Data Query Using MySQL

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talk outline

- Queries using SQL
- SQL by example
- Hands-on queries through PhpMyAdmin

SQL

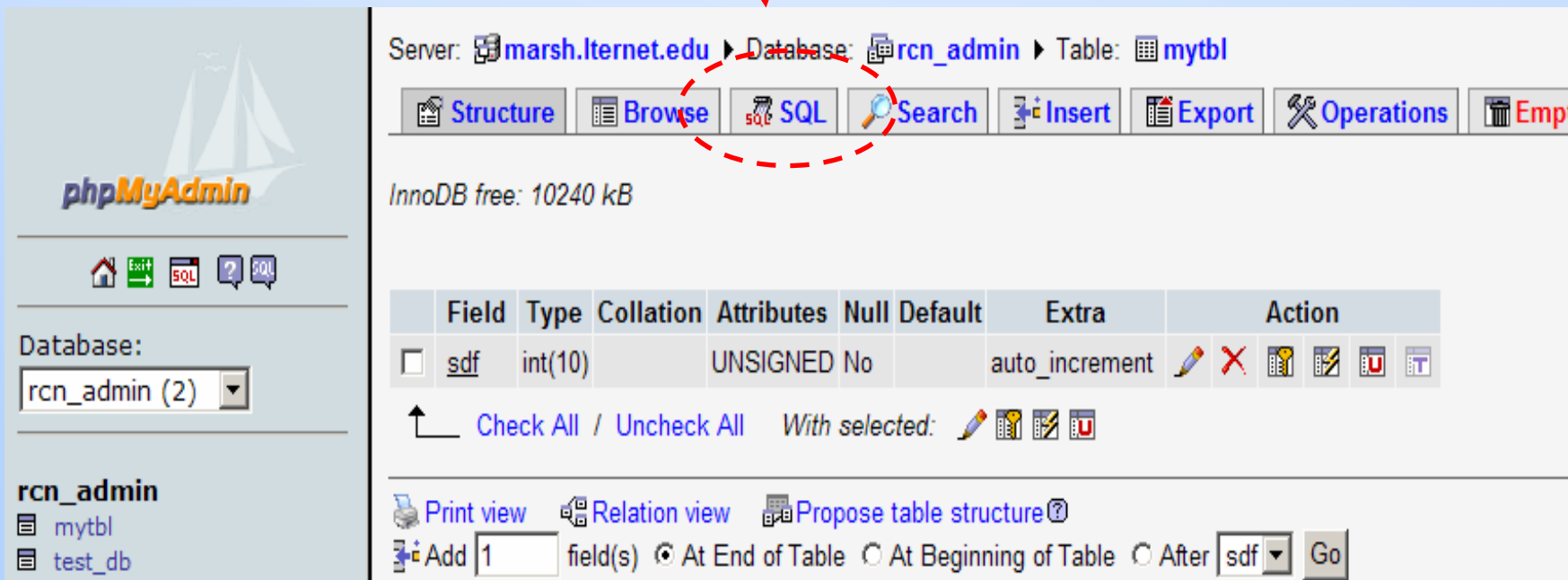
- Structured Query Language
- ANSI standard computer language with many variants (I'll use MySQL)
- Read, write, calculate, modify data
- Easy to learn, hard to master

Querying Tips

- Build queries incrementally.
- Make a back-up copy of tables.
- Manual: http://dev.mysql.com/doc/

Executing SQL Commands through PHPMyAdmin

Enter any SQL command and see results



4 Basic Queries:

- **SELECT** - retrieves data from a database table
- **INSERT** - inserts new data into a table
- **UPDATE** - updates data in a database table
- **DELETE** - deletes data from a database table

SELECT

Basic Syntax: **SELECT** *columns* **FROM** *table*

1) get specific columns from a table:

SELECT cover, height FROM observation

2) get all columns:

SELECT * FROM observation

3) get specific rows from a table:

SELECT cover, height FROM observation
WHERE cover > 1

SELECT (continued)

More complex conditions:

```
SELECT * FROM observation
WHERE ( height > 10 AND height < 20 ) OR cover > 10
```

JOINS

SELECT * FROM observation

SELECT * FROM *table1* **LEFT JOIN** *table2*
ON *match up two fields*

SELECT * FROM observation LEFT JOIN species
ON species_id = species_id

SELECT * FROM observation LEFT JOIN species
ON observation.species_id = species.species_id

LEFT OUTER JOIN aka LEFT JOIN

SPECIES_ID	COVER	HEIGHT
4	0.5	4
2	0.1	2
4	0.01	4
4	0.1	5
1	0.5	12
3	0.25	15

SPECIES_ID	NAME
0	LATR2
1	ERPU8
3	LEFE
4	GUSA2

SPECIES_ID	COVER	HEIGHT	SPECIES_ID	NAME
4	0.5	4	4	GUSA2
2	0.1	2		
4	0.01	4	4	GUSA2
4	0.1	5	4	GUSA2
1	0.5	12	1	ERPU8
3	0.25	15	3	LEFE

