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I. General Knowledge

1. What are the benefits of object oriented design and provide an example.

The benefits:
Reuse and Recycling of code: OO Objects can easily be reused in other projects.
Encapsulation: Once an Object is created, the inner implementatio is not needed to use it.
Design Benefits: OO software force developers to plan its implementation.
Software Maintenance: well implemented OO software is easier to maintain than non OO ones.
OO example:

```
<?php
class vehicle{
/*** define public properties ***/

/*** the color of the vehicle ***/
public $color;

/*** the number of doors ***/
public $num_doors;

/*** the price of the vehicle ***/
public $price;

/*** the shape of the vehicle ***/
public $shape;

/*** the brand of vehicle ***/
public $brand;

/*** the constructor ***/
public function __construct(){
  echo 'About this Vehicle.<br />';
}

/*** define some public methods ***/

/*** a method to show the vehicle price ***/
public function showPrice(){
  echo 'This vehicle costs '.$this->price.'.<br />';
}

/*** a method to show the number of doors ***/
public function numDoors(){
  echo 'This vehicle has '.$this->num_doors.' doors.<br />';
}
```

```
/*** method to drive the vehicle ***/
public function drive(){
  echo 'VRRROOOOOOM!!!';
}

} /*** end of class ***/
?>
```

2. What are design patterns and how do they help in development?

Design patterns are software solutions for common problems we can find in our projects.
They help in:
- use well tested solutions
- promotes software reuse
- helps not reinventing the wheel for commonly found problems

3. What is a relational database in comparison to a graph based one?

A relational database keeps data in organized collections stored in rows and columns of tables with relations between them while a graph database stores data in a graph data structure (each element has pointers to its adjacent elements)

Graph databases may be useful:

- keeping objects which need graph-like queries, for example computing the shortest path between two nodes in the graph
- may scales better in large data sets

II. PHP related questions

1. How would you call an external command from PHP and what do you need to look out for, what are the pitfalls and security considerations?

Using the exec() or system() functions.

When using them it is important to 'sanitize' the command passed as parameter.
For example:

```
1) exec('ping google.com');
2) exec('ping ' . $_GET['domain']);
3) exec('ping ' . escapeshellarg($_GET['domain']));
```

Example 1 is safe, because you cannot "inject" anything into it; it is a hard coded string.

Example 2 is very unsafe, because you can easily inject something into the value of $_GET['domain'].

Example 3 is mostly safe, because the escapeshellarg() function prevents people from adding in extra stuff like "rm -f /"

2. When would you use JSON and BASE64 for communication?

When you have to safety transfer data in your application. For example passign binary data in an ajax request, or a json object with a field that contains json formatting characters.

3. How would you implement a server side callback using javascript?

Using the XMLHttpRequest object we can use the onreadystatechange event to check if the server response is ready.

An example:

```
<html>
<head>
<script>
function loadXMLDoc()
{
  xmlhttp=new XMLHttpRequest();
  xmlhttp.onreadystatechange=function(
{
  if (xmlhttp.readyState==4 && xmlhttp.status==200)
    {
    document.getElementById("myDiv").innerHTML=xmlhttp.responseText;
    }
  }
xmlhttp.open("GET","ajax_info.php",true);
xmlhttp.send();
}
</script>
</head>
<body>

<div id="myDiv"><h2>Let AJAX change this text</h2></div>
```

<button type="button" onclick="loadXMLDoc()">Change Content</button>

</body>

</html>

In jquery we can use the success/error/complete callback options of the .ajax function

4. What is MVC and how does it help?

Model–view–controller is a software architectural pattern which separates an application into three layers:

- data model (model)
- business logic (controller)
- user interface (view)

It helps:

- making the code easier to re-use
- allow to replace layers (for example you can use the same business logic and user interface in different databases [data layers] or use the same data model and business logic with two differente user interfaces[web and or native app])
- allow to work and test each layer indepently
- ...

III. MySQL

1. What are stored procedures and are they better then external processing?

Stored procedures are a set of sql commands stored in the server.
Advantages:

- Increase performance: because they are compiled/cached/stored in the database, and because less information is sent between client and server
- Allows to have libraries of functions in the server accesible by any client supporting them (platform independent)
- In security environments (for example disallowing the direct management of table except through stored procedures)

Disadvantages:

- overload on the server
- may be more difficulty to develop and maintain

2. What are indexes and what kind of indexes are there in MySQL?

An index is a data structure that helps increase the speed of data queries with the cost of additional writes and storage space.

Depending on the MySQL storage engine used we have: normal, unique, primary keys, full-text, spacial, hash

3. How do you define memory tables and why are they useful? What are the pitfalls?

CREATE TABLE t (i INT) ENGINE = MEMORY;
Usefull:

- they are fast
- useful fot temporary fast access tables
- ...

