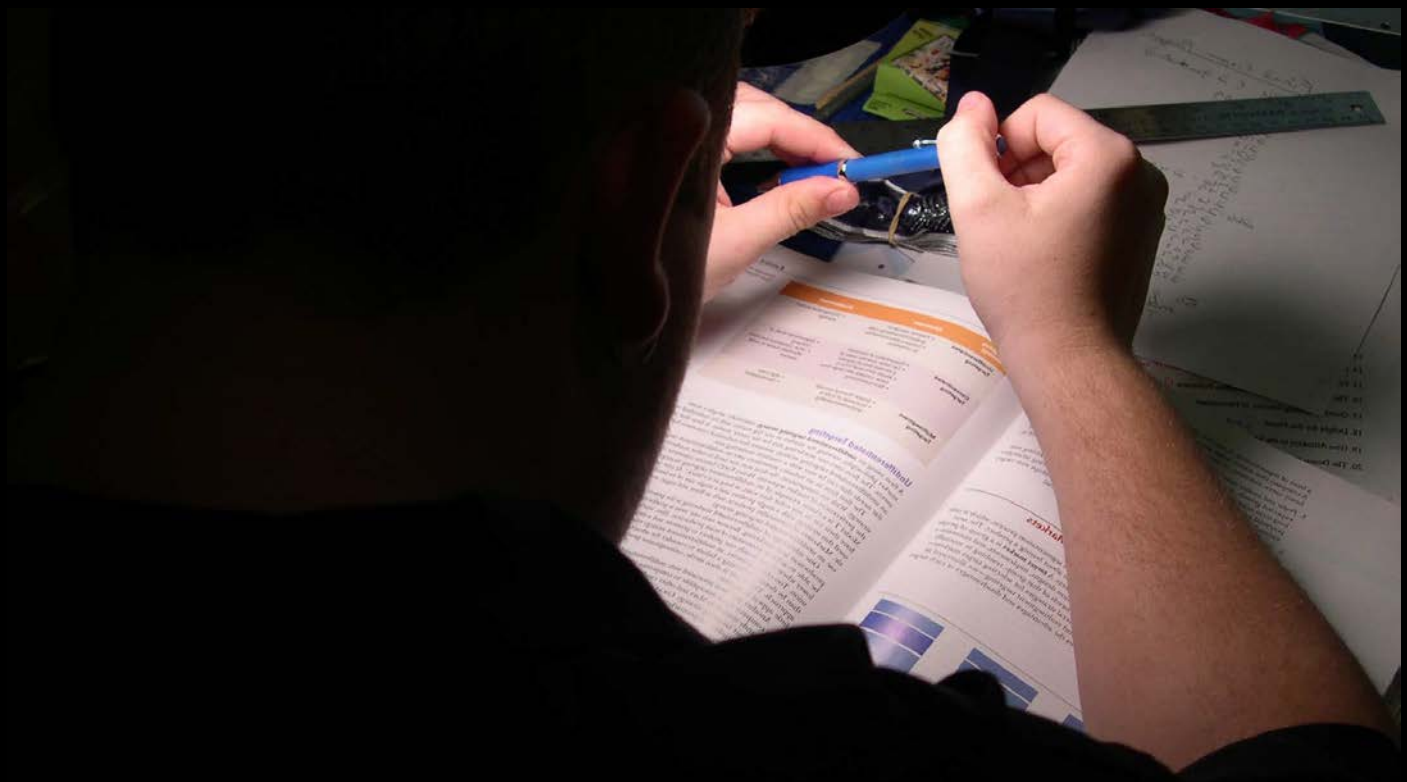

Zend Certified Engineer Exam Study Guide

version 1-5

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Introduction to the Certification

ZEND CERTIFIED ENGINEER (ZCE) CREDENTIAL

WHY BECOME A ZEND CERTIFIED ENGINEER? BECOMING A ZEND CERTIFIED ENGINEER ASSURES YOUR COMPETITIVENESS IN AN INCREASINGLY COMPETITIVE ENVIRONMENT, ENABLING YOU TO DIFFERENTIATE YOURSELF IN THE MARKETPLACE. WHETHER YOU ARE LOOKING FOR A NEW JOB, MAKING YOUR CASE AT YOUR ANNUAL SALARY REVIEW, OR LOOKING FOR WAYS TO INCREASE YOUR PROFILE, AS A ZEND CERTIFIED ENGINEER YOU HAVE A CLEAR ADVANTAGE. THE ZCE CREDENTIAL OFFERS THESE BENEFITS:

- GAIN RECOGNITION FROM YOUR EMPLOYER AND BOOST YOUR VALUE
- GET YOUR RESUME NOTICED AND DIFFERENTIATE YOURSELF WHEN COMPETING FOR A NEW JOB
- GET FEATURED IN ZEND'S CERTIFIED ENGINEERS DIRECTORY FOR PHP PROFESSIONALS, USED BY RECRUITERS TO FIND TOP PHP DEVELOPERS WORLDWIDE
- PARTICIPATE IN THE ZCE EXCLUSIVE GROUP ON LINKEDIN
- GET RECOGNIZED BY THE PHP COMMUNITY AS A PROUD AND DEDICATED SUPPORTER OF PHP
- GET A FREE PERPETUAL COPY OF ZEND STUDIO

STUDYING FOR THE ZEND CERTIFIED PHP ENGINEER EXAM

THIS STUDY GUIDE PROVIDES A COMPLETE OUTLINE OF THE ELEVEN MAJOR TOPIC AREAS ON WHICH YOU ARE TESTED. AT THE BEGINNING OF EACH TOPIC SECTION, THE GUIDE ALSO LISTS THE REQUIRED SUBTOPIC AREAS FOR WHICH YOU ARE RESPONSIBLE.

THIS GUIDE CANNOT ENCOMPASS ALL YOU NEED TO KNOW FOR THE CERTIFICATION... INSTEAD, IT HIGHLIGHTS MAJOR CONCEPTS WITHIN EACH SUBTOPIC. YOU WILL STILL NEED TO EXPLORE EACH SUBTOPIC WITHIN THE PHP MANUAL. THIS GUIDE IS MEANT TO HELP YOU FOCUS ON THE AREAS THAT ARE CONSIDERED THE MOST IMPORTANT FOR CERTIFYING YOU AS AN EXPERT IN PHP VERSION 7.1.

ABOUT ROGUE WAVE SOFTWARE

ROGUE WAVE SOFTWARE IS THE COMPANY BEHIND THE ZEND PHP CERTIFICATION. BUSINESSES UTILIZING PHP KNOW ROGUE WAVE AS THE PLACE TO GO FOR PHP EXPERTISE AND SOUND TECHNOLOGY SOLUTIONS. ROGUE WAVE DELIVERS PREMIER WEB APPLICATION PLATFORM PRODUCTS AND SERVICES FOR PHP APPLICATIONS. WITH COMMERCIAL PRODUCTS AND SERVICES THAT ENABLE DEVELOPERS AND IT PERSONNEL TO DELIVER BUSINESS-CRITICAL PHP APPLICATIONS, ZEND IS TAKING THE POWER OF PHP TO THE ENTERPRISE.

IF YOU HAVE ANY QUESTIONS ABOUT THE CERTIFICATION, OR WOULD LIKE TO PROVIDE FEEDBACK TO US ON THIS GUIDE, PLEASE CONTACT US AT: certification@zend.com.

PHP Certification: Snapshot

THE EXAM

- COMPOSED OF ~ 75 RANDOMLY-GENERATED QUESTIONS
- QUESTIONS VARY IN THEIR LEVEL OF DIFFICULTY
- BASED ON PHP 7.1 (ZEND CERTIFIED ENGINEER)
- QUESTIONS WILL OFTEN TEST MORE THAN ONE CONCEPT AT A TIME
- QUESTIONS WILL COVER ELEVEN DIFFERENT TOPIC AREAS
- ALLOWED 90 MINUTES IN TOTAL TO ANSWER THE QUESTIONS

THE TEST TOPICS

- TOPIC AREAS FROM WHICH THE QUESTIONS ARE DERIVED:

1. PHP BASICS
2. DATA FORMATS AND TYPES
3. STRINGS
4. ARRAYS
5. INPUT / OUTPUT
6. FUNCTIONS
7. OBJECT-ORIENTED PROGRAMMING
8. DATABASES
9. SECURITY
10. WEB FEATURES
11. ERROR HANDLING

PHP Certification: Snapshot

THE TEST TOPICS (CONTINUED)

- QUESTIONS REFLECT THE CURRICULUM SPECIFIED BY THE PHP EDUCATION ADVISORY BOARD
- CERTAIN TOPICS ARE GIVEN MORE WEIGHT IN THE CERTIFICATION:

HIGHEST EMPHASIS:

PHP BASICS

SECURITY

OOP

AVERAGE EMPHASIS:

FUNCTIONS

WEB FEATURES

ARRAYS

STRINGS & PATTERNS

LOWEST EMPHASIS:

DATABASES

ERROR HANDLING

DATA FORMATS AND TYPES

INPUT / OUTPUT

- PASSING THE TEST IS BASED ON A BREADTH OF KNOWLEDGE OF THESE TOPICS... BEING AN EXPERT IN ONLY A FEW TOPICS WILL NOT BE ENOUGH
- WITHIN A TOPIC, THERE ARE PARTICULAR AREAS OF CONCENTRATION – THESE ARE LISTED ON THE FIRST PAGE OF EACH SECTION

PHP Certification: Focus

THE REGISTRATION PROCESS

- THE CERTIFICATION EXAM IS ADMINISTERED BY PEARSON VUE TRAINING CENTERS (HTTP://WWW.PEARSONVUE.COM/ZEND/)
- REGISTER FOR THE “200-710” EXAM EITHER ONLINE, BY PHONE, OR AT A TEST CENTER
- OPTIONS VARY BY COUNTRY... PLEASE CHECK THE PEARSON VUE WEB SITE
- YOU NEED TO BRING 2 FORMS OF IDENTIFICATION - BOTH MUST HAVE YOUR SIGNATURE, ONE MUST HAVE YOUR PICTURE
- THE TESTING CENTER WILL SUPPLY YOU WITH EITHER "SCRATCH" PAPER OR AN ERASABLE BOARD FOR ANY CALCULATIONS YOU MIGHT NEED TO MAKE...
- YOU ARE NOT ALLOWED TO BRING ANYTHING INTO THE EXAM WITH YOU (NOTES, SMARTPHONE, ETC.)

TEST QUESTIONS: THREE TYPES

- MULTIPLE CHOICE... ONLY ONE ANSWER CORRECT

  MOST FREQUENT TYPE OF QUESTION

- MULTIPLE CHOICE... TWO OR MORE ANSWERS CORRECT

  QUESTIONS WILL INDICATE THE NUMBER OF ANSWERS REQUIRED

- FREE TEXT... OPEN ANSWER

  NO WHITESPACE, EXPLANATIONS, OR COMMENTS ALLOWED HERE

  YOU DO NOT HAVE TO CODE LARGE BLOCKS - TEST ANSWERS ARE SHORT;

  FOR EXAMPLE, YOU MAY HAVE TO IDENTIFY A FUNCTION OR ITS PARAMETERS, OR ANALYZE CODE

PHP Certification: Focus

GUESS!

THERE IS NO PENALTY FOR GETTING AN ANSWER WRONG... YOU ONLY GET CREDIT FOR CORRECT ANSWERS

MARK QUESTIONS FOR REVIEW

- YOU CAN EASILY RETURN TO QUESTIONS MARKED FOR REVIEW BEFORE SUBMITTING YOUR ANSWERS

EMPHASIS ON ANALYSIS VS. MEMORIZATION

- GENERALLY, THE QUESTIONS WILL FOCUS MORE ON ANALYSIS OF CODE RATHER THAN HAVING YOU SUPPLY MEMORIZED ELEMENTS
- HOWEVER, YOU WILL NEED TO KNOW COMMONLY USED CODE ELEMENTS, SUCH AS COMMON FUNCTIONS, CONSTANTS, CLASSES, ...

ASSUMED ENVIRONMENT

- THE QUESTIONS ARE INDEPENDENT OF OPERATING SYSTEM AND SPECIFIC DATABASES/ ADAPTERS
    - HOWEVER, A GENERAL UNDERSTANDING OF RELATED TECHNOLOGIES LIKE HTTP OR SQL IS REQUIRED
    - EXAMPLE: YOU SHOULD BE ABLE TO UNDERSTAND THE FOLLOWING QUERY: `SELECT * FROM TABLE WHERE ID > 10 ORDER BY NAME`
- QUESTIONS REFER TO A VIRTUAL PHP SYSTEM WITH THE RECOMMENDED CONFIGURATION, INCLUDING SPECIFIC ERROR REPORTING SETTINGS:
    - ERROR REPORTING IS SET TO E_ALL
    - ERRORS ARE DISPLAYED (UNLESS OTHERWISE NOTED)

TEST RESULTS

- YOU ARE IMMEDIATELY NOTIFIED WHETHER YOU HAVE PASSED OR NOT
- IF YOU DO NOT PASS, YOU ARE GIVEN PRINTED FEEDBACK ON EACH TOPIC TO IDENTIFY AREAS REQUIRING ADDITIONAL STUDY... NO DETAILED SCORE GIVEN

TOPIC ONE: BASICS

Syntax

Operators

Variables

Control Structures

Language Constructs & Functions

Constants

Namespaces

Extensions

Configuration

Performance

SYNTAX

PUNCTUATION

- TERMINATE CODE STATEMENTS WITH A SEMI-COLON (;)
- USE APPROPRIATE TAGS

TAGS

OPENING ...	CLOSING ...
<?php	?>
<?= (short for <?php echo)	?>

COMMENTS

```
// USED FOR A SINGLE COMMENT LINE
// MUST BE REPEATED FOR MULTIPLE LINES...


/* AND */  ARE USED TO DELINEATE A COMMENT BLOCK

    /* USED ONCE AT BEGINNING
     USED ONCE AT THE END    */
```

OPERATORS

ARITHMETIC OPERATORS

- BASIC CALCULATIONS

  `+` (ADDING)

  `-` (SUBTRACTING)

  `*` (MULTIPLYING)

  `/` (DIVIDING)

- MODULUS (REMAINDER WHEN DIVIDING)

  EX: `$m = 5 % 2; // $m == 1`

BITWISE OPERATORS

- USE TO WORK WITH BINARY INTEGERS AT THE BIT LEVEL; ARITHMETIC
- INTEGRAL NUMBERS ARE INTERNALLY CONVERTED INTO BITS

  EX: `5 -> 0101 = 0*8 + 1*4 + 0*2 + 1*1`

BITWISE	SYMBOL	CRITERIA (BY PLACE)
AND	&	MATCHING "1" IN BOTH OPERANDS
OR	|	AT LEAST ONE "1" IN AN OPERAND
XOR	^	TRUE ONLY IF OPERANDS ARE DIFFERENT

- SHIFT BITS `<< X` MOVE BITS BY X TIMES

  EX: `4 >> 2 == 1` [LIKE DIVIDING BY 4]

- NEGATE BITS `~` CONVERT ZEROS INTO ONES; ONES INTO ZEROS

OPERATORS

ASSIGNMENT OPERATORS

- ASSIGN (=)

  WHEN USING ARRAYS, ASSIGN VALUES TO KEYS WITH =>

- SHORT FORMS (COMBINED)
  - ASSIGNMENT (+ AND *OPERATOR*)

    WORKS WITH OPERATORS: - * / & | ^ >> <<

    EX: `$a += 1;` IS SHORT-HAND FOR `$a = $a + 1;`

  - COMBINED/CONCATENATING ASSIGNMENT (. =)

    EX: `$a = "Hello,";`

    `$a .= " World !";` ... RESULTS IN "HELLO, WORLD !"