INNER JOIN

SPECIES_ID	COVER	HEIGHT
4	0.5	4
2	0.1	2
4	0.01	4
4	0.1	5
1	0.5	12
3	0.25	15

SPECIES_ID	NAME
0	LATR2
1	ERPU8
3	LEFE
4	GUSA2

SPECIES_ID	COVER	HEIGHT	SPECIES_ID	NAME
4	0.5	4	4	GUSA2
~~2~~	~~0.1~~	~~2~~		
4	0.01	4	4	GUSA2
4	0.1	5	4	GUSA2
1	0.5	12	1	ERPU8
3	0.25	15	3	LEFE

INSERT

Basic syntax:

INSERT INTO *table (list of fields)* **VALUES** *(list of values)*

INSERT INTO species (species) VALUES ('alin')

INSERT INTO location (site, web, plot, quad) VALUES ('P', 2, 'E', 1)

UPDATE

Basic syntax: **UPDATE** *table* **SET** *field* **=** *value*

```
SELECT * FROM observation
    WHERE comments = "NA"

UPDATE observation SET comments = "Not Applicable"
    WHERE comments = "NA"

SELECT comments FROM observation
    WHERE comments LIKE "never%"

UPDATE observation
    SET comments = concat("Cannot identify as of ", curdate())
    WHERE comments LIKE "never%"
```

Update with multiple tables

Basic Syntax: **UPDATE** *tables* **SET** *assignments* **WHERE** *conditions*;

Useful for normalizing tables. After creating a separate Location table…

UPDATE observations, locations

SET observations.location_id=location.location_id

WHERE observation.site = location.site AND
observation.web=location.web AND
observation.plot=location.plot AND
observation.quad=location.quad

DELETE

Basic syntax:

DELETE FROM *table* **WHERE** *condition*

DELETE FROM species WHERE species = ‘acer saccharum’

But good to try a select first, before deleting:

SELECT FROM species WHERE species = ‘acer saccharum’

Aggregate Functions

You can use function in place of plain column names.

SELECT AVG(height) FROM observation

Examples: AVG(), STDDEV(), VARIANCE(), MAX(), MIN()

Calculate the average height of sand muhly (MUAR2):

```
SELECT AVG(height) FROM observation
        LEFT JOIN species ON observation.species_id = species.species_id
        WHERE species.species = 'MUAR2'
```

Normalizing An Existing Data Table

Overview:

NPP Table

Date	Site	Web	Plot	Quad	Species	Cover	Height	Comments
2/5/2005	G	1	N	1	BOER4	1	12	
2/5/2005	G	1	N	1	BOER4	0.5	12	
2/5/2005	G	1	N	1	BOER4	0.25	10	
2/6/2005	G	1	N	1	LATR2	9	24	grazed
2/6/2005	G	1	N	2	LATR2	5	18	
2/6/2005	G	1	N	2	SPCR	4	12	

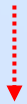
A. Make the location table
B. Use it to assign foreign keys to observations table
C. Delete location info in observations table

Normalizing An Existing Data Table: Step 1

Make 2 copies of the origintal table

NPP Table

Date	Site	Web	Plot	Quad	Species	Cover	Height	Comments
2/5/2005	G	1	N	1	BOER4	1	12	
2/5/2005	G	1	N	1	BOER4	0.5	12	
2/5/2005	G	1	N	1	BOER4	0.25	10	
2/6/2005	G	1	N	1	LATR2	9	24	grazed
2/6/2005	G	1	N	2	LATR2	5	18	
2/6/2005	G	1	N	2	SPCR	4	12	



Observations

Date	Site	Web	Plot	Quad	Species	Cover	Height	Comments
2/5/2005	G	1	N	1				
2/5/2005	G	1	N	1				
2/5/2005	G	1	N	1				
2/6/2005	G	1	N	1				
2/6/2005	G	1	N	2				
2/6/2005	G	1	N	2				

Locations

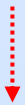
Date	Site	Web	Plot	Quad	Species	Cover	Height	Comments
2/5/2005	G	1	N	1	BOER4	1	12	
2/5/2005	G	1	N	1	BOER4	0.5	12	
2/5/2005	G	1	N	1	BOER4	0.25	10	
2/6/2005	G	1	N	1	LATR2	9	24	grazed
2/6/2005	G	1	N	2	LATR2	5	18	
2/6/2005	G	1	N	2	SPCR	4	12	