Pitfalls:

- all data is lost on server shut down
- cannot contain blob or text fields
- server memory use
- no transaction or FK
- ...

IV. Ajax

1. What is AJAX and what is it good for?

It is a web client side development technique used to create asynchronous Web applications.
Is is used to update web pages in an asynchronous way even allowing the creation of SPAs (simple page applications)

2. What are the pitfalls of using ajax based queries? How can you ensure execution of a callback?

Pitfalls:

- ajax calls are not registered on browser's history engine so back buttons does not work
- not search engine friendly: web crawlers does not execute javascript so, and unique uris require a specific treatment
- XMLHttpRequest must follow the same origin policy

Ensure execution of a callback:

- one possibility is to make it sinchronous so the execution stops until the callback is done
- another one would be to check http_status on the response query and/or set a time out and retry the call if necesary

V. Technical Exercises

Note: please install the CodeIgniter application you should find under web directory of the zip. Create a database and configure application/config/database.php as necessary

1. How would you implement a menu structure in SQL? Please provide stored procs for insertion, updates and relocation of menu items.

See TECH_EXER_1 directory in the zip

First run the create.sql in a test database to create the menu_item table and related stored

procedures.
Then run reset.sql to insert test data. Take a look at the table data, no contact item.
Then run each stored procedure call in test.sql and see table data to see the creation, update and move of the contact item.

Of course the code lacks of paramater testing and validation of menu coherence but it can serve as an ultrasimple menu structure implementation

2. How would you synchronize multiple databases over several severs into one while keeping the keys intact? Separate servers can have the same keys but the merged ones should not. Please provide a simple example using SQL statements and PHP code.

There has to be a far more elegant way of doing this:
- may be with stored procedures
- or the new table with different structure with a new autoincrement id and the previous id as a new field...

I have choosen the uglier, slower, but probably safer way of selecting and inserting field by field from the source db to the target db. It is neccesary to take on account possible foreign keys and update the related fields depending on the newly inserted ids.

I use codeigniter to short the final code.

To run this test we need the target database (default connection on codeiginiter configuration) and any number of sources databases. (each of these databases must have configured its connection on application/config/databases.php config file)
In the target (default connection) database we must run the create.sql file found in TECH_EXER_2 directory
In the sources databases we must run both the create.sql and populate.sql files found in the same dir.

Then we can run
http://{your_host}/{codeigniter_app_path}/index.php/exercise2/hospedaje/{connection_name}
where {connection_name} is one of the source connection in application/config/databases.php

The code is not elegant but it is short (no more than 40 lines) and fully functional. It takes on account the foreign keys integrity.
May it could be parametrized for different databases schemas.

3. Create a simple CodeIgniter project which displays a button and a text field. Once the button is pressed it returns the URL contents via HTML from the text field and displays that into a section of the screen. This has to be achieved WITHOUT reloading the page. Please use proper MVC.

In the installed application run

http://{your_host}/{codeigniter_app_path}/index.php/exercise3

I have used Jquery for simplicity though this can of course be done with pure javascript.

In php I have used the simple to use and usefull https://github.com/chriskacerguis/codeigniter-restserver

It has been implemented with an ajax call on form submit that recieves an json object with the posted form fields. In the success callback function we update the dom for the expected section with our field value. Comunication is done through json.

It should need some test and validation of data.

4. Create a simple CodeIgniter project which consists of tracking visitor statistics to a given page. You should be able to extract generic information like referrer, agent, IP, browser, OS. There should be a config option as well to limit the hits that are allowed. The visits should be logged to a MySQL database which should be displayable from a standard View Page using some Scaffolding or CRUD system.

Run this sql in the database configured for the code igniter applicacion:

```
CREATE TABLE IF NOT EXISTS `visit` (
  `id` int(11) NOT NULL AUTO_INCREMENT,
  `href` varchar(255) NOT NULL,
  `referer` varchar(255) NOT NULL,
  `useragent` varchar(255) NOT NULL,
  `browser` varchar(255) NOT NULL,
  `os` varchar(255) NOT NULL,
  `ip` varchar(50) NOT NULL,
  `createdat` datetime NOT NULL,
  PRIMARY KEY (`id`)
) ENGINE=InnoDB  DEFAULT CHARSET=utf8;
```

In the installed application run

http://{your_host}/{codeigniter_app_path}/index.php/exercise4

Browse through the pages and see the alerts on visit tracking.

In application/config/config.php you can set the custom param max_hits_per_page_per_minute

To access the crud (I have used the http://www.grocerycrud.com/ library)

http://{your_host}/{codeigniter_app_path}/index.php/crud