- INCREMENT/DECREMENT (++ --)

  PLACEMENT IMPORTANT: IN FRONT OF EXPRESSION - INCREASED OR DECREASED FIRST; AFTER EXPRESSION, THE REVERSE

COMPARISON OPERATORS

- VALUE EQUALITY (==) VALUE INEQUALITY (!=)

  COMPARES VALUES WITHOUT A TYPE CHECK

  PHP HANDLES DATA TYPE CONVERSION "123" == 123

- VALUE/TYPE EQUALITY (===) VALUE/TYPE INEQUALITY (!==)

  COMPARES VALUES WITH A TYPE CHECK

  PHP CHECKS THE DATA TYPE "123" !== 123

- GREATER THAN (>) LESS THAN (<)

- GREATER OR EQUAL (>=) LESS THAN OR EQUAL (<=)

OPERATORS

STRING OPERATORS

- CONCATENATE (.) AND CONCATENATING ASSIGNMENT (.=) SEE ABOVE

ARRAY OPERATORS

+	UNION
==	EQUAL
===	IDENTICAL
!=	NOT EQUAL
<>	NOT EQUAL
!==	NOT IDENTICAL

LOGICAL OPERATORS

EXAMPLE	OPERATOR	EVALUATES AS TRUE WHEN...
$a and $b	and	BOTH $a AND $b TRUE
$a or $b	or	EITHER $a OR $b TRUE
$a xor $b	xor	EITHER $a,$b TRUE; NOT BOTH
! $a	not	$a NOT TRUE
$a && $b	&&	BOTH $a AND $b TRUE
$a || $b	||	EITHER $a OR $b TRUE
$a ^ $b	xor	EITHER $a,$b TRUE; NOT BOTH

OPERATORS

EXECUTION OPERATORS

- USE BACKTICKS (ALSO KNOWN AS BACKQUOTES) `` TO EXECUTE THE CONTENTS ENCLOSED BY THEM AS A SHELL COMMAND, EQUIVALENT TO `shell_exec()`
- `exec()` AND `system()` FUNCTIONS WORK SIMILARLY

OPERATOR PRECEDENCE

- FOLLOWS MATHEMATICAL PRECEDENCE IN MOST INSTANCES (EX: MULTIPLICATION/DIVISION PRECEDES ADDITION/SUBTRACTIONS)
- USE PARENTHESES TO ENFORCE NON-STANDARD PRECEDENCE

VARIABLES

NAMING

- START WITH A "$"
- CAN CONTAIN LETTERS, NUMBERS, AND UNDERSCORES
- MUST START WITH LETTER OR UNDERSCORE AND BY CONVENTION SHOULD START WITH A LOWER CASE LETTER OR UNDERSCORE
- CASE-SENSITIVE

REFERENCING

- VARIABLES CAN BE ASSIGNED BY VALUE OR BY REFERENCE
- THE AMPERSAND (&) CREATES A REFERENCE, OR ALIAS, AND CAUSES BOTH THE ORIGINAL VARIABLE AND ALIAS TO POINT TO THE SAME MEMORY VALUE

INITIALIZING

- VARIABLE TYPING IS SET AUTOMATICALLY BY THE PHP PARSER AND CALLED "TYPE JUGGLING/COERCION"
- INITIALIZING VARIABLES EMPTY IS A GOOD PRACTICE IF IT IS POSSIBLE IT ALREADY POINTS TO MEMORY VALUES AND YOU WANT TO START EMPTY
- THE FUNCTION `isset()` RETURNS A BOOLEAN ON A PASSED VARIABLE CONTAINING A VALUE OTHER THAN NULL STRING, NULL, OR ZERO

CONTROL STRUCTURES

CONDITIONS

- IF

  EVALUATES FOR A CONDITION (BOOLEAN VALUE), TO DETERMINE WHETHER TO EXECUTE CODE; CAN BE NESTED

- ELSE

  PROVIDES ALTERNATIVE EXECUTION, WHEN COMBINED WITH IF (=FALSE)

- ELSEIF (ELSE IF)

  PROVIDES ALTERNATIVE EXECUTION, WHEN COMBINED WITH IF (=FALSE), BUT ITS OWN CONDITION MUST BE MET
  (FLOW: IF... ELSEIF ... ELSE)

- IF-ELSE (TERNARY OPERATOR)

  COMMON ASSIGNMENT FORM:

  ```
  $FOO = <EXPRESSION> ? <VALUE IF TRUE> : <VALUE IF FALSE>;
  ```

- TERNARY OPERATOR, SHORT FORM

  SHORTHAND ASSIGNMENT FORM: RAISES AN E_NOTICE IF NO VALUE AND THEREFORE NOT RECOMMENDED

  ```
  $FOO = <EXPRESSION> ?: <VALUE IF FALSE>;
  ```

- NULL COALESCE OPERATOR

  NULL COALESCING ASSIGNMENT FORM: No `E_NOTICE` IF NO VALUE. (BEST PRACTICE)

  ```
  $FOO = <EXPRESSION> ?? <VALUE IF FALSE>;
  ```

- SPACESHIP OPERATOR, SHORT FORM

  A <=> B

  RETURNS 1 IF A > B, -1 IF B > A, 0 IF A == B

- SWITCH

USE TO EVALUATE (BOOLEAN VALUE) AGAINST A SERIES OF CONDITIONS, TO DETERMINE WHICH CODE TO EXECUTE FOR EACH CONDITION

CONTROL STRUCTURES

LOOPS

- WHILE

  EXECUTES STATEMENT UNTIL CONDITION IS NO LONGER EVALUATED AS BOOLEAN TRUE; CONDITION EVALUATED AT BEGINNING

- DO-WHILE

  EXECUTES STATEMENT UNTIL CONDITION IS NO LONGER EVALUATED AS BOOLEAN TRUE; CONDITION EVALUATED AT END

- FOR

  HAS THREE STATEMENTS IN PARENTHESES. EXECUTES FIRST STATEMENT AS A ONE TIME ASSIGNMENT. ITERATION CONTINUES WHILE THE SECOND STATEMENT (A LOOP CONDITION) IS NO LONGER EVALUATED AS BOOLEAN TRUE. THIRD STATEMENT IS EXECUTED AT THE END OF EACH ITERATION.

- FOREACH

  USED ONLY FOR ARRAYS; ASSIGNS VALUE OF CURRENT ELEMENT TO THE VARIABLE AND ADVANCES THE ARRAY POINTER UNTIL IT REACHES THE LAST ELEMENT

- CONTINUE

  WITHIN LOOPS, USED TO SKIP SUBSEQUENT CODE WITHIN THE ITERATION AND JUMP TO THE NEXT CONDITION EVALUATION STEP

- BREAK

  HALTS EXECUTION OF LOOPS UTILIZING THE FOR, FOREACH, WHILE, DO-WHILE, SWITCH CONTROL STRUCTURES

LANGUAGE CONSTRUCTS

OUTPUT CONSTRUCTS

- `die()` AND `exit()`

  THESE CONSTRUCTS ARE EQUIVALENT

  USED TO OUTPUT A RESULT AND THEN TERMINATE THE RUNNING SCRIPT

- `echo()`

  USED TO OUTPUT A SCALAR (STRING, FLOAT, BOOLEAN, INT) VALUE

  IF USING STRINGS CONTAINING QUOTATIONS, MAKE SURE YOU HANDLE THEM CORRECTLY (USE APOSTROPHE OR ESCAPE WITH \)

- `return`

  USED TO HALT EXECUTION OF A FUNCTION (CALLED WITHIN FUNCTION) OR OF A SCRIPT (CALLED WITHIN GLOBAL SCOPE)

- `print`

  USED TO OUTPUT A SCALAR VALUE

EVALUATION CONSTRUCTS

- `empty()`

  RETURNS BOOLEAN TRUE ON AN EMPTY VALUE PASSED IN: A NO ELEMENT ARRAY, 0, 0.0 ...

- `eval()`

  USED TO EVALUATE THE CONTENTS OF A STRING AS PHP CODE

- `include` AND `include_once`

  USED TO BOTH INCLUDE AND EVALUATE A FILE

- `require` AND `require_once`

  THESE CONSTRUCTS ARE SIMILAR TO `include` AND `include_once`, EXCEPT THAT A FAILURE IN EXECUTION RESULTS IN A FATAL ERROR, WHILE `include` GENERATES A WARNING

LANGUAGE CONSTRUCTS

OTHER CONSTRUCTS

- `isset()` AND `unset()`

  `isset()`: USE TO DETERMINE WHETHER A VARIABLE HAS BEEN SET (THEREFORE, IS NOT NULL)

  `unset()`: USE TO UNSET THE VARIABLE

- `list()`

  COMMON USE:

  ASSIGN A LIST OF VARIABLES BY DESTRUCTURING ARRAY VALUES

```
$info = array('coffee', 'brown', 'caffeine');

// Listing all the variables

list($drink, $color, $power) = $info;
```

  WITH ASSOCIATIVE ARRAY:

  ASSIGN A LIST OF VARIABLES BY DESTRUCTURING ARRAY KEYS AND VALUES

```
$info = array('drink' => 'coffee', 'color' => 'brown', 'power'
=> 'caffeine');

// Listing all the variables

list("a" => $a, "b" => $b, "c" => $c) ] = $info
```

CONSTANTS

DEFINITION:

- IDENTIFIER FOR A VALUE THAT DOES NOT CHANGE ONCE DEFINED

NAMING:

- START WITH A LETTER OR UNDERSCORE, ARE CASE SENSITIVE, CONTAIN ONLY ALPHANUMERIC CHARACTERS AND UNDERSCORES
- BY CONVENTION USE ONLY UPPERCASE LETTERS

ACCESS:

- MAY BE DEFINED AND ACCESSED ANYWHERE IN A PROGRAM
- MUST BE DEFINED BEFORE USE; CANNOT BE CHANGED SUBSEQUENTLY

"MAGIC" CONSTANTS (__XXX__)

DEFINITION:

- PHP PROVIDES A SET OF PREDEFINED CONSTANTS DEFINED BY THE PHP CORE (EX: E_ERROR; TRUE)
- SEVERAL OF THESE CAN CHANGE, DEPENDING UPON WHERE THEY ARE USED; THEREFORE, NOT TRUE CONSTANTS (EX: __DIR__; __NAMESPACE__)

  - __DIR__: returns the current working directory
  - __FILE__: returns the current working directory and file name
  - __FUNCTION__: returns the current function name
  - __CLASS__: returns the current class and namespace if defined
  - __LINE__: returns the current line number at the point of use
  - __METHOD__: returns the current method name
  - __TRAIT__: returns the trait name including namespace if defined.
  - __NAMESPACE__: returns the current namespace

Example:

```
ClassName::class: returns the fully qualified class name
namespace NS {
    class ClassName {}
    echo ClassName::class;

}
```

NAMESPACES

DEFINITION:

- NAMESPACES ARE A METHOD OF GROUPING RELATED PHP CODE ELEMENTS WITHIN A LIBRARY OR APPLICATION

USE:

- HELPS TO PREVENT ACCIDENTALLY RE-DEFINING FUNCTIONS, CLASSES, CONSTANTS, ...
- AVOIDS HAVING TO USE LONG, HIGHLY DESCRIPTIVE CLASS NAMES
- CONSTANTS, CLASSES, TRAITS, INTERFACES AND FUNCTIONS ARE AFFECED BY THE USE OF NAMESPACES
- CREATE SUB-NAMESPACES TO SUB-DIVIDE A LIBRARY

DECLARING NAMESPACES

- MUST DECLARE THE USE OF NAMESPACES WITH THE KEYWORD "`namespace`" AT THE BEGINNING OF THE CODE FILE (RIGHT AFTER `<?PHP`)
- USE ONE NAMESPACE PER CODE FILE (BEST PRACTICE)
- UNLESS A NAMESPACE IS DEFINED, CONSTANTS, CLASSES, FUNCTIONS, TRAITS AND INTERFACES ARE DEFINED WITH THE GLOBAL NAMESPACE
    - WITHIN A NAMESPACE QUALIFYING WITH A "\" REFERENCES THE GLOBAL NAMESPACE
- ONCE CODE ELEMENTS WITHIN A SINGLE NAMESPACE ARE DEFINED, THEY CAN BE USED IN OTHER PHP FILES

EXAMPLE:

```
namespace NS {

    class Db {

            public function getInstance(){

                return new \pdo(...);

            }

     }

}
```

NAMESPACES

IMPORTING / ALIASING NAMESPACES

- ONCE DECLARED, IMPORT NAMESPACES WITH THE "`use`" OPERATOR
- DECLARATIONS MY BE GROUPED (`use m\namespace\{A, B, C}`)
- CAN CREATE ALIASES FOR NAMESPACES
    - EX:

      USE PATH1\PATH2\PATH3 AS E; $test = new E\SOME_CLASS();

NOTE:

- NAMESPACES ARE NOT EQUIVALENT TO CLASSES… A NAMESPACE IS AN EXECUTION ENVIRONMENT ISOLATION IN WHICH A CLASS, FUNCTION, CONSTANT, TRAIT AND INTERFACE ARE DEFINED AND THEREFORE PROTECTED FROM NAMING COLLISIONS FROM A DIFFERENT ENVIRONMENT

EXTENSIONS

THERE ARE MANY ADD-ONS (EXTENSIONS) AVAILABLE FOR SPECIFIC PROGRAMMING TASKS

- ADDED TO THE `php.ini` CONFIGURATION FILE
- NEED TO CONFIGURE `php.ini` TO ACTIVATE THE EXTENSIONS YOU WANT TO USE, AS WELL AS SPECIFY ALL THE NEEDED PATHS (EX: LIBRARIES)
- NOT ALL EXTENSIONS CAN BE DISCUSSED WITHIN THIS GUIDE… PLEASE REVIEW THE COMPLETE LISTING AVAILABLE IN THE PHP MANUAL (REFERENCE CITED BELOW)

PECL (PHP EXTENSION COMMUNITY LIBRARY)

- REPOSITORY FOR PHP EXTENSIONS; SIMILAR STRUCTURE AND CONCEPT TO THE PHP CODE REPOSITORY PEAR (PHP EXTENSION AND APPLICATION REPOSITORY)

CORE EXTENSIONS

- THERE ARE A SET OF VARIOUS PHP LANGUAGE ELEMENTS, CALLED CORE EXTENSIONS, THAT ARE PART OF THE PHP CORE
- THEY INCLUDE SPECIFIC ARRAYS, CLASSES, OBJECTS, ETC.