Normalizing An Existing Data Table: Step 2

To **observations** table, add a primary key and a location_id field

Observations

Date	Site	Web	Plot	Quad	Species	Cover	Height	Comments
2/5/2005	G	1	N	1	BOER4	1	12	
2/5/2005	G	1	N	1	BOER4	0.5	12	
2/5/2005	G	1	N	1	BOER4	0.25	10	
2/6/2005	G	1	N	1	LATR2	9	24	grazed
2/6/2005	G	1	N	2	LATR2	5	18	
2/6/2005	G	1	N	2	SPCR	4	12	



Observations

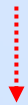
ID	Location_id	Date	Site	Web	Plot	Quad	Species	Cover	Height	Comments
1		2/5/2005	G	1	N	1	BOER4	1	12	
2		2/5/2005	G	1	N	1	BOER4	0.5	12	
3		2/5/2005	G	1	N	1	BOER4	0.25	10	
4		2/6/2005	G	1	N	1	LATR2	9	24	grazed
5		2/6/2005	G	1	N	2	LATR2	5	18	
6		2/6/2005	G	1	N	2	SPCR	4	12	

Normalizing An Existing Data Table: Step 3

In **locations** table, empty the data and delete unnecessary columns.

Locations

Date	Site	Web	Plot	Quad	Species	Cover	Height	Comments
2/5/2005	G	1	N	1	BOER4	1	12	
2/5/2005	G	1	N	1	BOER4	0.5	12	
2/5/2005	G	1	N	1	BOER4	0.25	10	
2/6/2005	G	1	N	1	LATR2	9	24	grazed
2/6/2005	G	1	N	2	LATR2	5	18	
2/6/2005	G	1	N	2	SPCR	4	12	



Site	Web	Plot	Quad

Normalizing An Existing Data Table: Step 4

Fill **locations** table by pulling distinct data from observations.

pulling distinct data:

```
SELECT distinct site, web, plot, quad FROM observations
```

pulling distinct data and putting it into locations table:

```
INSERT INTO locations SELECT distinct site, web, plot, quad
FROM observations
```

Site	Web	Plot	Quad
FPC	1	E	1
FPC	1	E	2
FPC	1	E	3
FPC	1	E	4
FPC	1	N	1
FPC	1	N	2

Locations

Normalizing An Existing Data Table: Step 5

To **locations** table, add a primary key. Set auto-increment.

ID	Site	Web	Plot	Quad
1	FPC	1	E	1
2	FPC	1	E	2
3	FPC	1	E	3
4	FPC	1	E	4
5	FPC	1	N	1
6	FPC	1	N	2

Locations

Normalizing An Existing Data Table: Step 6

Update foreign key in **observations** table using **locations** table.

```
UPDATE observations, locations
SET observations.location_id=locations.id
WHERE observations.site=locations.site AND
      observations.web=locations.web AND
      observations.plot=location.plot AND
      observations.quad=locations.quad
```

Observations

ID	Location_id	Date	Site	Web	Plot	Quad	Species	Cover	Height	Comments
1		2/5/2005	G	1	N	1	BOER4	1	12	
2		2/5/2005	G	1	N	1	BOER4	0.5	12	
3		2/5/2005	G	1	N	1	BOER4	0.25	10	
4		2/6/2005	G	1	N	1	LATR2	9	24	grazed
5		2/6/2005	G	1	N	2	LATR2	5	1	
6		2/6/2005	G	1	N	2	SPCR	4	1	

Locations

ID	Site	Web	Plot	Quad
1	FPC	1	E	1
2	FPC	1	E	2
3	FPC	1	E	3
4	FPC	1	E	4
5	FPC	1	N	1
6	FPC	1	N	2

Normalizing An Existing Data Table: Step 7

In **observations** table, delete the location columns.

Observations

ID	Location_id	Date	Species	Cover	Height	Comments
1	24	2/5/2005	BOER4	1	12	
2	24	2/5/2005	BOER4	0.5	12	
3	24	2/5/2005	BOER4	0.25	10	
4	24	2/6/2005	LATR2	9	24	grazed
5	25	2/6/2005	LATR2	5	18	
6	25	2/6/2005	SPCR	4	12	

Locations

ID	Site	Web	Plot	Quad
1	FPC	1	E	1
2	FPC	1	E	2
3	FPC	1	E	3
4	FPC	1	E	4
5	FPC	1	N	1
6	FPC	1	N	2

Normalizing Existing Data with MS Access

The problem: How to split up large data into smaller chunks with correct foreign keys?

