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Database Application Development

Ramakrishnan & Gehrke, Chapter 6

PHP and (My)SQL

www.php.net

- PHP calls embedded within HTML as special tag
  - <?php *php-statement-sequence* ?>
- Execution (server-side!) of PHP:
- PHP statements → (HTML) text; complete file forwarded by Web server:

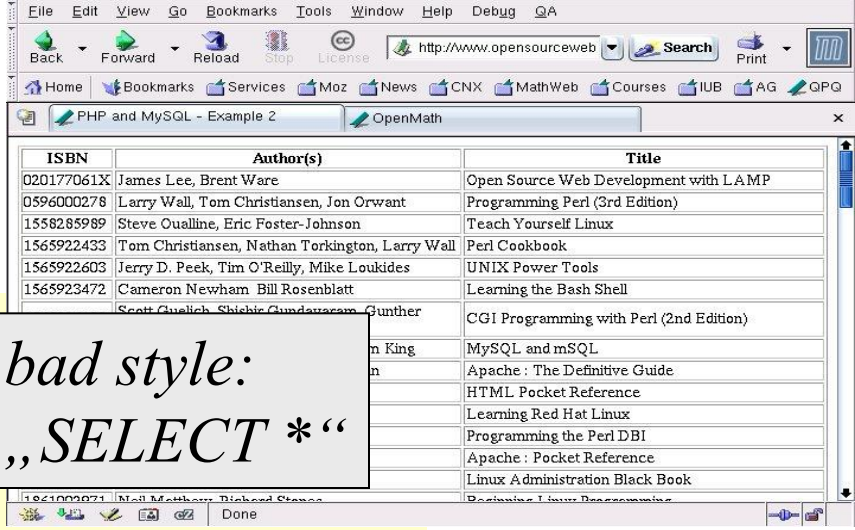
```
<h1><?php echo “Hello World”; ?></h1>   ⟶   <h1>Hello World</h1>
```

- Example: connecting to mysql server on localhost

```
<?php
   $mysql = mysql_connect( “localhost”, “apache”, “DBWAisCool” )
      or die( “cannot connect to mysql” );
?>
```

variables have „$“ prefix

PHP, HTML, and (My)SQL



*bad style: „SELECT *“*

```
<html>
  <head>
    <title>PHP and MySQL Example</title>
  </head>
  <body>
   <?php $mysql = mysqli_connect( “localhost” );
     $result = mysql_db_query( “books”, “SELECT isbn, author, title FROM book_info" )
        or die( “query failed - “ . mysql_errno() . “: “ . mysql_error(); )
    ?>
    <table>
      <tr>  <th>ISBN</th>  <th>Author(s)</th>  <th>Title</th>  </tr>
      <?php while ( $array = mysql_fetch_array($result) ); ?>
      <tr><td><?php echo $array[ "isbn"    ]; ?></td>
            <td><?php echo $array[ "author" ]; ?></td>
            <td><?php echo $array[ "title"    ]; ?></td>
      </tr>
      <?php endwhile; ?>
    </table>
    <?php mysql_close($mysql); ?>
  </body>
</html>
```

open

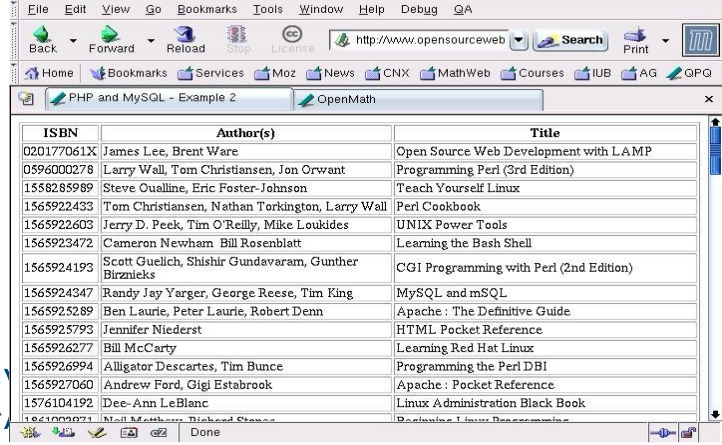
query

iterate over result set

close

Python and (My)SQL

- Different approach: Python prime, not HTML
- Python code example (schematic, using Flask)