USERLAND RULES

- USERLAND REFERS TO THOSE APPLICATIONS THAT RUN IN THE USER SPACE (NOT THE KERNEL)
- SELECT RULES: (SEE THE COMPLETE LISTING IN THE PHP MANUAL)

EXTENSIONS

GLOBAL NAMESPACE CONSTRUCTS:

- FUNCTIONS
- CLASSES
- INTERFACES
- CONSTANTS (OTHER THAN CLASS)
- VARIABLES (DEFINED OUTSIDE OF FUNCTIONS OR METHODS)

BEST PRACTICE

INTERNAL NAMING:

- FUNCTIONS USE UNDERSCORES BETWEEN WORDS
- CLASSES USE THE `CamelCase` RULE
- THE DOUBLE UNDERSCORE PREFIX IS RESERVED, AND REFERS TO ELEMENTS CONSIDERED "MAGICAL"

CONFIGURATION

DEFINITION:

- CONFIGURATION FILES ESTABLISH THE INITIAL SETTINGS FOR APPLICATIONS, AS WELL AS SERVERS AND OPERATING SYSTEMS

PHP.INI:

- CONFIGURATION FILE FOR PHP
- FILE RUN UPON SERVER STARTING (CGI) OR UPON INVOCATION (CLI)
- SEARCH ORDER UNDER WINDOWS:

  sapi MODULE > phprc VARIABLE > Registry KEYS > HKEY_LOCAL_MACHINE\software\php > Working DIRECTORY (NOT CLI) > Directory (SERVER OR PHP) > WIN DIRECTORY

.USER.INI:

- PHP SUPPORTS USER TYPE INI FILES
  - PROCESSED BY CGI/FASTCGI SAPI
  - MUST USE PHP_INI_PERDIR OR PHP_INI_USER
- PHP SEARCHES FOR THESE INI FILES IN ALL DIRECTORIES
- CONTROLLED BY DIRECTIVES `user_ini.filename`, `user.cache_ttl`
  - FILE NAMED BY `user_ini.filename` (default = `user.ini`)
  - FILE READING FREQUENCY DEFINED BY `user.cache_ttl`

SETTINGS

- CAN DEFINE VERSION/S OF PHP IN INI FILE
- GENERALLY, USE ini_set() WITHIN THE PHP SCRIPT; SOME SETTINGS REQUIRE php.ini OR httpd.conf

PERFORMANCE

FACTORS AFFECTING PERFORMANCE (TWO MAJOR AREAS)

- REDUCED MEMORY USAGE
- RUN-TIME DELAYS

GARBAGE COLLECTION

- CLEARS CIRCULAR-REFERENCE VARIABLES ONCE PREREQUISITES ARE MET, VIA ROOT-BUFFER FULL OR CALL TO THE FUNCTION GC_COLLECT_CYCLES()
- GARBAGE COLLECTION EXECUTION HINDERS PERFORMANCE

OPCODE CACHE

- STORES THE BYTECODE/OPCODE RESULTS OF COMPILING PHP CODE, WHICH OFTEN IMPROVES PERFORMANCE.
- AVAILABLE IN PHP (NEEDS TO BE TURNED ON); THIRD-PARTY PRODUCTS ARE ALSO AVAILABLE

TEST YOUR KNOWLEDGE : QUESTIONS

1

What is the output of the following code?

```
$a = 1;
    ++$a;
    $a *= $a;
    echo $a--;
```

A: 4
B: 3
C: 5
D: 0
E: 1

2

When PHP is running on a command line, what super-global will contain the command line arguments specified?

A: $_SERVER
B: $_ENV
C: $GLOBALS
D: $_POST
E: $_ARGV

3

Function world() is defined in the namespace 'myapp\utils\hello'. Your code is in namespace 'myapp'.

What is the correct way to import the hello namespace so you can use the world() function?

A: use hello
B: use utils\hello
C: use myapp\utils\hello
D: use myapp\utils\hello\world;

4

What is the output of the following script?

```php
<?php
function fibonacci ($x1, $x2)
{
        return $x1 + $x2;
}

$x1 = 0;
$x2 = 1;

for ($i = 0; $i < 10; $i++) {
    echo fibonacci($x1, $x2) . ',';
}
?>
```

A: 1,2,3,4,5,6,7,8,9

B: 1,2,3,4,5,6,7,8,9,10,

C: 1,2,3,5,8,13,21,34,55,89,

D: 1,1,1,1,1,1,1,1,1,1,

5

Which PHP functions may be used to find out which PHP extensions are available in the system? (Choose 2)

A: extension_loaded()

B: get_extension_funcs()

C: get_loaded_extensions()

D: phpinfo()

6

What is the name of the error level constant that is used to designate PHP code that will not work in future versions?

????

7

Your PHP script is repeatedly parsing 50KB of data returned from a remote web service into browser-readable HTML.

Users complain that the script takes a long time to run. Which of the following measures usually leads to the best results? (Choose 2)

- **A: Activate the opcode cache**
- **B: Install an SSD drive on the server**
- **C: Cache the data returned by the web service locally**
- **D: Upgrade to the latest version of PHP**

8

What will the following code produce?

```
1  <?php
2
3  define('CONSTANT',1);
4  define('_CONSTANT',0);
5
6  define('EMPTY','');
7
8  if (!empty(EMPTY)) {
9      if (!((boolean) _CONSTANT)) {
10         print "One";
11     }
12 }
13 else if(constant('CONSTANT') == 1){
14     print "Two";
15
16 }
```

- **A: One**
- **B: Two**
- **C: Parse Error**

TEST YOUR KNOWLEDGE : ANSWERS

1

A: 4

2

A: $_SERVER

3

C: use myapp\utils\hello

4

D: 1,1,1,1,1,1,1,1,1,1,

5

C: get_loaded_extensions()

D: phpinfo()

6

E_DEPRECATED

7

C: Cache the data returned by the web service locally

D: Upgrade to the latest version of PHP

8

C: Parse Error

TOPIC TWO: DATA FORMATS & TYPES

XML Basics

XML Extension

SimpleXML

DOM

SOAP

REST

JSON & AJAX

Date & Time

XML BASICS

- DEFINITION
  - XML IS ACRONYM FOR EXTENSIBLE MARKUP LANGUAGE
  - DATA FORMAT ("UNIVERSAL") USED FOR STRUCTURED DOCUMENT EXCHANGE

XML EXTENSION

- EXTENSION ALLOWS FOR PARSING OF XML DOCUMENTS
- CREATE XML PARSERS (+ PARAMS) AND DEFINE CORRESPONDING HANDLERS

`xml_parser_create()`	... AND ...
`xml_parser_create_ns()`	FOR PARSER WITH NAMESPACE SUPPORT
`xml_set_element_handler()`	SEE OTHER FUNCTIONS IN PHP MANUAL

CHARACTER ENCODINGS

- SOURCE ENCODING :
  - CONDUCTED AT TIME OF PARSING
  - CANNOT BE CHANGED DURING PARSER LIFETIME
  - TYPES:

    UTF-8 (PHP USES THIS TYPE FOR INTERNAL DOCUMENT REPRESENTATION; BYTES UP TO 21)

    US-ASCII (SINGLE BYTE)

    ISO-8859-1 (SINGLE BYTE; DEFAULT)
- TARGET ENCODING :
  - CONDUCTED AT TIME OF PHP PASSING DATA TO XML HANDLERS
  - TARGET ENCODING INITIALLY SET TO SAME AS SOURCE ENCODING
  - CAN BE CHANGED AT ANY TIME
- CHARACTERS NOT CAPABLE OF SOURCE ENCODING CAUSE AN ERROR
- CHARACTERS NOT CAPABLE OF TARGET ENCODING ARE DEMOTED (TO "?")

SIMPLEXML

- REQUIRES THE LIBXML EXTENSION (ENABLED BY DEFAULT IN PHP)
  - FUNCTIONS PART OF EXPAT LIBRARY ALSO ENABLED BY DEFAULT

- SET OF PREDEFINED ERROR CODE CONSTANTS AVAILABLE
  - AVAILABLE WHEN DYNAMICALLY LOADED AT RUNTIME OR WHEN COMPILED INTO PHP
  - PARTIAL LIST

```
XML_ERROR_**
            _SYNTAX
            _INVALID TOKEN
            _UNKNOWN_ENCODING

XML_OPTION_**
            _OPTION_CASE FOLDING
               _SKIP_WHITE
```

SIMPLEXML -- CONTINUED

- DEFINITION
  - "SIMPLE" ACCESS TO XML DATA FROM PHP

- CONCEPT: OOP ACCESS FOR XML DATA
  - ELEMENTS BECOME OBJECT PROPERTIES
  - ATTRIBUTES CAN BE ACCESSED VIA ASSOCIATIVE ARRAYS

- FUNCTIONS:

```
$xml = simplexml_load_string('<?xml...');
$xml = simplexml_load_file('file.xml');
$xml = new SimpleXMLElement('<?xml...');
```

- CLASS: (EXAMPLES)

CREATES A SIMPLEXMLELEMENT OBJECT

```
SimpleXMLElement::construct()
```

IDENTIFIES AN ELEMENT'S ATTRIBUTES

```
SimpleXMLElement::attributes()
```

RETRIEVES AN ELEMENT'S NAME

```
SimpleXMLElement::getName()
```

FINDS CHILDREN OF GIVEN NODE

```
SimpleXMLElement::children()
```

COUNTS THE NUMBER OF CHILDREN OF AN ELEMENT

```
SimpleXMLElement::count()
```

RETURNS A WELL-FORMED XML STRING BASED ON A SIMPLEXML ELEMENT

```
SimpleXMLElement::asXML()
```

RUNS AN XPATH QUERY ON THE CURRENT NODE

```
SimpleXMLElement::xpath()
```

DOM

- DEFINITION
  - DOM EXTENSION PERMITS MANIPULATING OF XML DOCUMENTS WITH ITS API AND PHP

- REQUIRES THE LIBXML EXTENSION (ENABLED BY DEFAULT IN PHP)
  - FUNCTIONS PART OF EXPAT LIBRARY ALSO ENABLED BY DEFAULT

- ENCODING:
  - USES UTF-8 ENCODING

- SIMPLEXML AND DOM
  - `simplexml_import_dom()` CONVERTS A DOM NODE INTO A SIMPLEXML OBJECT
  - `dom_import_simplexml()` CONVERTS A SIMPLEXML OBJECT INTO A DOM (DOCUMENT OBJECT MODEL)

- SET OF PREDEFINED CONSTANTS AVAILABLE
  - AVAILABLE WHEN EXTENSION DYNAMICALLY LOADED AT RUNTIME OR WHEN COMPILED INTO PHP
  - PARTIAL LIST (SEE PHP MANUAL FOR FULL LIST)

XML_ELEMENT_NODE	DEFINES NODE AS A DOM ELEMENT
XML_TEXT_NODE	DEFINES NODE AS A DOMTEXT

SOAP

- DEFINITION
  - DERIVED ACRONYM FOR SIMPLE OBJECT ACCESS PROTOCOL
  - VERSIONS 1.0 AND 1.1 RELEASED BY THE INDUSTRY; POPULARITY LED TO CONTROL BY W3C WITH VERSION 1.2
  - EXTENSION USED TO WRITE SOAP SERVERS AND CLIENTS
- REQUIRES THE LIBXML EXTENSION (ENABLED BY DEFAULT IN PHP)
- RUNTIME CONFIGURATION
  - SOAP CACHE FUNCTIONS ARE AFFECTED BY `php.ini` SETTINGS (`soap.wsdl_cache_*`)
- SET OF PREDEFINED CONSTANTS AVAILABLE
  - AVAILABLE WHEN DYNAMICALLY LOADED AT RUNTIME OR WHEN COMPILED INTO PHP
  - PARTIAL LIST (ALL INTEGERS)

SOAP_1_1	1
SOAP_1_2	2
SOAP_ENCODED	1
SOAP_LITERAL	2
SOAP_AUTHENTICATION_	0/1
SOAP_ENC_*	300/301
SOAP_CACHE_*	0/1/2/3
SOAP_PERSISTENCE_*	1/2
SOAP_RPC	1

- SOAP FUNCTIONS

`is_soap_fault`	CHECKS IF A SOAP CALL HAS FAILED
`use_soap_error_handler`	INDICATES WHETHER TO USE AN ERROR HANDLER

REST

- DEFINITION
  - REST IS ACRONYM FOR REPRESENTATIONAL STATE TRANSFER
  - DESIGN STANDARD (NOT AN EXTENSION); SET OF 4 ARCHITECTURAL PRINCIPLES FOR DESIGNING WEB PAGES AND SERVICES
    - STATELESS
    - EXPOSES URIS
    - CAN TRANSFER ANY FORMAT, FOR EXAMPLE, XML, JSON, OR BOTH
- DATA TYPES SUPPORTED INCLUDE:
  - ASCII STRINGS
  - INTEGERS
  - BOOLEANS
  - SCALARS
- REST USES HTTP "VERBS":

GET	LIST (WITHOUT IDENTIFIER)
GET	RESOURCE (WITH IDENTIFIER)
POST	CREATE
PUT	UPDATE (WITH IDENTIFIER)
DELETE	DELETE (WITH IDENTIFIER)

REST (CONTINUED)

- REST AND REQUEST HEADERS
  - TWO CONCEPTS:
    - `CONTENT-TYPE`: WHAT IS BEING PROVIDING
    - `ACCEPT`: WHAT IS EXPECTED IN RESPONSE
  - STATUS CODES:
    - `201` = CREATED
    - `400` = BAD REQUEST / FAILED VALIDATION
    - `401` = UNAUTHORIZED
    - `204` = NO CONTENT (USEFUL WITH DELETE)
    - `500` = APPLICATION ERROR
  - `ext/curl` IS A COMMON WAY OF SENDING MORE COMPLEX HEADER REQUESTS FROM A PHP SCRIPT

- CONTEXT SWITCHING
  - REFERS TO THE ACT OF PROVIDING DIFFERENT OUTPUT BASED ON CRITERIA FROM THE REQUEST
  - THE PROCESS INSPECTS THE HTTP REQUEST HEADERS AND/OR THE REQUEST URI, AND VARIES THE RESPONSE APPROPRIATELY
  - COMMONLY USED FOR:
    - PROVIDING DIFFERENT OUTPUT FOR REQUESTS ORIGINATED VIA `XMLHttpRequest`
    - PROVIDING DIFFERENT OUTPUT BASED ON ACCEPT HTTP HEADERS (EX: REST ENDPOINTS)
    - PROVIDING ALTERNATE LAYOUTS/CONTENT BASED ON BROWSER DETECTION

JSON & AJAX

- DEFINITION
  - JSON IS AN ACRONYM FOR JAVASCRIPT OBJECT NOTATION
  - DATA-INTERCHANGE FORMAT
  - EXTENSION LOADED IN PHP BY DEFAULT

- SET OF PREDEFINED CONSTANTS AVAILABLE
  - AVAILABLE WHEN DYNAMICALLY LOADED AT RUNTIME OR WHEN COMPILED INTO PHP
  - PARTIAL LIST (ALL INTEGER)

JSON_ERROR_NONE	CONFIRMS WHETHER ERROR OCCURRED OR NOT
JSON_ERROR_SYNTAX	INDICATES SYNTAX ERROR JSON_ERROR_UTF8
	AIDS IN DETECTING ENCODING ISSUES
JSON_FORCE_OBJECT	AIDS IN ENSURING THE RECEIVING END GETS AN OBJECT WHEN AN EMPTY PHP ARRAY IS PASSED

- FUNCTIONS
  - DECODES A JSON STRING
    ```
    json_decode($json, $assoc=false, $depth=512, $options=0)
    ```
  - RETURNS THE JSON REPRESENTATION OF A VALUE
    ```
    json_encode($value, $options=0, $depth=512)
    ```
  - RETURNS THE LAST ERROR OCCURRED
    ```
    json_last_error()
    ```

where

$assoc:	INDICATES WHETHER OBJECTS SHOULD BE CONVERTED INTO ASSOCIATIVE ARRAYS (BOOLEAN)
$value:	CAN BE OF ANY TYPE EXCEPT A RESOURCE
$depth:	NESTING DEPTH
$options:	DECODING OPTIONS

DATE & TIME

- DEFINITION
  - FUNCTIONS THAT RETRIEVE THE DATE AND TIME FROM THE PHP SERVER
  - FLEXIBLE DATE AND TIME FORMATTING DUE TO FACT THEY ARE STORED AS A 64-BIT NUMBER
  - FUNCTION VALUES REFLECT LOCALE SET ON SERVER, AS WELL AS SPECIAL DATE ADJUSTMENTS LIKE DAYLIGHT SAVINGS TIME, LEAP YEAR

- RUNTIME CONFIGURATION
  - `date.*` FUNCTIONS ARE AFFECTED BY PHP.INI SETTINGS
  - `date.default_latitude`; `date.timezone`

- SET OF PREDEFINED CONSTANTS AVAILABLE
  - `DateTime` CONSTANTS PROVIDE STANDARD DATE FORMATS, IN CONJUNCTION WITH A DATE FUNCTION LIKE date()