Date	Site	Web	Plot	Quad	SPECIES	COVER	HEIGHT	COUNT	COMMENTS
2/2/2005	FPC	1	E	1	ERPU8	0.5	4	13	NA
2/3/2005	FPC	1	E	1	ERPU8	0.1	2	16	NA
2/4/2005	FPC	1	E	1	GUSA2	0.01	4	2	NA
2/5/2005	FPC	1	E	1	GUSA2	0.1	5	1	NA
2/6/2005	FPC	1	E	1	GUSA2	0.5	12	1	NA
2/7/2005	FPC	1	E	1	LEFE	0.25	5	1	NA

ID numbers need to match

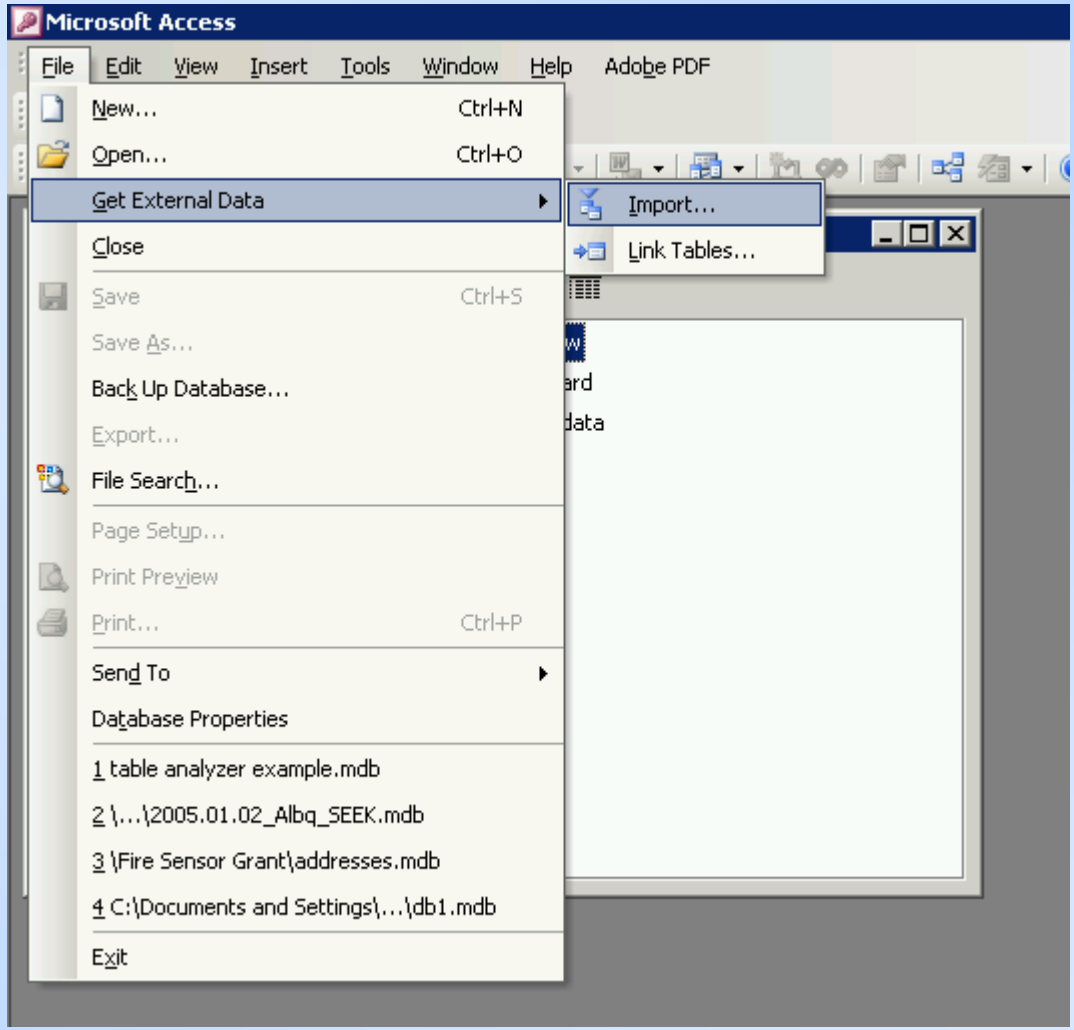
Date	Site	Web	Plot	Quad	Species_id	COVER	HEIGHT	COUNT	COMMENT
2/2/2005	FPC	1	E	1	1	0.5	4	13	NA
2/3/2005	FPC	1	E	1	1	0.1	2	16	NA
2/4/2005	FPC	1	E	1	2	0.01	4	2	NA
2/5/2005	FPC	1	E	1	2	0.1	5	1	NA
2/6/2005	FPC	1	E	1	2	0.5	12	1	NA
2/7/2005	FPC	1	E	1	3	0.25	5	1	NA

Species_id	Species_code
1	ERPU8
2	GUSA2
3	LEFE

Normalizing Existing Data with MS Access – Step 1

Step 1:

Import data into Access as a single table.