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```
from flask import Flask, request, render_template
import mysql.connector
import sys
app = Flask( __name__ )
query_components = parse_qs(urlparse(self.path).query)
name = query_components["name"][0]

def booklist() :
    connection = mysql.connector.connect( … )
    cursor = connection.cursor()
    cursor.execute( "SELECT isbn, author, title FROM book_info WHERE author='?' ", author )
    result = cursor.fetchall()
    connection.close()
    return render_template( 'booklist.html', result = result )
```

not in exams

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SQLJ

- SQLJ = Java + embedded JDBC database access, nicely wrapped
  - ISO standard
  - eliminates JDBC overhead
    → compact & elegant database code, less programming errors
- SQLJ program ----[SQLJ translator]----> std Java source code
  - embedded SQL statements → calls to SQLJ runtime library
- (semi-) static query model: Compiler does
  - syntax checks, strong type checks
  - consistency wrt. schema
- Primer: http://archive.devx.com/dbzone/articles/sqlj/sqlj02/sqlj012102.asp

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SQLJ Code Example

```
Int sid; String name; Int rating;
#sql iterator Sailors( Int sid, String name, Int rating );
Sailors sailors;

#sql sailors =
   { SELECT sid, sname INTO :sid, :name FROM Sailors WHERE rating = :rating };

while (sailors.next())
{    System.out.println( sailors.sid + ": " + sailors.sname) );
}

sailors.close();
```

SQLJ Iterators

- Named iterator
  - Needs both variable type and name, and then allows retrieval of columns by name
  - See example on previous slide:
    #sql iterator Sailors(Int sid, String name, Int rating);
- Positional iterator
  - Needs only variable *type* (not name), uses FETCH ... INTO construct:

```
#sql iterator Sailors( Int, String, Int );
Sailors sailors;
#sql sailors = { SELECT sid, sname INTO :sid, :name FROM Sailors WHERE rating = :rating };
do
{   #sql { FETCH :sailors INTO :sid, :name };
    if ( ! sailors.endFetch() )
        …; // process sailor
} while (! sailors.endFetch() );
```

Stored Procedures

- Program executed through a single SQL statement
  - Executed in server
- Advantages:
  - Can encapsulate application logic while staying “close” to the data
  - Reuse of application logic by different users
  - Avoid tuple-at-a-time return of records through cursors

SQL/PSM Example

- PSM code:

```
CREATE FUNCTION rateSailor (IN sailorId INTEGER) RETURNS INTEGER
        DECLARE rating INTEGER
        DECLARE numRes INTEGER

        SET numRes = (SELECT COUNT(*)
                      FROM Reserves R
                      WHERE R.sid = sailorId)

        IF (numRes > 10)
        THEN rating =1;
        ELSE rating = 0;
        END IF;

        RETURN rating;
```

- Foreign code:

```
CREATE PROCEDURE TopSailors( IN num INTEGER )
   LANGUAGE JAVA
   EXTERNAL NAME "file:///c:/storedProcs/rank.jar"
```

Calling Stored Procedures from Client

- Embedded SQL:
  - EXEC CALL IncreaseRating(:sid, :rating);
- JDBC:
  - CallableStatement cstmt = con.prepareCall("{call ShowSailors}");
- SQLJ:
  - #sql showsailors = { CALL ShowSailors };

Summary: Connecting PL & DBMS

- Coupling techniques
  - API: library with DBMS calls = layer of abstraction between application and DBMS
  - Embedded SQL: extend PL with SQL statements
  - Stored procedures: execute application logic directly at the server
- Cursor for record-at-a-time traversal