- DATETIME CLASS
  - CONSTANTS: FORMAT (EXAMPLES)

```
const string DateTime::*
::COOKIE = l, d-M-y H:i:s T ; MONDAY, 14-AUG-17 15:52:01 UTC
::RSS = D, d M Y H:i:s O ;    MON, 14 AUG 2017 15:52:01 +0000
```

  - METHODS: FORMAT (EXAMPLES)

```
public __construct([[string $time = "now"
[, DateTimeZone $timezone = NULL ]])

public DateTime add(DateInterval $interval)

public DateTime setDate(int $year, int $month, int
$day)
```

- STATIC METHODS: FORMAT (OOP-STYLE EXAMPLES)

  ADD A SPECIFIED AMOUNT OF TIME TO A DATETIME OBJECT

  ```
  public DateTime DateTime::add(DateInterval $interval)
  ```

  RETURN A NEW DATETIME OBJECT (INSTANTIATION)

  ```
  public  DateTime::__construct()([string $time = "now"
  [, DateTimeZone $timezone = NULL ]])
  ```

  RETURN A DATETIME OBJECT IN A SPECIFIC FORMAT

  ```
  public static  DateTime DateTime::createFromFormat(
  string $format, string $time [, DateTimeZone
  $timezone])
  ```

  RETURN A DATE FORMATTED ACCORDING TO A GIVEN FORMAT

  ```
  public string DateTime::format(string $format)
  ```

  RETURN THE DIFFERENCE BETWEEN TWO DATETIME OBJECTS

  ```
  public DateInterval DateTime::diff( DateTime
  $datetime2 , bool $absolute = false])
  ```

  RETURN THE UNIX TIMESTAMP

  ```
  public int DateTime::getTimestamp(void)
  ```

  ALTER THE CURRENT TIMESTAMP

  ```
  public DateTime DateTime::modify(string $modify)
  ```

- EACH CASE, THE METHOD RETURNS AN OBJECT ON SUCCESS, FALSE ON FAILURE

  `$timezone`: WHEN SET TO `NULL`, RETURNS THE CURRENT TIME

  `$format`: THE PARAMETER MUST BE IN A FORMAT ACCEPTED BY `DATE()`

  `$modify`: DATE / TIME STRING IN VALID FORMATS (ADD/SUBTRACT)

TEST YOUR KNOWLEDGE : QUESTIONS

1

What is wrong with this XML document?

```
<?xml version="1.0" encoding="UTF-8"?>
<node>
    <?var type="string" ?>
    <leaf>Value</leaf>
</node>
```

A: The encoding is only required for non-western languages

B: <?var is not a valid node type

C: <?var is missing a closing tag

D: Nothing

2

Which of the following is a feature that does NOT exist in the DateTime extension?

A: The ability to list time zones by continent

B: The ability to modify date data

C: The ability to generate dates between two date periods

D: The ability to parse dates in the cookie format

E: None of the above

3

What is the output of the following code?

```
1  <?php
2
3  $doc = new DOMDocument();
4  $doc->loadXML('<root />');
5  $el = $doc->createElement('test', 'some value');
6
7  echo $doc->saveXML();
```

A:
```
<?xml version="1.0"?>
<root/>
```

B:
```
<?xml version="1.0"?>
<root/>
<test>some value</test>
```

C:
```
<?xml version="1.0"?>
<root><test>some value</test>
</root>
```

D:
```
<?xml version="1.0"?>
<root test="some value"/>
```

4

What is the name of the method that allows xpath expressions in SimpleXML?

A: There is no such method

B: query

C: xpathExpression

D: xpath

5

What is the XSL extension in PHP doing?

A: Formatting the XML output

B: Applying style sheets to the XML

C: Applying XML transformations

D: Checking the syntax of an XML document for validity

6

What is the output of the following code?

```php
<?php

$xml = '<root>
    <parent name="Peter">
        <child age="20">James</child>
        <child age="5">Leila</child>
    </parent>
    <parent name="Anna">
        <child age="10">Dido</child>
        <child age="11">George</child>
    </parent>
</root>';

$xmlElement = new SimpleXMLElement($xml);
$teens = $xmlElement->xpath('*/child[@age>9]');
print $teens[1];
```

A: It will print James

B: It will print nothing

C: It will cause a Run-time error

D: It will print Dido

7

Which web services are natively supported in PHP? (Choose two)

A: SOAP

B: REST

C: XML-RPC

D: Corba

8

Which of the following is true about SOAP and PHP?

A: It uses the JSON data format in PHP

B: Only SOAP Clients can be created in PHP

C: Every PHP class can be used automatically as a SOAP service by adding a special parameter to the URL

D: SOAP Clients in PHP are hiding the complexity of sending a request to a remote SOAP Server and processing the response

9

What is the purpose of this HTTP request?

```
PUT /user/123
<?xml ...?>
```

????

10

What is JSON?

A: A way of serializing any PHP type in order to exchange it with different programming languages and systems

B: A portable XML representation of the data using PHP's serialize($value, true)

C: A format to represent any PHP type, except a resource, that can be used later on in JavaScript or other languages

TEST YOUR KNOWLEDGE : ANSWERS

1

D: Nothing

2

E: None of the above

3

A:
```
<?xml version="1.0"?>
<root/>
```

4

D: xpath

5

C: Applying XML transformations

6

D: It will print Dido

7

A: SOAP *and* C: XML-RPC

8

D: SOAP Clients in PHP are hiding the complexity of sending a request to a remote SOAP Server and processing the response

9

B: Update user 123

10

C: A format to represent any PHP type, except a resource, that can be used later in JavaScript

TOPIC THREE: STRINGS

Quoting

HEREDOC & NOWDOC

Matching

Extracting

Searching

Replacing

Formatting

PCRE

Encoding

STRINGS & PATTERNS

DELIMITED BY SINGLE OR DOUBLE QUOTES

- DOUBLE QUOTES OFFER MORE OPTIONS, INCLUDING SPECIAL CHARACTERS

HEREDOC SYNTAX

- DELIMITS STRINGS WITHOUT USING QUOTES (SO NO NEED TO ESCAPE)
- START WITH <<< AND AN IDENTIFIER; END WITH SAME IDENTIFIER
- DO NOT INDENT ENDING IDENTIFIER OR ADD ANY CHARS

NOWDOC SYNTAX

- SIMILAR TO HEREDOC, BUT NO PARSING IS CONDUCTED
- SAME <<< IDENTIFIER, BUT THE IDENTIFIER MUST BE ENCLOSED IN SINGLE QUOTES

SUBSTRINGS

- USE THE `substr(string, start, length)` FUNCTION
- RETURNS A SUBSTRING OF THE GIVEN STRING

LOCATING STRINGS:

- USE THE `strpos (haystack, needle, offset)` FUNCTION
- SEARCHES THE STRING, STARTING AT THE BEGINNING (OR THE POSITION INDICATED), AND RETURNS THE POSITION OF FIRST OCCURRENCE, OR RETURNS FALSE IF NOT

COMPARING STRINGS

`==`	SETS UP COMPARISON, INCLUDING DATA TYPE CONVERSION
`===`	SETS UP COMPARISON, INCLUDING DATA TYPE CHECK
`strcasecmp()`	CASE-INSENSITIVE COMPARISON
`strcmp()`	CASE-SENSITIVE COMPARISON
`similar_text()`	SIMILARITY OF TWO STRINGS... RETURNS THE NUMBER OF MATCHING CHARS `echo similar_text("cat", "can"); //2`
`levenshtein()`	LEVENSHTEIN DISTANCE BETWEEN STRINGS... DEFINED AS MINIMUM NUMBER OF CHARS NEEDED TO REPLACE, INSERT, OR DELETE TO TRANSFORM STRING 1 > STRING 2 `echo levenshtein("cat", "can"); //1`

COUNTING STRINGS:

- NUMBER OF CHARACTERS — USE THE `strlen(string)` FUNCTION
- NUMBER OF WORDS — USE `str_word_count(`*`string`*`);` `str_word_count(`*`strings`*`,`*`true`*`)` YIELDS AN ARRAY WITH ALL SINGLE WORDS

PHONETIC FUNCTIONS

`soundex()`	SOUNDEX VALUE OF A STRING
`metaphone()`	METAPHONE KEY OF A STRING BASED ON ENGLISH PRONUNCIATION RULES, SO MORE PRECISION THAN THE `soundex()` FUNCTION BUT OF LIMITED USE WITH GLOBAL SITES

STRINGS AND ARRAYS:

`explode(split string, string)`	CONVERTS A STRING INTO AN ARRAY
`implode(glue string, string)`	CONVERTS AN ARRAY INTO A STRING

FORMATTING OUTPUT

`printf()`	PRINTS A FORMATTED STRING
`sprintf()`	RETURNS A FORMATTED STRING
`vprintf()`	PRINTS A FORMATTED STRING, PLACEHOLDER VALUES SUPPLIED AS AN ARRAY
`vsprintf()`	RETURNS A FORMATTED STRING, PLACEHOLDER VALUES SUPPLIED AS AN ARRAY
`fprintf()`	SENDS A FORMATTED STRING TO A RESOURCE

FORMATTING CHARACTERS (PARTIAL LISTING)

`%b` (BINARY)

`%d` (DECIMAL)

`%f` (FLOAT)

`%o` (OCTAL)

`%e` (SCIENTIFIC NOTATION)

`%s` (STRING)

`%nd` (N IS THE NUMBER OF DIGITS)

`%.nf` (N IS THE NUMBER OF DECIMAL PLACES)

REGULAR EXPRESSIONS

- DESCRIBE A PATTERN
- PCRE (PERL COMPATIBLE REGULAR EXPRESSION)
- DELIMITER
    - USUALLY "/", "#", OR "!"
    - USED AT BEGINNING AND END OF EACH PATTERN
- LITERALS ARE ANY CHARACTERS
- BOUNDARIES (EXAMPLES)

^	START OF A LINE
$	END OF A LINE
\A	START OF A STRING
\Z	END OF A STRING

- CHARACTER CLASSES DELIMITED WITH [ ]
    - BUILT-IN CHARACTER CLASSES; CAPITALIZATION INDICATES ABSENCE (EXAMPLE)

\d	DIGIT
\D	NO DIGIT

- "GREEDINESS"
    - MAXIMUM MATCH IS RETURNED
    - USUALLY NEED TO USE PARENTHESES WITH ALTERNATIVES

REGULAR EXPRESSIONS (CONTINUED)

- QUANTIFIERS (EXAMPLES)

*	ANY NUMBER OF TIMES
+	ANY NUMBER OF TIMES, BUT AT LEAST ONCE
?	0 OR 1

  *COMBINATION OF ? WITH * OR + MAKES NON-GREEDY*

- PATTERN MATCHING
  - USE THE `preg_match(pattern, string)` FUNCTION
  - RETURNS NUMBER OF MATCHES
  - OPTIONAL THIRD PARAM DEFINES MATCH
  - `preg_match_all()` RETURNS ALL MATCHES
  - RETURNS ALL MATCHES IN AN ARRAY

- REPLACING

  `preg_replace(`*`search pattern`*`,` *`replace pattern`*`,` *`string`*`)`

ENCODINGS

- SOME LANGUAGE CHARACTER SETS CAN BE REPRESENTED WITH SINGLEBYTE ENCODINGS (BASED ON 8-BIT VALUES; EX: LATIN-BASED LANGUAGES) AND OTHERS REQUIRE MULTIBYTE ENCODINGS BECAUSE OF THEIR COMPLEXITY (EX: CHINESE LOGOGRAPHIC CHARACTER SET)

- OPERATING WITH STRINGS IN MULTIBYTE ENCODING REQUIRES USING SPECIAL FUNCTIONS (`mbstring` EXTENSION) OR THE CHARACTERS WILL DISPLAY INCORRECTLY

- EXISTING APPLICATIONS BUILT IN A SINGLEBYTE ENVIRONMENT, THAT UTILIZE FUNCTIONS LIKE `substr()` AND `strlen()`, WILL NOT WORK PROPERLY IN MULTIBYTE ENVIRONMENTS

- NEED TO EMPLOY FUNCTION OVERLOADING, TO CONVERT SINGLEBYTE FUNCTION AWARENESS TO A MULTIBYTE EQUIVALENT, SUCH AS `mb_substr()` AND `mb_strlen()`

- MBSTRING MODULE:
    - HANDLES CHARACTER ENCODING CONVERSION
    - DESIGNED FOR UNICODE-BASED (UTF-8, UCS-2) AND SOME SINGLE-BYTE ENCODINGS (PHP MANUAL HAS COMPLETE LIST)
    - MODULE MUST BE ENABLED USING THE `configure` OPTION (NOT A DEFAULT EXTENSION)
    - `mb_check_encoding()` WILL VERIFY WHETHER THE STRING IS VALID FOR THE SPECIFIED ENCODING

TEST YOUR KNOWLEDGE : QUESTIONS

1

What is a good rule to follow when quoting string data?

A: Use double quotes because you might want to use variable interpolation at a later time

B: Use single quotes unless you are using variable interpolation because single quotes are faster

C: Use single quotes unless you have a ' in your string or you are doing variable interpolation because it declares whether you want variables to be interpolated

2

What is the output of this code?

```
echo strcmp(12345, '12345');
```

A: Less than zero because (int)12345 is less than (string)'12345'

B: Zero because (int)12345 is equal to (string)'12345'

C: Greater than zero because (int)12345 is greater than (string)'12345'

3

Given a string '$str = '12345';' what is the pattern required to extract each digit individually?

A: $result = sscanf($str, '%d');

B: $result = sscanf($str, '%d%d%d%d%d');

C: $result = sscanf($str, '%1d%1d%1d%1d%1d');

4

What will the following code print out?

```
$str = 'abcdef';
if (strpos($str, 'a')) {
    echo "Found the letter 'a'";
} else {
    echo "Could not find the letter 'a'";
}
```

?????

5

What will this code do?

```
$var = 2;
$str = 'aabbccddeeaabbccdd';
echo str_replace('a', 'z', $str, $var);
```

A: Replace all of the 'a' characters with 'z' characters and put the replacement count in $var

B: Replace up to 2 of the 'a' characters with a 'z' character

C: 2 is a flag which, when passed to str_replace, will remove all characters _except_ those listed

6

What will the following code print?

```
$str = printf('%.1f', 7.1);
echo 'Zend PHP Certification ';
echo $str;
```

A: Zend PHP Certification 7.1

B: Zend PHP Certification

C: 7.1Zend PHP Certification 3

7

What is the output of the following code?

```
$data = 'ȟęııǫ ₩oɼIḍ';
$matches = array();
preg_match('/./u', $data, $matches);

echo $matches[0];
```

A: An unprintable character because PHP does not understand UTF-8

B: ȟ, because PCRE can understand UTF-8

C: Nothing, because PHP does not understand UTF-8

A:

8

What is the key difference between HEREDOC and NOWDOC?