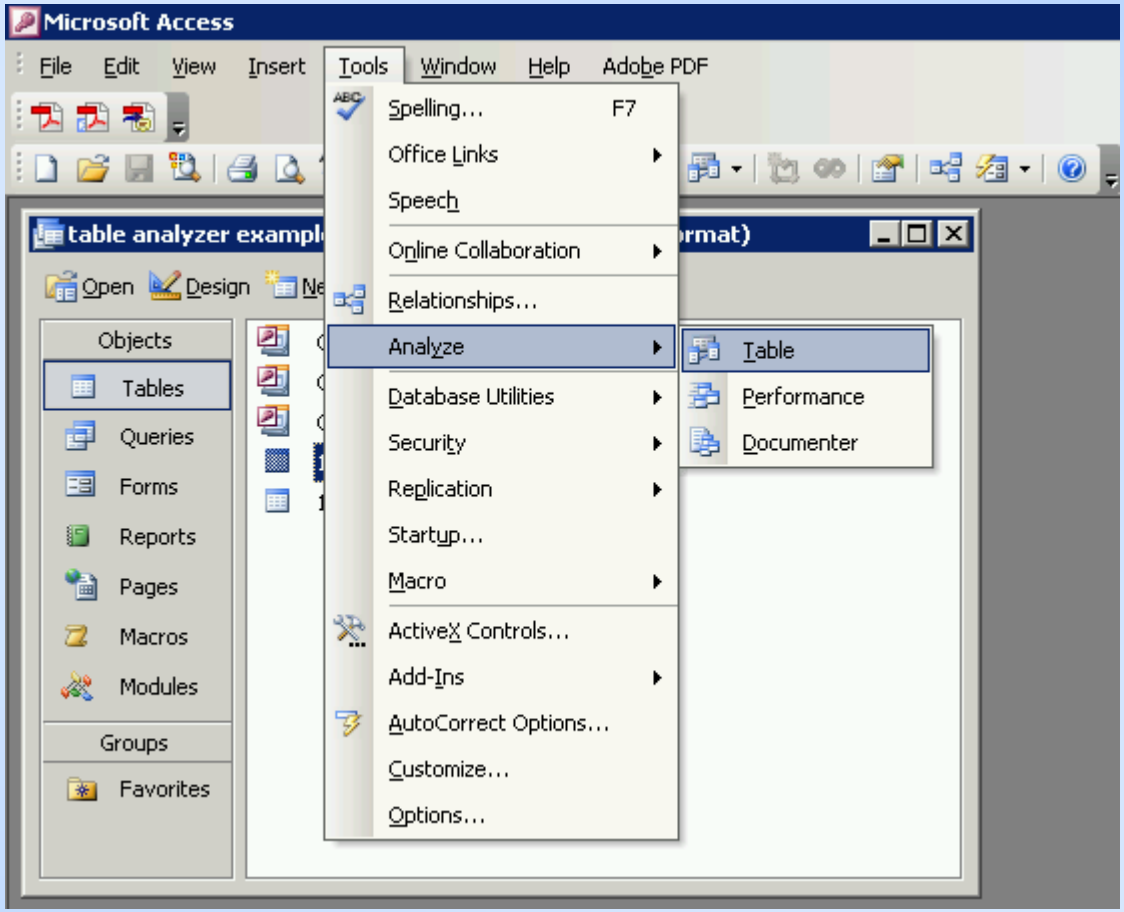


Normalizing Existing Data with MS Access – Step 2

Step 2:

Run table analyzer tool.

(Can also launch right into it from **Import…** command)

