - summaries, sub-summaries, aggregate functions

Why might someone prefer SQL?

Why might someone prefer FileMaker?

Another study question: compare & contrast database management with Excel & FileMaker