A: NOWDOC allows you to use block delimiters with a single quote

B: HEREDOC terminates a block starting at the first character, but NOWDOC allows you to indent the end of the block

C: NOWDOC does not parse for variable interpolation, but HEREDOC does

A: single quote

9

What will the following code print?

```
$a = 'ĥęııǫ ₩oɼld';
echo strlen($a);
```

A: 1, since the space is the only ASCII character in the string

B: 26, since PHP does not natively understand UTF-8 encoding

C: 10, since it only counts the first byte of a UTF-8 encoded character

A: 1, since the space is the only ASCII character in the string

B: 26, since PHP does not natively understand UTF-8 encoding

C: 10, since it only counts the first byte of a UTF-8 encoded character

TEST YOUR KNOWLEDGE : ANSWERS

1. C: Use single quotes unless you have a ' in your string or you are doing variable interpolation because it declares whether you want variables to be interpolated

2. B: Zero because (int)12345 is equal to (string)'12345'

3. C: $result = sscanf($str, '%1d%1d%1d%1d%1d');

4. Could not find the letter 'a'

5. A: Replace all of the 'a' characters with 'z' characters and put the replacement count in $var

6. C: 7.1Zend PHP Certification 3

7. B: ĥ, because PCRE can understand UTF-8

8. C: NOWDOC does not parse for variable interpolation, but HEREDOC does

9. B: 26, since PHP does not natively understand UTF-8 encoding

TOPIC FOUR: ARRAYS

Enumerated Arrays

Associative Arrays

Multi-dimensional Arrays

Array Iteration

Array Functions

SPL / Objects as Arrays

ARRAY DEFINITION

- WAY OF ORDERING DATA BY ASSOCIATING VALUES TO KEYS
- UNIQUE KEYS ARE ASSOCIATED WITH A SINGLE VALUE, OR SET OF VALUES
- ARRAYS CAN BE NESTED, SO THAT A VALUE IN ONE ARRAY ACTUALLY REPRESENTS A COMPLETE OTHER ARRAY (MULTI-DIMENSIONAL ARRAYS)

CREATING ARRAYS

- INDEXED NUMERICALLY (INDEXED ARRAY)
  - EX: `$x = array('a', 'b', 'c');`
  - EX: `$x = ['a', 'b', 'c'];`
  - EX: `$x = array(0 => 'a', 1 => 'b', 2 => 'c');`
  - EX: `$x = [0 => 'a', 1 => 'b', 2 => 'c'];`
- INDEXED WITH STRINGS (ASSOCIATIVE ARRAY)

```
$x = array(
'XML' => 'eXtensible Markup Language'
);
$x = [
'XML' => 'eXtensible Markup Language'
];
```

FILLING ARRAYS

- `range()` CREATES AN ARRAY WITH VALUES FROM AN INTERVAL
  - DEFAULT STEP IS "1"
  - EX: `$x = range(1.2, 4.1) // == array(1.2, 2.2, 3.2)`

SPLITTING ARRAYS

- `array_slice(array, offset)` RETURNS PART OF AN ARRAY
    - OPTIONAL 3RD PARAM = LENGTH
    - OPTIONAL 4TH PARAM = MAINTAIN INDICES (BOOLEAN)
- NEGATIVE OFFSET MEANS COUNT FROM THE END OF THE ARRAY
- NEGATIVE LENGTH EXCLUDE ELEMENTS x POSITIONS FROM THE END OF THE ARRAY
    - EX:
```
$x = array(1,2,3,4,5)
$y = array_slice($x, -4, -1); //== array(2,3,4);
```

ADDING ELEMENTS

- `array_push()` ADDS 1 OR MORE ELEMENTS TO THE END OF AN ARRAY
- ARRAY IS PROVIDED BY REFERENCE
- RETURN VALUE IS THE NEW NUMBER OF ARRAY ELEMENTS
    - EX:
```
$x = [1, 2, 3];
$n = array_push($x, 4, 5); // $n == 5
```
    - ALTERNATIVE: `$n[] = 4;$n[] = 5;`
- `array_unshift()` ADDS 1OR MORE ELEMENTS TO THE BEGINNING OF AN ARRAY
- ALREADY EXISTING ELEMENTS ARE MOVED TOWARDS THE END
- RETURN VALUE IS THE NEW NUMBER OF ARRAY ELEMENTS
    - EX:
```
$x = [3, 4, 5];
$n = array_unshift($x, 1, 2); // $n == 5
```

REMOVING ELEMENTS

- `array_pop()` REMOVES 1 ELEMENT AT THE END OF AN ARRAY
  - ARRAY IS PROVIDED BY REFERENCE
- RETURN VALUE IS THE REMOVED ELEMENT
  - EX:
```
$x = [1, 2, 3];
$n = array_pop($x); // $n == 3
```
- `array_shift()` REMOVES 1 ELEMENT AT THE BEGINNING OF AN ARRAY
- REMAINING ELEMENTS ARE MOVED TOWARDS THE FRONT
- RETURN VALUE IS THE REMOVED ELEMENT
  - EX:
```
$x = [1, 2, 3];
$n = array_shift($x); // $n == 1
```

LOOPING ARRAYS

- `for` LOOP AND INDICES
  - EX:
```
for ($i = 0; $i < count($a); $i++) {
    echo $a[$i];
}
```
  - ONLY MAKES SENSE IF THERE ARE NO GAPS IN THE INDICES
- `foreach` LOOP AND VALUES
  - EX:
```
foreach ($a as $value) {
    echo $value . '<br />';
}
```
- `foreach` LOOP AND KEYS AND VALUES
  - EX:
```
foreach ($a as $key => $value) {
    echo "$key: $value<br />";
}
```
- `array_walk()` PROVIDES ACCESS TO ALL ARRAY ELEMENTS
  - A CALLBACK FUNCTION IS CALLED FOR EACH ELEMENT

LOOPING ARRAYS (CONTINUED)

- CHECKING FOR ARRAY VALUES
  - `array_key_exists($key, $array)`
    DETERMINES WHETHER THERE IS AN INDEX `$key` IN THE ARRAY `$array`
  - `in_array($element, $array)`
    DETERMINES WHETHER THERE IS AN ELEMENT `$element` IN THE ARRAY `$array`
  - `array_keys()` IS AN ARRAY OF ALL ARRAY INDICES
  - `array_values()` IS AN ARRAY OF ALL ARRAY VALUES

SORTING ARRAYS

- `sort($a)` SORTS VALUES ALPHABETICALLY
- THE SECOND PARAMETER INDICATES THE SORT MODE

`SORT_LOCALE_STRING`	SORTS ACCORDING TO LOCALE SETTINGS
`SORT_NUMERIC`	NUMERIC SORTING
`SORT_REGULAR`	"NORMAL" SORTING (DEFAULT)
`SORT_STRING`	SORTING AS STRINGS

OTHER SORTING FUNCTIONS

`rsort()`	LIKE `sort()`, BUT IN REVERSE
`asort()`	SORTS ASSOCIATIVE ARRAYS (MAINTAINS KEY-VALUE)
`arsort()`	LIKE `asort()`, BUT IN REVERSE
`ksort()`	SORTS BY KEYS
`krsort()`	LIKE `ksort()`, BUT IN REVERSE
`usort()`	USER-DEFINED SORT

NATURAL SORTING

- `natsort()` RETURNS RESULTS BASED ON HOW A HUMAN WOULD SEE ORDER
  `(*9.PHP > *10.PHP > *11.PHP)` "NATURAL" STRING SORTING vs.
  `(*10.PHP > *11.PHP > *9.PHP)` "NORMAL" STRING SORTING

MERGING ARRAYS

- `array_merge($x, $y)` CREATES AN ARRAY CONTAINING THE ELEMENTS OF BOTH ARRAYS, X AND Y

COMPARING ARRAYS

- `array_diff($x, $y)` COMPARES THE TWO ARRAYS, X AND Y
- RETURN VALUE IS AN ARRAY WITH ALL ELEMENTS IN $x NOT IN $y
- RELATED FUNCTIONS:

`array_diff_assoc()`	COMPARES VALUES AND KEYS
`array_diff_key()`	COMPARES ONLY KEYS
`array_diff_uassoc()`	LIKE `array_diff_assoc()` BUT WITH USER-DEFINED COMPARE FUNCTION
`array_diff_ukey()`	LIKE `array_diff_key()` BUT WITH USER-DEFINED COMPARE FUNCTION

SPL - ARRAYOBJECT CLASS

- CLASS ALLOWS OBJECTS TO FUNCTION AS ARRAYS

`ArrayObject::STD_PROP_LIST`	PROPERTIES ARE RETAINED WHEN ACCESSED AS A LIST (EX: `var_dump`, `foreach`)
`ArrayObject::ARRAY_AS_PROPS`	ENTRIES CAN BE ACCESSED AS PROPERTIES (EX: READ/WRITE)

- RELATED ARRAYOBJECTS (SELECTION):

`ArrayObject::append`	APPENDS A VALUE
`ArrayObject::asort`	SORTS THE ENTRIES BY VALUE
`ArrayObject::natsort`	SORTS ACCORDING TO A "NATURAL ORDER"... SEE `natsort()` ABOVE

TEST YOUR KNOWLEDGE : QUESTIONS

1

What is the output of the following code ?

```php
<?php
    $a = array(1, 2, 3);
    foreach ($a as $x) {
        $x *= 2;
    }
    echo $a[0] * $a[1] * $a[2];
    ?>
```

????

2

What is the output of the following code ?

```php
<?php
   $a = array(1,2,4,8);
   $b = array(0,2,4,6,8,10);
   echo count(
      array_merge(
          array_diff($a, $b),
          array_diff($b, $a)
      )
   );
?>
```

????

3

What is the output of the following code ?

```php
<?php
   $a = array(
     "1" => "A", 1 => "B", "C", 2 => "D");
   echo count($a);
?>
```

????

4

Which of the following will generate an E_NOTICE error assuming the following code?

```php
<?php

$array = array(
    array(
        1, 2
    ),
    'a' => array(
        'b' => 1,
        'c'
    )
);
```

A: $array[] = 1;
B: echo $array[5][2];
C: echo $array[5][2] = 2;
D: isset($array[7][3][1]);

5

Read carefully: Which interface can be used to allow an object to be executed in a foreach loop?

A: ArrayObject
B: Iterator
C: ArrayList
D: Hashtable

6

Given the following PHP code, which of these answers create(s) a valid associative array in PHP?

```php
<?php

$one = array ('one', 'two','three');
$two = array (1, 2, 3);
```

A: array_combine($one, $two)
B: array_merge($one, $two)
C: array_values($two)
D: array_flip($one)

TEST YOUR KNOWLEDGE : ANSWERS

1. 6

2. 4

3. 2

4. B: `echo $array[5][2];`

5. B: `Iterator`

6. A: `array_combine($one, two)` *and*
   D: `array_flip($one)`

TOPIC FIVE: INPUT / OUTPUT

Files

Filesystem Functions

Streams

Contexts

Reading

Writing

FILES and FILESYSTEM FUNCTIONS

- TWO MAIN TYPES OF FUNCTIONS:

  `f*()` FUNCTIONS THAT WORK WITH A FILE RESOURCE
  EX: `fopen()`

  `file*()` FUNCTIONS THAT WORK WITH A FILENAME:
  EX: `file_get_contents()`

- FILES WITH RESOURCES
  - USER ASSIGNED A UNIQUE IDENTIFIER, THE "SESSION ID"
    - CREATE A FILE RESOURCE WITH `fopen()`

      1ST PARAMETER: FILE NAME (REQUIRED)

      2ND PARAMETER: FILE MODE (REQUIRED)

    - READ WITH `fread()`

      EX:

```
$fp =  fopen('file.txt',  'r');
while (!feof($fp))  {
     echo htmlspecialchars(fread($fp,  4096));
}
fclose($fp);
```

      OR

```
echo htmlspecialchars(
fread($fp, filesize('file.txt'));
```

FILES and FILESYSTEM FUNCTIONS (CONTINUED)

- WRITE TO RESOURCES

  `fwrite()` AND `fputs()` WRITE DATA INTO A RESOURCE

  EX:

```
$fp =  fopen('file.txt',  'w');
fwrite($fp,  'data...');
fclose($fp);
```

- OTHER FUNCTIONS

`fputcsv()`	WRITES AN ARRAY IN CSV FORMAT INTO A FILE
`fprintf()`	WRITES A FORMATTED STRING TO A STREAM

- OUTPUT FILES

`fpassthru()`	OUTPUTS ALL DATA OF A FILE HANDLE DIRECTLY TO THE OUTPUT BUFFER; STARTS AT CURRENT FILE POSITION USING `fread()` PLUS ESCAPING SPECIAL CHARACTERS IS OFTEN A BETTER ALTERNATIVE

FILE OPERATIONS (ONLY PARTIAL LIST… SEE PHP MANUAL)

- DIRECTORY

`chdir()`	CHANGES THE DIRECTORY
`chroot()`	CHANGES THE ROOT DIRECTORY
`readdir()`	READS AN ENTRY FROM THE DIRECTORY HANDLE
`rmdir()`	DELETES A DIRECTORY

- FILE INFORMATION

`finfo_open()`	CREATE A NEW FILEINFO RESOURCE
`finfo_file()`	RETURNS INFORMATION ABOUT A FILE

- FILESYSTEM

`basename()`	RETURNS FILENAME COMPONENT OF A PATH
`chmod()`	CHANGES THE FILE MODE
`copy()`	COPIES A FILE
`file_exists()`	CHECKS IF A FILE OR DIRECTORY EXISTS
`fpassthru()`	OUTPUTS ALL DATA OF A FILE HANDLE DIRECTLY TO THE OUTPUT BUFFER (STARTING AT THE CURRENT FILE POSITION)
`fputcsv()`	WRITES DATA INTO A RESOURCE
`fputs()`	
`rename()`	MOVES/RENAMES A FILE
`unlink()`	DELETES A FILE

STREAMS

- PROVIDE A WAY OF GROUPING AND MAKING AVAILABLE OPERATIONS WHICH HAVE FUNCTIONS AND ACTIONS IN COMMON
- PARTS OF A DATA STREAM:

  WRAPPER

  PIPELINES

  CONTEXT

  META DATA

- FILE WRAPPERS
  - PROVIDE INFORMATION ON PROTOCOLS AND ENCODINGS
    - CAN BE ANY FILE WRAPPER
    - ALLOWS FOR TWO PIPELINES AT MOST - FOR READING & WRITING
  - PREFIX IN FRONT OF A FILE PATH

`file://`	`php://`
`http://`	`compress.zlib://`
`https://`	`compress.bzip2://`
`ftp://`	`ftps://`

  - CUSTOM WRAPPERS

    `stream_wrapper_register(protocol, classname)`

    REGISTERS A PROTOCOL; IMPLEMENTATION IS PART OF THE CLASS

    - THE CLASS IMPLEMENTS STANDARD FUNCTIONALITY LIKE READING, WRITING, OR CHANGING THE FILE POSITION
    - `php_user_filter` IS A PREDEFINED CLASS IN PHP AND IS USED IN CONJUNCTION WITH USER-DEFINED FILTERS

- PIPELINES / TRANSPORT
  - CODE WRAPPER COMMUNICATION
  - CONTEXT: ADDITIONAL INFORMATION FOR A STREAM (EX: HTTP HEADERS FOR HTTP STREAMS)
  - META DATA: CAN BE DETERMINED WITH `stream_get_meta_data()`

- STREAM CONTEXTS
  - SET OF PARAMETERS AND WRAPPER OPTIONS THAT CAN MODIFY A STREAM'S BEHAVIOR
  - CREATE CONTEXTS WITH `stream_context_create()`
    - OPTIONS CAN BE SPECIFIED WHEN THE FUNCTION IS CALLED
    - PARAMETERS CAN BE SPECIFIED WITH `stream_context_set_params()`
  - CURRENT OPTIONS FOR A GIVEN STREAM CAN BE DETERMINED BY CALLING `stream_context_get_options`

- STREAM FILTERS
  - CAN BE APPLIED TO STREAM DATA

```
stream_filter_append($fp, 'filtername');
```

  - CAN CREATE CUSTOM FILTERS

```
stream_filter_register(filtername, classname);
```

  - CLASS IMPLEMENTS THE FOLLOWING METHOD

```
function filter($in,  $out, &$consumed,  $closing);
```

READING and WRITING

- READ IN THE COMPLETE CONTENTS OF A FILE

```
string file_get_contents(string filename [, bool
use_include_path [, resource context [, int offset [,
int maxlen ]]]])
```

- READ A FILE DELIMITED BY LINE INTO AN ARRAY

```
array file(string filename [, int use_include_path])
```

- READ AND OUTPUT A FILE TO THE OUTPUT BUFFER

```
int readfile(string filename [, int use_include_path])
```

- WRITE DATA INTO A FILE

```
file_put_contents(string filename, mixed data [, int
flags [, resource context]] )
```

- WRITE DATA INTO A RESOURCE

```
fwrite(), fputs() ...
$fp =  fopen('file.txt',  'w');
fwrite($fp,  'data...');
fclose($fp);
```

- WRITE TO STREAMS

`fprintf()` `printf` FOR RESOURCES

TEST YOUR KNOWLEDGE : QUESTIONS

1

Which function can be used to read and parse data from a CSV file?