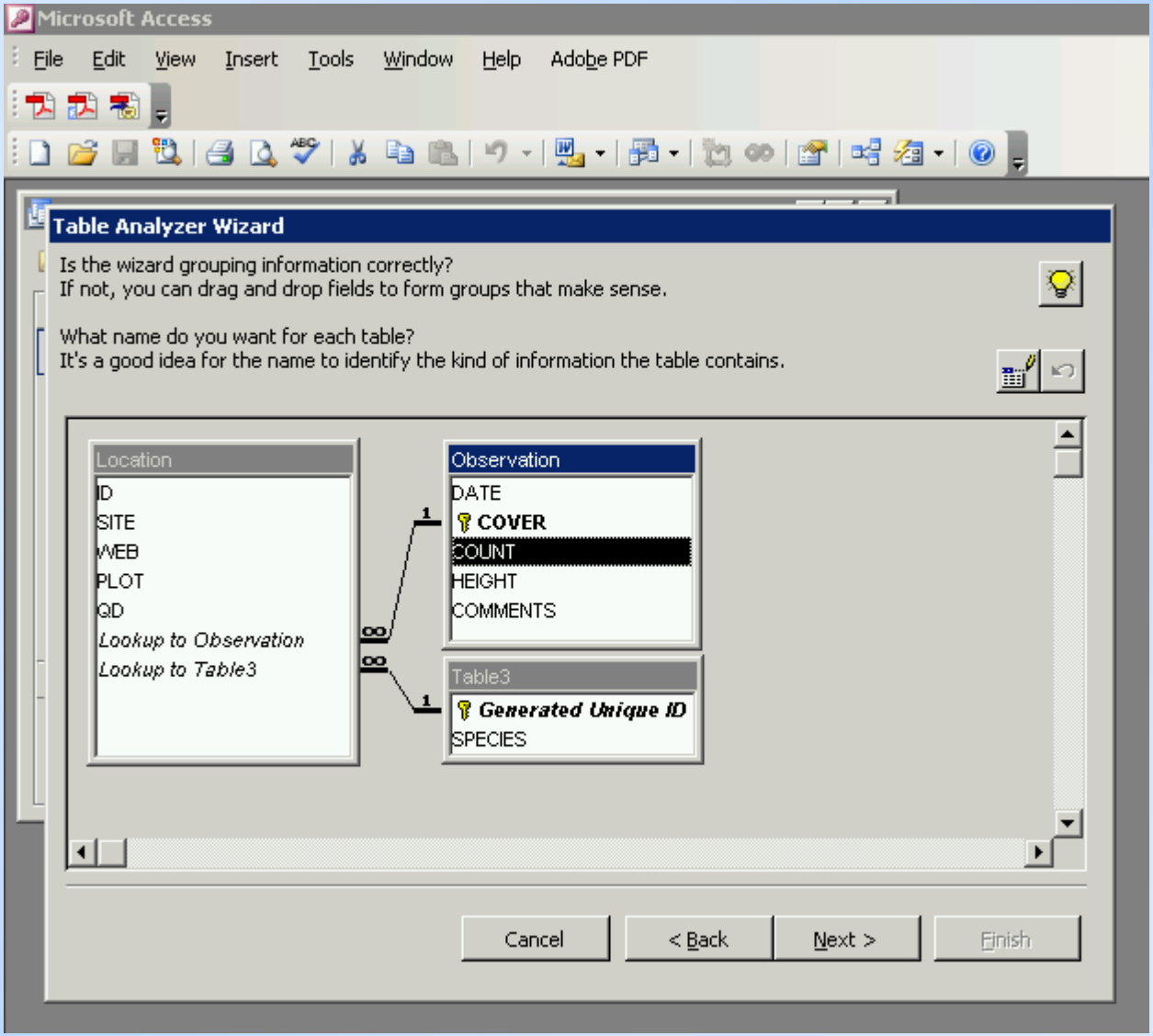


Normalizing Existing Data with MS Access – Step 2.1

Step 2.1:

a) Name tables

b) Move fields across tables

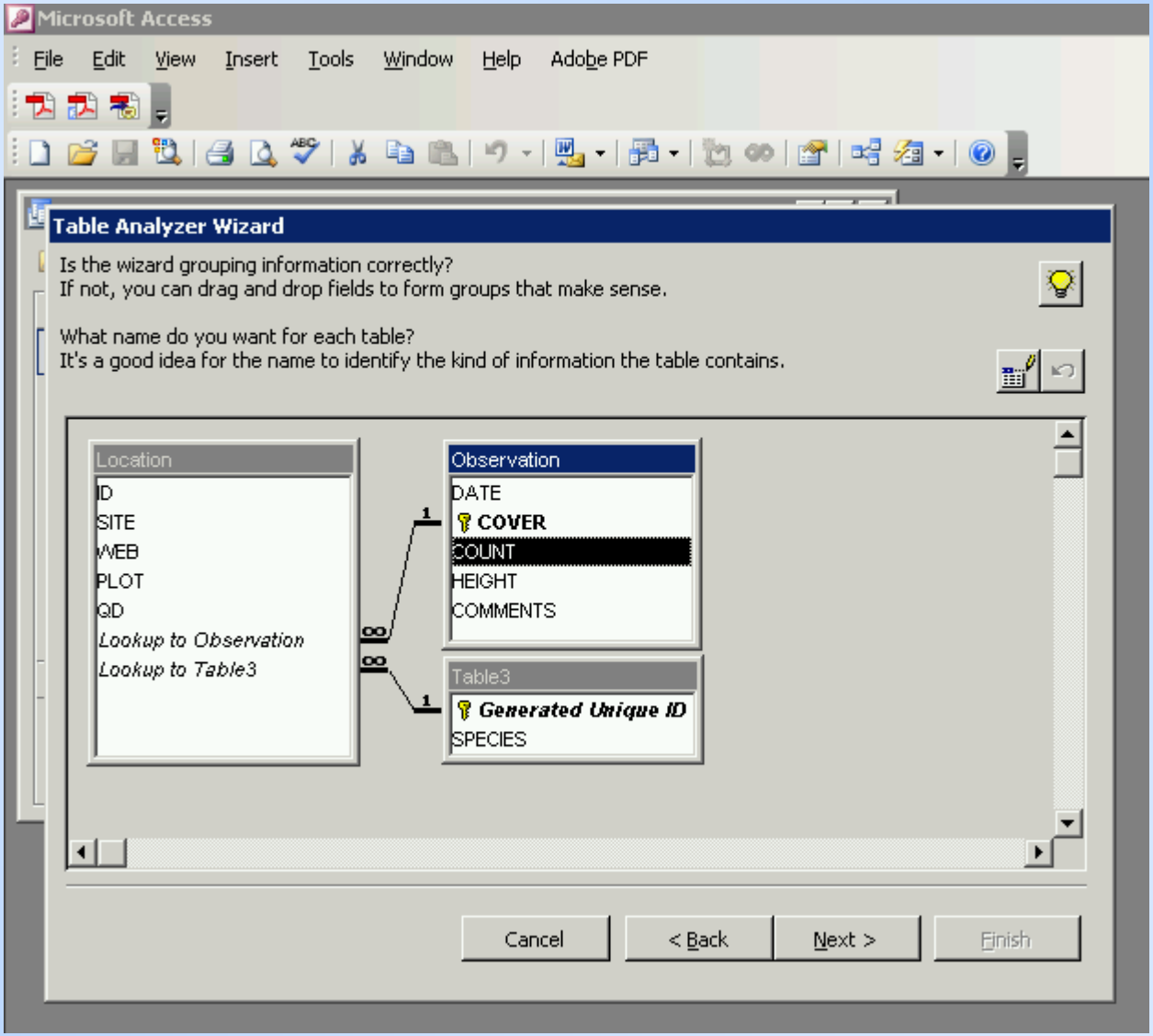


Normalizing Existing Data with MS Access – Step 2.2

Step 2.2:

a) Name tables

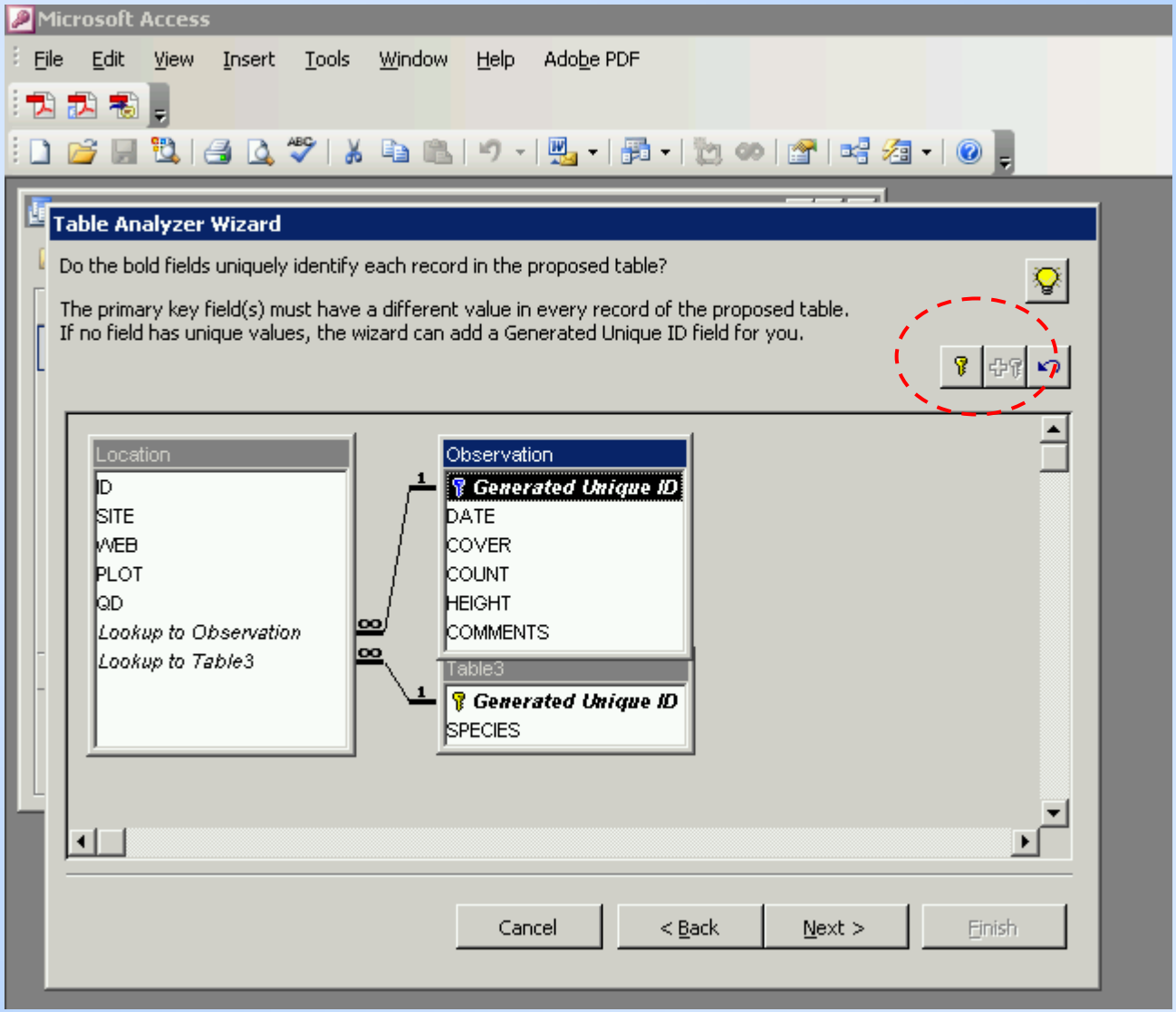
b) Move fields across tables



Normalizing Existing Data with MS Access – Step 2.3

Step 2.3:

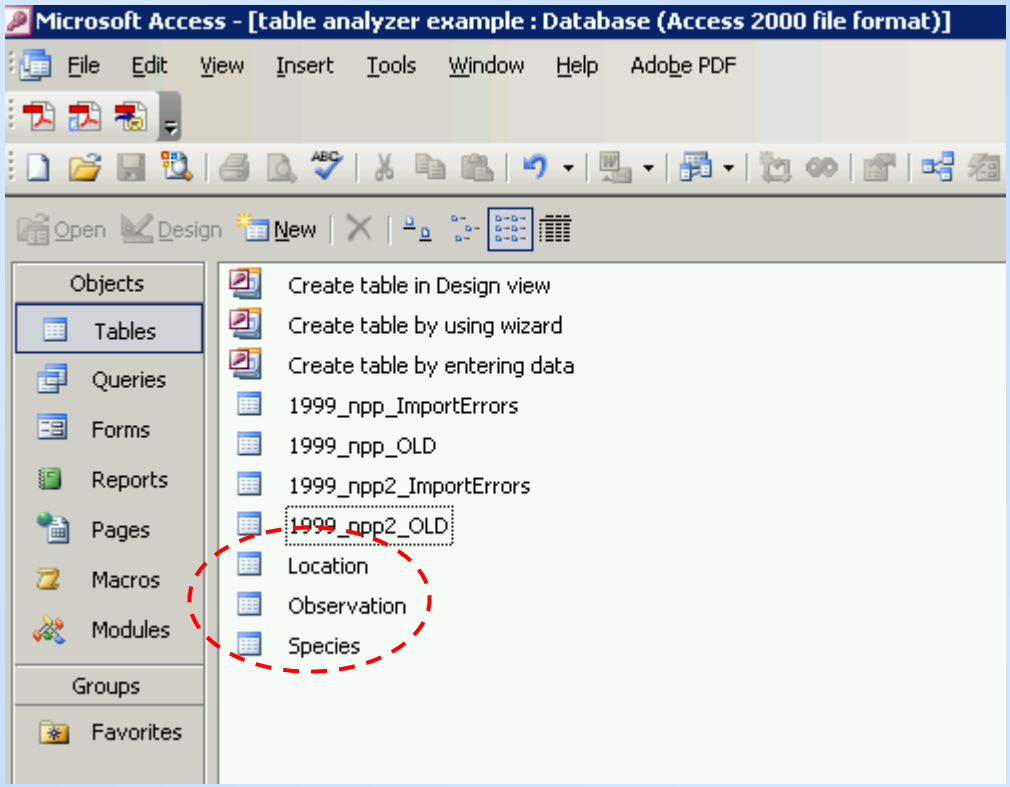
Designate or create primary keys



Normalizing Existing Data with MS Access – Done

Done!

(Export tables)



EXERCISES

I've copied NPP tables to your databases as **loc**, **obs**, and **spe**.
MySQL documentation: http://dev.mysql.com/doc/

1. List all observations where height is less than 5.

2. List all observations at site **CM**.
   (Hint: best done with a *join*)

3. List all observations of species **BOGR2** at site **CM**.

4. Calculate average heights of all observations from (3).

5. Insert a new species into the **species** table.