????

2

What is the output of the following function call (assuming that foo.txt exists and contains text)?

```
$output = file("foo.txt");
```

A: A file handle that can be used in subsequent calls such as fread
B: True if the file could successfully be read, false if not
C: A string containing the contents of foo.txt
D: An array where every entry is a line from the file foo.txt
E. True if the file exists, false if not

3

What happens if you use fwrite to write data to a file opened in 'r' mode?

A: A PHP fatal error occurs
B: 0 is returned
C: An exception is thrown
D: A PHP warning occurs

4

Consider the following snippet of code. What is the name of the function that needs to be inserted in the placeholder?

```
$dh = opendir(".");
while ($file = ____($dh)) {
   echo $file;
}
```

????

5

Which of the following is NOT a default PHP input or output stream?

A: php://stdin
B. php://stdout
C. php://stderr
D. php://input
E. php://output
F. php://error

6

Which of the following functions does not accept a stream $context parameter?

A: fopen
B: fgets
C: file_get_contents
D: file

TEST YOUR KNOWLEDGE : ANSWERS

1. fgetcsv

2. D: An array where every entry is a line from the file foo.txt

3. B: 0 is returned

4. readdir

5. F: php://error

6. B: fgets

TOPIC SIX: FUNCTIONS

Syntax

Arguments

Variables

References

Returns

Variable Scope

Anonymous Functions
(Closures)

Type Declarations

FUNCTION DEFINITION

- BLOCKS OF CODE THAT EXECUTE IN ISOLATION (AND LOCAL SCOPE) THAT PERFORM AN ACTION
- FUNCTION NAMES ARE CASE-INSENSITIVE; DEFINED IN GLOBAL SCOPE
- CAN BE REFERENCED BEFORE BEING DEFINED UNLESS FUNCTION CONDITIONAL
- TYPES: BUILT-IN (PHP SUPPLIED); USER-DEFINED; EXTERNALLY PROVIDED

DECLARING FUNCTIONS

- RETURN VALUES AND PARAMETERS ARE OPTIONAL, PARAMETERS MAY BE ASSIGNED DEFAULT VALUES; SINCE PHP 7.1, NEW VOID FUNCTIONS AND METHODS ARE POSSIBLE; SET PARAM DEFAULT TO AVOID `Error` EXCEPTION.
- EX:

```
function myFunction ($p)  {
     // do something
    return $p;
}
$x = myFunction("ABC");   //$x == "ABC"
$x = myFunction();    //Error exception thrown!
```

- EX:

```
function myFunction ($p = "ABC")  {
    // do something
    return $p;
}
$x = myFunction("DEF");  //$x == "DEF"
$x = myFunction();       //$x == "ABC"
```

FUNCTION ARGUMENTS

`func_num_args()`	NUMBER OF PARAMETERS
`func_get_arg(nr)`	PARAMETER NUMBER "NR"S (STARTING AT 0)
`func_get_args()`	ALL PARAMETERS AS AN ARRAY

- ARGUMENT LIST IS A SET OF COMMA-DELIMITED EXPRESSIONS
- CAN PASS ARGUMENTS IN SEVERAL WAYS
  - BY VALUE (DEFAULT)
    - CREATES COPY: ARGUMENT CHANGES EXTEND ONLY WITHIN FUNCTION
  - BY REFERENCE
    - USE "&" TO SUPPLY PARAMETERS BY REFERENCE
    - CALL TIME PASS REFERENCE NOT ALLOWED ANY MORE
      - BY DEFAULT, ARGUMENT VALUES (PARAMETERS)
      - CHANGES TO ANY REFERENCE AFFECTS ALL REFERENCES

SPLAT OPERATOR

- `function myFunction($a, ...$b) {}`
- `$a` CONTAINS THE FIRST PARAMETER, `$b` IS AN ARRAY WITH ALL REMAINING PARAMETERS
- ALSO, SOMETIMES CALLED “REST PARAMETER”

RETURN VALUES

- `return` STATEMENT ENDS FUNCTION EXECUTION
- WILL RETURN VALUES THAT INCLUDE ARRAYS, OBJECTS, ANONYMOUS FUNCTIONS

VARIABLE SCOPE

- VARIABLES DECLARED WITHIN FUNCTIONS ONLY VISIBLE IN THAT FUNCTION
- VARIABLES DECLARED OUTSIDE OF FUNCTIONS ARE VISIBLE EVERYWHERE OUTSIDE OF FUNCTIONS
- FUNCTION USING `$GLOBALS` ARRAY OR "`GLOBAL`" KEYWORD

VARIABLE FUNCTIONS

- PARSED SIMILAR TO VARIABLE VARIABLES
- VARIABLES FOLLOWED BY PARENTHESES CAUSES SEARCH FOR, AND EXECUTION OF, FUNCTION WITH SAME NAME AS VARIABLE EVALUATION
- COMMONLY USED FOR CALLBACKS, FUNCTION TABLES
- SOME USE RESTRICTIONS WITH COMMON CONSTRUCTS
  - EX: `echo(), print()`

ANONYMOUS FUNCTIONS (CLOSURES)

- ENABLE CREATION OF FUNCTIONS WITHOUT SPECIFYING A NAME
- IMPLEMENTED USING THE `Closure` CLASS
- COMMONLY USED AS PARAM VALUE FOR CALLBACK FUNCTIONS, OR ALTERNATIVELY AS VARIABLE VALUES
- TO INHERIT VARIABLES FROM PARENT SCOPE (FUNCTION IN WHICH CLOSURE WAS DECLARED), THESE VARIABLES MUST BE DECLARED IN THE FUNCTION HEADER WITH THE "`USE`" KEYWORD, OR PASSING PARAMETERS IN THE CALL LINE
- NEW CLOSURE `TYPE HINT`

TYPE DECLARATIONS

- PROVIDE DATA TYPE OF PARAMETER
- `function myFunction(int $a, string $b, bool ...$c) {}`
  - ALLOWED DATA TYPES: `int`, `string`, `bool`, `float`, `array`, ANYTHING `callable`, `iterable` `<class name>` (NEW PSEUDO TYPE INTRODUCED IN 7.1), `<interface name>`, `nullable`
- ALSO POSSIBLE TO PROVIDE RETURN TYPES
  - `function myFunction(float $a): int {}`
  - `void` RETURN TYPE IF THERE IS NO RETURN VALUE
- BY DEFAULT, VALUES WILL BE CONVERTED INTO THE TARGET DATA TYPE
- `declare(strict_types=1)` AT THE BEGINNING OF THE PHP FILE ENFORCES THE TARGET DATA TYPE (OTHERWISE A TYPE ERROR OCCURS).
- STRICT MODE ALSO INCLUDES ENFORCING OF RETURN TYPES
- NULLABLE TYPES FOR PARAMETERS AND RETURN VALUES SINCE PHP 7.1: `function myFunction(?int $a): ?string {}`

TEST YOUR KNOWLEDGE : QUESTIONS

1

What is the output of the following code? (Choose 2)

```
<?php
    function addValues() {
        $sum = 0;
        for ($i = 1; $i <= func_num_args(); $i++) {
            $sum += func_get_arg($i);
        }
        return $sum;
    }
    echo addValues(1,2,3);
?>
```

A: 5

B: 6

C: A parser error

D: A warning

2

Take a look at the following code...

```
<?php
function myFunction($a) {
  $a++;
}
$b = 1;
myFunction($b);
?>
```

What code do you need to replace so that $b has the value 2 at the end of the script?

A: Line 02: Replace $a with &$a

B: Line 03: Replace $a++ with $a +=2;

C: Line 03: Replace $a++ with $a *=2;

D: Line 06: Replace $b with &$b

3

What is the output of the following code (ignoring any PHP notices and error messages)?

```php
<?php
$v1 = 1;
$v2 = 2;
$v3 = 3;
function myFunction() {
  $GLOBALS['v1'] *= 2;
  $v2 *= 2;
  global $v3; $v3 *= 2;
}
myFunction();
echo "$v1$v2$v3";
?>
```

A: 123

B: 246

C: 226

D: 126

4

What is the output of the following code?

```php
<?php

function increment ($val)
{
    return ++$val;
}

echo increment (1);

?>
```

????

5

What is the output of the following code?

```
1  <?php
2
3  function func($x, $x=1, $x=2) {
4      return $x;
5  }
6
7  print func(3);
```

A: Syntax error
B: 3 will be printed
C: 2 will be printed
D: None of the above

6

What is the output of the following code?

```
1  <?php
2
3  $x = function func($a, $b, $c) {
4      print "$c|$b|$a\n";
5  };
6
7  print $x(1,2,3);
```

A: Syntax error
B: 3|2|1
C: 1|2|3

7

What is the best way to test if $param is an anonymous function in a method?

A:

A: Use method_exists($this,$param)
B: Use is_callable($param)
C: Use the type-hint Closure on the signature
D: Use is_executable($param)

8

If a function signature contains three parameters, for which of them may the splat operator be used?

A:

A: The first parameter
B: The second parameter
C: The third parameter
D: All three parameters

TEST YOUR KNOWLEDGE : ANSWERS

1. A: 5 *and* D: a warning

2. A: Line 02: Replace $a with &$a

3. C: 226

4. 2

5. D: None of the above

6. A: Syntax error

7. C: Use the type-hint Closure on the signature

8. C: The third parameter

TOPIC SEVEN: OOP

Instantiation

Instance Methods & Properties

Class Definition

Modifiers / Inheritance Abstracts

Interfaces

Exceptions

Static Methods & Properties

Autoload

Reflection

Type Hinting

Class Constants

Late Static Binding

Magic Methods

SPL

Traits

OBJECTS

- CONVERTING OBJECTS TO STRINGS
  - THE MAGIC METHOD `__toString()` IS CALLED, IF AVAILABLE
  - INCLUDES PRINT, STRING INTERPOLATION, OPERATION WITH STRINGS, CALLING FUNCTIONS THAT EXPECT STRINGS, ...

- COPYING OBJECTS
  - KEYWORD: `clone`
  - OBJECTS ARE ALWAYS PASSED BY REFERENCE
  - CLONING AN OBJECT CAUSES THE OBJECT ITSELF TO BE COPIED INSTEAD OF PASSING THE REFERENCE
    - CLONING BY DEFAULT COPIES ALL THE PROPERTIES, BUT USES ASSIGNMENT, NOT CLONE, SO CLONING IS "SHALLOW" BY DEFAULT
  - PHP EXECUTES THE MAGIC METHOD `__clone()` UPON CLONING, IF AVAILABLE

- SERIALIZING OBJECTS
  - FUNCTIONS: `serialize()` / `unserialize()`
  - MAGIC METHOD `__sleep()` IS EXECUTED WITH SERIALIZATION, IF AVAILABLE
  - ALLOWS YOU TO SPECIFY WHICH PROPERTIES SHOULD BE STORED (SERIALIZED) AND WHICH SHOULD NOT BE STORED
    - CAN ALSO CREATE/CHANGE PROPERTIES FOR SERIALIZATION
  - MAGIC METHOD `__wakeup()` IS EXECUTED WITH DESERIALIZATION, IF AVAILABLE
    - EX: TO OPEN A DATABASE CONNECTION UNIQUE TO THE OBJECT

CREATING CLASSES AND INSTANTIATION

- KEYWORD: `class`
- A CLASS DEFINES THE ABSTRACT CHARACTERISTICS OF AN OBJECT, INCLUDING ITS PROPERTIES AND METHODS
- PROPERTIES AND METHODS DEFINED BY A CLASS ARE CALLED "MEMBERS"
- STRUCTURE:

  KEYWORD > CLASS NAME > { CONSTANTS, PROPERTIES & METHODS }

  WHERE

  PROPERTIES = CLASS VARIABLES AND METHODS = CLASS FUNCTIONS

- CREATE AN INSTANCE OF A CLASS WITH THE KEYWORD "`new`"
  - AN OBJECT IS CREATED UNLESS IT HAS A CONSTRUCTOR DEFINED THAT THROWS AN EXCEPTION
  - CLASSES SHOULD BE DEFINED "PRIOR" TO INSTANTIATION
    - WITH AUTOLOADING, A CLASS CAN BE DEFINED (LOADED) AT THE MOMENT IT IS REQUIRED BY THE NEW OPERATOR
    - ASSIGNING AN EXISTING OBJECT TO A NEW VARIABLE, OR PASSING AS A FUNCTION PARAMETER, RESULTS IN A REFERENCE TO THE SAME OBJECT
    - EX:

```
class myClass {

    // ...

)

 $c = new myClass();
```

- CREATE AN ANONYMOUS CLASS WITH "`$c = new class { }`"

INHERITANCE: CLASS

- USE THE KEYWORD `extends` IN THE CLASS DECLARATION TO HAVE A CLASS INHERIT THE METHODS AND PROPERTIES OF ANOTHER CLASS
  - A CLASS CAN INHERIT FROM ONLY ONE CLASS
  - INHERITED METHODS AND PROPERTIES CAN BE OVERRIDDEN BY REDECLARING THEM WITH SAME NAME

- WHENEVER AN EXTENDING CLASS OVERRIDES THE PARENTS' METHOD DEFINITION, THE PARENTS' METHOD WILL NOT BE CALLED
  - SIMILARLY FOR MAGIC METHODS DEFINED IN THE SUBCLASS
  - OVERRIDDEN PROPERTIES AND METHODS CANNOT HAVE A LOWER VISIBILITY
    - FOR EXAMPLE, IF `classA` HAS A PUBLIC METHOD CALLED `getA()`, `classB` WHICH EXTENDS `classA` CANNOT DECLARE A METHOD CALLED `getA()` AND DECLARE IT PRIVATE
    - CLASSES AND METHODS MARKED WITH FINAL CANNOT BE OVERRIDDEN
    - THE PARAMETER SIGNATURE CANNOT BE "STRICTER" THAN BEFORE or AN `E_STRICT` ERROR WILL BE THROWN (EXCEPT FOR THE CONSTRUCTOR)

ABSTRACT CLASSES

- KEYWORD: `abstract`
- CAN BE USED AS A BASE OR SKELETON OF A DERIVED CLASS
- MAY CONTAIN METHOD IMPLEMENTATIONS
- ABSTRACT METHODS MUST BE IMPLEMENTED IN DERIVED CLASSES
- VISIBILITY CAN BECOME WEAKER / MORE PERMISSIVE, BUT NOT STRONGER / LESS PERMISSIVE (EX: YOU CANNOT GO FROM PUBLIC TO PRIVATE)

INTERFACES

- KEYWORDS: `interface`, `implements`
- PROVIDES METHODS TO IMPLEMENT
  - DOES NOT CONTAIN ANY IMPLEMENTATION ITSELF
- CLASSES MAY IMPLEMENT MORE THAN ONE INTERFACE
- INTERFACES MAY INHERIT FROM OTHER INTERFACES USING THE `extends` KEYWORD
- ALL METHODS ARE ASSUMED TO BE PUBLIC IN THE INTERFACE DEFINITION - CAN BE DEFINED EXPLICITLY AS PUBLIC, OR IMPLICITLY
- WHEN A CLASS IMPLEMENTS MULTIPLE INTERFACES, THERE CANNOT BE ANY NAMING COLLISION BETWEEN METHODS DEFINED IN THE DIFFERENT INTERFACES UNLESS THE DUPLICATE METHODS HAVE THE SAME SIGNATURE

EXCEPTIONS

- KEYWORD: `throw ...` TO LAUNCH AN EXCEPTION
- TRY/CATCH/FINALLY STRUCTURE: `try{...} catch(...){...} finally {...}`
  - A `catch` BLOCK MAY USE TYPE-HINTING TO EXPECT SPECIFIC EXCEPTIONS
  - NEED TO PROVIDE THE TYPE IN THE CATCH
    - TYPE MAY BE AN EXCEPTION EXTENDED FROM ANOTHER
  - `finally` BLOCK CONTAINS CODE THAT IS EXECUTED WHETHER AN EXCEPTION HAPPENED OR NOT
- CUSTOM EXCEPTIONS NEED TO EXTEND THE BASE `Exception` CLASS

CONSTRUCTORS / DESTRUCTORS

- `__construct()` IS A RESERVED METHOD NAME FOR THE CLASS CONSTRUCTOR
- `function __construct` IS USED TO DECLARE A CONSTRUCTOR CLASS METHOD
  - THESE ARE SETUP METHODS FOR NEW OBJECTS
- `__destruct()` IS A RESERVED METHOD NAME FOR THE CLASS DESTRUCTOR
  - IF A CLASS MAINTAINS AN OPEN FILE HANDLE OR CONNECTION THROUGHOUT ITS LIFE, THEN THE `__destruct()` METHOD IS A GOOD PLACE FOR A CLOSE-TYPE OPERATION
- `__destruct()` IS CALLED WHENEVER AN OBJECT IS DESTROYED (WHEN ALL ITS REFERENCES ARE REMOVED OR THE END OF THE SCRIPT) IS REACHED

PROPERTIES (VARIABLES)

- CLASS MEMBER VARIABLES ARE CALLED PROPERTIES OR ATTRIBUTES
- VISIBILITY KEYWORDS: PUBLIC, PRIVATE, PROTECTED
- DECLARED LIKE ANY VARIABLE; IF INITIALIZED, MUST BE WITH A CONSTANT VALUE
- CREATING A VARIABLE WITHIN THE CLASS…
- EX:

```
class myClass {
    public $member = "ABC";
// ...
}
$c = new myClass();
echo $c->member;
```

METHODS (FUNCTIONS)

- METHODS ARE FUNCTIONS WITHIN A CLASS CONSTRUCT
- IF VISIBILITY IS NOT EXPLICITLY DEFINED, THEN DEFAULT IS PUBLIC
- CAN ACCESS PROPERTIES OR METHODS OF THE CURRENT INSTANCE USING $this (FORMAT `$this->property`), FOR NON-STATIC PROPERTIES
- EX:

```
class myClass {
     public $member = "ABC";
     function showMember() {
         echo $this->member;
      }
}
$c = new myClass();
$c->showMember();
```

STATIC PROPERTIES / METHODS

- KEYWORD: `static`
- SCOPE RESOLUTION OPERATOR (`::`)
  - TOKEN THAT PERMITS ACCESS TO THE STATIC, CONSTANT, OR OVERRIDDEN PROPERTIES / METHODS OF A CLASS
    - USE THE CLASS NAME WHENEVER REFERENCING THESE ELEMENTS OUTSIDE OF THE CLASS DEFINITION
    - SELF ALWAYS REFERS TO THE CURRENT CLASS; PARENT REFERS TO THE PARENT OF THE CURRENT CLASS (THE ONE IT EXTENDS)
    - STATIC CONTEXT IS WORKING WITH A CLASS DIRECTLY AND NOT WITH OBJECTS
- REQUIRES DECLARATION, AS WITH ANY METHOD; OTHERWISE RESULTS IN A FATAL ERROR
- NO OBJECT INSTANCES
- YOU CAN ACCESS A STATIC CLASS METHOD USING A VARIABLE REFERENCE (EX: `ClassName::$varMethod`)

AUTOLOAD

- PHP EXECUTES THE `__autoload()` FUNCTION, IF DEFINED, WHENEVER THERE IS AN ATTEMPT TO USE A CLASS OR INTERFACE THAT HAS NOT BEEN DEFINED
  - PARAM: NAME OF MISSING CLASS
- EXCEPTIONS THROWN IN `__autoload()` CAN NOW BE CAUGHT IN A CATCH BLOCK, AS LONG AS THE CUSTOM EXCEPTION CLASS IS AVAILABLE
  - `__autoload()` CAN RECURSIVELY LOAD THE CUSTOM EXCEPTION CLASS
- `spl_autoload()` IS USED AS AN IMPLEMENTATION FOR `__autoload()`
  - CALL `spl_autoload_register()`, WHICH WILL REGISTER A FUNCTION AS AN `__autoload()` IMPLEMENTATION
  - BOOLEAN: IT PREPENDS THE AUTOLOADER ON THE AUTOLOAD STACK WHEN TRUE; APPENDS WHEN FALSE

REFLECTION

- ALLOWS FOR INTROSPECTION OF:
  - OBJECTS
  - CLASSES
  - METHODS
  - PROPERTIES
  - FUNCTIONS
  - PARAMETERS
  - EXCEPTIONS
  - EXTENSIONS
  - GENERATORS
  - RETURN TYPES
- HELPER CLASSES FORMAT: `Reflection`XXX (WHERE XXX = OBJECT/CLASS, ...)

TYPE HINTING

- DATA TYPES MAY BE PROVIDED FOR FUNCTION & METHOD PARAMETERS AND RETURN TYPES
  - CLASSES
  - ARRAYS
  - INTERFACES
  - CALLABLE
  - ITERABLE
  - SCALARS
- IF A PARAMETER DATA TYPE DOES NOT MATCH A SPECIFIED TYPE HINT, A FATAL ERROR OCCURS
- CLASS TYPE MATCHES EITHER EXACT TYPE OR ANY TYPE THAT EXTENDS OR IMPLEMENTS (IN THE CASE OF INTERFACES) THIS TYPE
- AS LONG AS THE TYPE-HINTED CLASS EXISTS SOMEWHERE BELOW THE PASSED CLASS' HIERARCHY, IT WILL BE ALLOWED
- STRICT DATA TYPING AVAILABLE WITH `declare(strict_types=1)`
- MORE INFORMATION IN THE FUNCTIONS CHAPTER OF THIS GUIDE

CLASS CONSTANTS

- A CONSTANT THAT IS ONLY AVAILABLE WITHIN A CLASS OR INTERFACE SCOPE
  - SIMILAR IN CONCEPT TO A CONSTANT THAT IS RE-DEFINED USING `define()`
- INTERFACES MAY ALSO INCLUDE CONSTANTS
- REFERENCE A CLASS CONSTANT WITH THE `<classname>::CONSTANT` SYNTAX; THE CLASSNAME CAN ACTUALLY BE A VARIABLE
- VISIBILITY OF CLASS CONSTANTS AVAILABLE SINCE PHP 7.1

LATE STATIC BINDING

- BINDS THE "`STATIC`" KEYWORD TO THE NAME OF THE CALLING CLASS LATE AT RUN TIME
  - STORES THE CLASS NAMED IN THE LAST "NON-FORWARDING" CALL
  - STATIC METHOD CALLS CLASS EXPLICITLY NAMED (`name::xx`)
- STATIC REFERENCES (EX: `self::xx`) USE THE CURRENT CLASS TO WHICH THE FUNCTION BELONGS

MAGIC METHODS

- WHEN ACCESSING NON-EXISTENT PROPERTIES, PHP WILL EXECUTE SPECIAL ("MAGIC") FUNCTIONS, IF AVAILABLE
- EX:

`__get()` READS A NON-EXISTENT PROPERTY

`__set()` WRITES A NON-EXISTENT PROPERTY

`__isset()` CHECKS IF THE NON-EXISTENT PROPERTY IS SET

`__unset()` UNSETS OR DESTROYS A NON-EXISTENT PROPERTY

- WHEN ACCESSING NON-EXISTENT METHODS, PHP WILL EXECUTE THE SPECIAL `__call()` FUNCTION, IF AVAILABLE
- THE `__callStatic()` MAGIC METHOD ALLOWS THE CALLING OF NON-EXISTENT STATIC METHODS (MUST BE PUBLIC)

SPL

- ACRONYM FOR "STANDARD PHP LIBRARY"
- EXAMPLES:

  `ArrayIterator`

  - CREATES A STAND-ALONE ITERATOR OBJECT OVER AN ARRAY, WHICH ALLOWS IT TO ITERATE OVER THE SAME ARRAY MULTIPLE TIMES AND ALSO PASSES THE ITERATION STATE AROUND IN AN OBJECT
  - EX: CURRENT ELEMENT, NEXT ELEMENT
  - ALLOWS `foreach` ACCESS

  `ArrayObject`

  - INTERFACE THAT IMPLEMENTS AN ARRAY
  - EX: NUMBER OF ELEMENTS, READ/WRITE ACCESS
  - ALLOWS ACCESS TO THE OBJECT USING ARRAY FUNCTIONS

GENERATORS

- MECHANISM TO GENERATE ITERATORS
- A GENERATOR FUNCTION RETURNS MULTIPLE VALUES
- INDIVIDUAL VALUES ARE RETURNED USING THE `yield` KEYWORD
- EX:

```
function myGenerator() {
    for ($i = 1; $i <= 10; i++) {
        yield $i;
   }
}
```

- GENERATOR MAY USE `return` FOR THE FINAL RETURN EXPRESSION; THE GENERATOR´S `getReturn()` METHOD GIVES ACCESS TO THIS VALUE.

TRAITS

- A CONSTRUCT THAT ENCAPSULATES REUSABLE PROPERTIES AND METHODS
- A TRAIT IS LIKE A NON-INSTANTIABLE CLASS
- CLASSES CAN USE TRAITS
- KEYWORD `trait` TO DEFINE A TRAIT, KEYWORD `use` TO USE IT WITHIN A CLASS
- TRAIT PRECENDENCE: CURRENT CLASS MEMBERS > TRAIT METHODS > INHERITED METHODS
- MAY CHANGE VISIBILITY OF TRAIT METHODS USING THE `as` KEYWORD:

```
class c { use t { method1 as protected; } }
```

- A CLASS MAY USE MULTIPLE TRAITS
    - FATAL ERROR IF TRAITS HAVE CONFLICTING NAMES
- CONFLICT RESOLUTION WITH `insteadof` OPERATOR:

```
use t1, t2 { t1::method1 insteadof t2; }
```

- CAN ALSO USE ALIASING:

```
use t1, t2 { t2::method1 as method1_from_t2; }
```

TEST YOUR KNOWLEDGE : QUESTIONS

1

What is the relationship between classes and objects?

A: A class is a collection of objects

B: A class is a template from which objects are made

C: Objects are distinguished from one another by assigning them to a class

2

What is the output of the following code?

```php
<?php
interface Interface1{
    public function getFoo();
    public function setFoo($value);
}

interface Interface2{
    public function getFoo();
    public function setBar();
}

class Baz implements Interface1, Interface2 {
    public function getFoo(){
        return 'foo';
    }

    public function setFoo($value){
        $this->foo = $value;
    }

    public function setBar($value){
        $this->bar = $bar;
    }
}

$baz = new Baz();
$baz->getFoo();
```

A: ...

B: Parser error

C: Fatal error

D: None of the above

3

What is the output of the following code?

```
<?php
    abstract class myBaseClass {
         abstract protected function doSomething();
          function threeDots()  {
              return '…';
         }
    }
    class myBaseA extends myBaseClass {
        protected function doSomething() {
          echo $this->threeDots();
          }
    }
    $a = new myClassA();
    $a->doSomething();
?>
```

A: …

B: Parser error

C: Fatal error

D: None of the above

B: Parser error

4

Which of the following statements about exceptions is NOT true?

A: Only objects of class Exceptions, classes extending it, and class Error can be thrown

B: It is recommended that catch(Exception) be the last catch clause

C: Exceptions can be re-thrown after being caught

D: Uncaught exceptions always cause fatal errors

5

Which of the following statements about static functions is true?

Choose two

A: Static functions can only access static properties of the class

B: Static functions cannot be called from non-static functions

C: Static functions cannot be abstract

D: Static functions cannot be inherited

6

Which of the following CANNOT be a part of the class definition?

A: Constant

B: Property

C: Method

D: Interface

B: Multiple autoloading functions can be defined using spl_autoload_register()

7

Reflection functions CANNOT ...

A: Instantiate objects

B: Modify static properties of the class

C: Get the namespace name of a class

D: Modify static variables in functions

8

Of the following statements about typehints, which is NOT true?

Choose two

A: Typehinted parameters can default to NULL

B: A typehint class does not have to be defined when a function definition is parsed

C: Objects should be of the same class to satisfy typehinting

D: Typehints cannot be PHP scalar types

9

Which is the correct syntax to define a class constant for the class MyClass?

A: const $NAME="value";

B: Define("MyClass::NAME", "value");

C: const NAME="value";

D: static final $NAME='value';

10

What is the output of the following code?

```php
<?php
class Magic{
    public $a = "A";
    protected $b = array("a" => "A", "b" => "B", "c" => "C");
    protected $c = array(1, 2, 3);

    public function __get($v) {
        echo "$v,";
        return $this->b[$v];
    }

    public function __set($var, $val) {
        echo "$var: $val,";
        $this->$var = $val;
    }
}
$m = new Magic();
echo $m->a.",".$m->b.",".$m->c.",";
$m->c = "CC";
echo $m->a.",".$m->b.",".$m->c;
?>
```

A: A,Array,Array,A,Array,Array,CC

B: b,c,A,B,C,c: CC,b,c,A,B,C

C: a,b,c,A,B,C,c: CC,a,b,c,A,B,C

D: b,c,A,B,C,c: CC,b,c,A,B,CC

11

Which statement about SPLObjectStorage class is NOT true?

A: It uses objects as indexes

B: It can be used to implement sets of objects

C: It allows arbitrary data to be associated with an object

D: It permits the serialization of any object

TEST YOUR KNOWLEDGE : ANSWERS

1

B: A class is a template from which objects are made

2

C: Fatal Error

3

C: Fatal Error

4

A: Only objects of class Exceptions, classes extending it, and class Error can be thrown

D: Uncaught exceptions always cause fatal errors

5

A: Static functions can only access static properties of the class

C: Static functions cannot be abstract

6

D: Interface

7

D: Modify static variables in functions

8

C: Objects should be of the same class to satisfy type hinting

D: Typehints cannot be PHP scalar types

9

C: const NAME="value";

10

B: b,c,A,B,C,c: CC,b,c,A,B,C

11

D: It permits the serialization of any object

TOPIC EIGHT: DATABASES

SQL

JOINS

ANALYZING QUERIES

PREPARED STATEMENTS

TRANSACTIONS

PDO

DEFINITION

- WAY OF STORING AND RETRIEVING DATA EFFICIENTLY

KEYS

- PRIMARY KEY: COLUMN OF UNIQUE VALUES THAT DESCRIBE AN ENTRY IN THE DATA TABLE
- FOREIGN KEY: PRIMARY KEY FROM ANOTHER TABLE; ENABLES RELATIONAL DATABASES

SQL

- CREATE A TABLE:

```
CREATE TABLE tbl (
    id INT NOT NULL PRIMARY KEY,
    field1 VARCHAR(100),
    field2 CHAR(32) NOT NULL
)
```

  - NOTE: `NULL` IS NOT THE SAME AS THE NUMBER "`0`", "`false`", OR AN EMPTY STRING... IT REPRESENTS "`NO VALUE`" OR "`MISSING VALUE`"

- READ DATA:

```
SELECT field1, field2 FROM tbl
    WHERE field3 = 'value'
```

- INSERT DATA:

```
INSERT INTO tbl
    (field1, field2, field3) VALUES
    ('value1', 2, 'value3')
```

SQL (CONTINUED)

- UPDATE DATA:

```
UPDATE tbl
    SET field1 = 'value1', field2 = 'value2'
    WHERE field3 = 'value3'
```

- DELETE DATA:

```
DELETE FROM tbl WHERE field1 = 'value1'
DROP TABLE tbl
DROP DATABASE dbName
```

- SORTING (ORDER BY)
  - ORDER BY ASCENDING (ASC) OR DESCENDING (DESC)

```
SELECT * FROM tbl ORDER BY col DESC
```

- GROUPING (GROUP BY)
  - IN GENERAL, THE COLUMNS USED TO GROUP BY MUST BE INCLUDED IN THE SELECT LIST

```
SELECT col1, col2 FROM tbl
    GROUP BY col1
```

- AGGREGATION

`AVG()`	AVERAGE VALUE
`COUNT()`	NUMBER OF ELEMENTS
`DISTINCT COUNT()`	NUMBER OF DISTINCT ELEMENTS
`MIN()`	MINIMAL VALUE
`MAX()`	MAXIMUM VALUE
`SUM()`	SUM OF VALUES

JOINS

- INNER JOIN

  EX: RETURNS ALL ENTRIES IN TAB1 AND TAB2 LINKED USING THE PRIMARY/FOREIGN KEY, AND THAT FULFILL THE WHERE CLAUSE IN TAB1

```
SELECT * FROM tab1
    INNER JOIN tab2
    ON tab1.primkey = tab2.forkey
    WHERE tab1.col1 = 'value1'
```

- LEFT JOIN

  EX: ALL DATA FROM THE "LEFT" TABLE IS USED, EVEN IF THERE IS NO MATCH IN THE "RIGHT" TABLE

```
SELECT * FROM tab1
    LEFT JOIN tab2
    ON tab1.primkey = tab2.forkey
    WHERE tab1.col1 = 'value1'
```

- RIGHT JOIN

  EX: ALL DATA FROM THE "RIGHT" TABLE IS USED, EVEN IF THERE IS NO MATCH IN THE "LEFT" TABLE

```
SELECT * FROM tab1
    RIGHT JOIN tab2
    ON tab1.primkey = tab2.forkey
    WHERE tab2.col1 = 'value1'
```

PREPARED STATEMENTS

- SIMILAR IN CONCEPT TO TEMPLATES - CONTAIN COMPILED CODE USED TO RUN COMMON SQL OPERATIONS
  - ADVANTAGES:
    - QUERY ONLY PARSED ONCE, BUT ALLOWS FOR MULTIPLE EXECUTIONS, WITH SAME OR DIFFERENT PARAMETERS (PERFORMANCE CONSIDERATION)
    - RELATED PARAMETERS DO NOT NEED TO BE QUOTED (SECURITY CONSIDERATION)
  - ONLY FEATURE PDO WILL EMULATE FOR ADAPTERS THAT DO NOT SUPPORT PREPARED STATEMENTS

TRANSACTIONS

- COMBINES INDIVIDUAL SQL OPERATIONS INTO ONE
- USUALLY START WITH BEGIN OR BEGIN TRANSACTION
- EXECUTE THE TRANSACTION USING COMMIT
- CANCEL THE TRANSACTION USING ROLLBACK

PDO (PHP DATA OBJECTS EXTENSION)

- PROVIDES INTERFACE FOR ACCESSING DATABASES - A DATA-ACCESS ABSTRACTION LAYER
  - CAN USE THE SAME FUNCTIONS TO MANIPULATE DATABASES, REGARDLESS OF DB TYPE
    - NOT FOR DATA TYPE OR SQL ABSTRACTION
- MUST USE DATABASE-SPECIFIC PDO ADAPTERS TO ACCESS A DB SERVER
  - DATABASE ADAPTERS IMPLEMENTING PDO INTERFACES EXPOSE DATABASE-SPECIFIC FEATURES AS REGULAR EXTENSION FUNCTIONS
- RUNTIME CONFIGURATION OPTIONS:
  - `pdo.dsn.*` IN `php.ini`
  - `PDO::setAttribute()`
- SET OF PREDEFINED CLASS CONSTANTS AVAILABLE
- ERROR SETTINGS AVAILABLE: Silent, Warning, AND Exception
- CONNECTIONS
  - CONNECTIONS ARE MADE BY CREATING AN INSTANCE OF THE PDO CLASS, *NOT* BY CREATING INSTANCES OF `PDOStatement` OR `PDOException`
  - EX: CONNECTING TO MYSQL

```
<?php
$dbh = new
PDO('mysql:host=localhost;
     dbname=test', $user, $pass);
?>
```

QUERIES

PDO::query()

EXECUTES A SQL STATEMENT, IN A SINGLE FUNCTION CALL, AND RETURNS THE RESULTING VALUES AS A PDOStatement OBJECT

NEED TO RETRIEVE ALL DATA IN THE RESULT SET BEFORE CALLING QUERY FUNCTION AGAIN

FETCH

PDOStatement->setFetchMode

SETS THE DEFAULT FETCH MODE (EX: FETCH_COLUMN)

- COMMON FETCH MODES: PDO::FETCH*: _ASSOC, _OBJ, _CLASS
- DEFAULT FETCH MODE: PDO::FETCH_BOTH

TRANSACTIONS

PDO::beginTransaction()

TURNS OFF AUTOCOMMIT MODE FOR CHANGES MADE TO THE DATABASE

PDO::commit()

CALL TO END TRANSACTION AND COMMIT CHANGES

PDO::rollBack()

CALL TO REVERSE ALL CHANGES MADE TO THE DATABASE AND REACTIVATE AUTOCOMMIT MODE

PDOSTATEMENT

- ONLY VALUES CAN BE BOUND (*NOT* ENTITIES, SUCH AS TABLE NAMES AND COLUMN NAMES)
- ONLY SCALARS CAN BE BOUND TO THE VALUES (NOT ARRAYS OR NULLS)

`PDO::prepare()` AND `PDOStatement::execute()`

`PDO::prepare()` IS USED TO PREPARE THE STATEMENT OBJECT , WHILE
`PDOStatement::execute()` IS USED TO ISSUE THE STATEMENT

IF USING PARAMS, MUST EITHER PASS AN ARRAY OF INPUT

PARAM VALUES, OR CALL
`PDOStatement::bindParam()`TO BIND THE PARAMETER PLACEHOLDERS TO THE CORRESPONDING VARIABLES

`PDOStatement::bindParam()`

BINDS THE VARIABLE AS A REFERENCE TO THE CORRESPONDING PARAMETER PLACEHOLDER IN THE SQL STATEMENT; EVALUATED ONLY WHEN `PDOStatement::execute()` IS CALLED

`PDOStatement::bindValue()`

BINDS A LITERAL VALUE, OR THE CURRENT VALUE OF A VARIABLE, TO THE CORRESPONDING PARAMETER PLACEHOLDER IN THE SQL STATEMENT

`PDOStatement::bindColumn()`

BINDS A VARIABLE TO A DESIGNATED DATABASE COLUMN

`PDOStatement::closeCursor()`

FREES ANY RESOURCES TIED TO THE `PDOStatement` OBJECT

APPROPRIATE FOR A SINGLE ISSUE OF A SELECT STATEMENT

`PDO::exec()`

EXECUTES A SQL STATEMENT IN A SINGLE FUNCTION CALL, AND RETURNS THE NUMBER OF ROWS (NOT THE DATA) AFFECTED BY THE STATEMENT

APPROPRIATE FOR MULTIPLE CALLS TO A SELECT STATEMENT

TEST YOUR KNOWLEDGE : QUESTIONS

1

Given the following table called "names" ...

pos	name	email
-2	anna	anna@example.com
-1	betty	betty@example.com
NULL	clara	clara@example.com
1	demi	demi@example.com
2	emma	emma@example.com
3	gabi	gabi@example.com

... how many rows will be returned from the following query?

```
SELECT * FROM names WHERE pos < 10
```

A: 3
B: 4
C: 5
D: 6

2

Given the following table called "names"...

id	name
1	anna
2	betty
3	clara
4	demi
5	emma

... and the following table called "emails"

id	email
1	anna@example.com
3	clara@example.com
5	emma@example.com
7	gabi@example.com
9	julia@example.com

... how many rows will be returned from the following query?

```
SELECT names.name, emails.email
 FROM names
JOIN emails ON emails.id = names.id
```

A: 3
B: 5
C: 9
D: 10

3

Given the following table called "names"...

```
 id   |  name   |  email
 ---  |  -------  |  ------------------
1     |  anna    | anna@example.com
2     |  betty   | betty@example.com
3     |  clara   | clara@example.com
4     |  anna    | anna@example.com
5     |  betty   | betty@example.com
6     |  clara   | clara@example.com
```

A: 2

B: 4

C: 6

D: None – the prepared statement is invalid

.

.. what will the COUNT() value be when the following PHP code runs? (Assume PDO connection is valid)

```
$pdo = new PDO(...);
$sql = "SELECT :cols FROM names WHERE name = :name";
$stmt = $pdo->prepare($sql);
$stmt->bindValue(':cols', 'COUNT(id)');
$stmt->bindValue(':name', 'anna');
$stmt->execute();
```

4

Given the following table called "names" ...

```
id |  name   |  email
-- |  -------  |  ------------------
1  |  anna    |  anna@example.com
2  |  betty   |  betty@example.com
3  |  clara   |  clara@example.com
```

A: 2

B: 3

C: 4

D: Invalid – the transaction has been rolled back

... and the following PDO code (assume PDO connection is valid)...

```
$pdo = new PDO(...);
$pdo->beginTransaction();
$pdo->query("INSERT INTO NAMES (name, email) VALUES
          ('demi', 'demi@example.com')");
$stmt = $pdo->query('SELECT COUNT(*) FROM names');
$count1 = $stmt->fetchColumn();
$pdo->rollBack();
$stmt = $pdo->query('SELECT COUNT(*) FROM names');
$count2 = $stmt->fetchColumn();
```

... what is the value of `$count2` **?**

5

Given the following table called "names" ...

```
id |  name   |  email
-- | ------- | ------------------
1  |  anna   |  anna@example.com
2  |  betty  |  betty@example.com
3  |  clara  |  clara@example.com
```

A: 'anna'
B: 'betty'
C: 'clara'
D: NULL

... what is the value of $name at the end of the following PHP code? (Assume PDO connection is valid)

```
$pdo = new PDO(...);
$name = null;
$stmt = $pdo->prepare('SELECT * FROM names WHERE name =
                  :name');
$stmt->bindValue(':name', 'anna');
$stmt->execute();
while ($row = $stmt->fetch()) {
    var_dump($name);
}
```

TEST YOUR KNOWLEDGE : ANSWERS

1. C: 5

2. A: 3

3. D: NONE - the prepared statement is invalid

4. B: 3

5. D: NULL

TOPIC NINE: SECURITY

Configuration

Session Security

Cross-Site Scripting

Cross-Site Request Forgeries

SQL Injection

Remote Site Injection

Email Injection

Input Filtering

Escape Output

Password Hashing API

File Uploads

Data Storage

SSL

CONFIGURATION

- PHP.INI ERROR CONFIGURATION DIRECTIVES
  - `display_error = off, log_errors = on (Production)`
  - `error_reporting = E_ALL (DEVELOPMENT SYSTEM)`
  - `error_reporting = E_ALL & ~E_DEPRECATED & ~E_STRICT (PRODUCTION)`

- USING PHP AS A CGI BINARY

  PHP HAS BUILT-IN SAFEGUARDS AGAINST COMMON ATTACK SCHEMES USING INTERPRETERS, ALONG WITH CONFIGURABLE SETTINGS FOR ADDED SECURITY:

  - ACCESSING SYSTEM FILES: PHP DOES NOT INTERPRET COMMAND LINE ARGUMENTS PASSED BY THE INTERPRETER TO THE CGI INTERFACE
  - ACCESSING PRIVATE DOCUMENTS: RUNTIME DIRECTIVES `cgi.force_redirect, doc_root,` AND `user_dir` CAN BE USED TO OVERCOME SECURITY VULNERABILITIES IN SERVER SETUPS WHEN DEALING WITH RESTRICTED DIRECTORIES
  - ACCESSING PUBLIC FILES: OPTION `--enable-force-cgi-redirect` CAN BE ADDED TO THE CONFIGURE SCRIPT FOR SERVERS THAT DO NOT ALLOW REDIRECTS OR DO NOT HAVE A WAY TO CONFIRM A REQUEST HAS BEEN SAFELY REDIRECTED
  - DIRECTLY CALLING PHP: THE CONFIGURATION DIRECTIVE `cgi.force_redirect` BLOCKS THE ABILITY TO CALL PHP DIRECTLY FROM A URL; DIRECTIVE WILL ALLOW PHP TO PARSE ONLY IF IT HAS BEEN REDIRECTED (APACHE WEB SERVER)
  - PARSER: (OPTIONAL) PLACE PHP PARSER BINARY OUTSIDE OF THE WEB TREE
  - ACTIVE CONTENT (SCRIPTS, EXECUTABLES): SET UP A SEPARATE SCRIPT DIRECTORY FOR EXECUTABLES TO AVOID SECURITY ISSUES DUE TO DISPLAYING ACTIVE CONTENT AS HTML DOCUMENTS; SET DOCUMENT ROOT USING DIRECTIVE `doc_root` IN THE CONFIG FILE OR SET ENVIRONMENT VARIABLE `PHP_DOCUMENT_ROOT`; FILES WILL BE OPENED WITH `doc_root` AND PATH INFO IN THE REQUEST; ANOTHER OPTION IS TO UTILIZE `user_dir` - WHEN UNSET CAUSES A REQUESTED FILE TO OPEN UNDER `DOC_ROOT` AND NOT USER'S HOME DIRECTORY (FILE FORMAT `~user/document.php`)

USING PHP INSTALLED AS AN APACHE MODULE

PHP IN THIS CONFIGURATION WILL INHERIT THE PERMISSIONS STRUCTURE OF THE APACHE SERVER. COMMON SECURITY STEPS TO TAKE INCLUDE:

- SET THE APACHE AUTHORIZATION (VS. USING DEFAULT 'NOBODY' SETTING)
- CREATE AN ACCESS MODEL USING `.htaccess` FILES, LDAP, ...
- DO NOT GRANT THE WEB SERVER USER ROOT PERMISSION (PERMIT THE USE OF SUDO, CHROOT); INSTEAD, USE `open_basedir` TO CONTROL DIRECTORY USE

FILESYSTEM SECURITY

- ONLY ALLOW LIMITED PERMISSIONS TO THE APACHE WEB USER BINARY

ERROR HANDLING

- DISPLAY ERRORS ONLY IN A DEVELOPMENT ENVIRONMENT; IN PRODUCTION,

  ```
  display_errors = off and log_errors = on
  ```

- USE HIGH ERROR REPORTING SETTINGS

  ```
  error_reporting = E_ALL
  ```

SESSION SECURITY

- DESCRIPTION: SESSION HIJACKING
  - OCCURS WHEN THE SESSION ID IS STOLEN
  - A SESSION ID IS THE SOLE AUTHENTICATION TOKEN FOR THE WEB SITE

- DESCRIPTION: SESSION FIXATION
  - OCCURS WHEN USER GETS A "FIXED" SESSION ID (USUALLY VIA A SPECIALLY-CRAFTED URL)

- COUNTER-MEASURES
- REGENERATE THE SESSION ID UPON LOGIN, BEFORE AUTHENTICATION, USING `session_regenerate_id(true).` PASSING BOOLEAN `true` REMOVES THE OLD SESSION AND IS CRITICAL AS A COUNTER MEASURE
  - ALSO, REGENERATE SESSION ID PRIOR TO "CRITICAL" OPERATIONS
  - USE SSL ENCRYPTION FOR THE LOGIN, OR ASSIGN A HIDDEN KEY (NOT AS GOOD)
  - CHECK THAT THE IP ADDRESS REMAINS THE SAME (ALTHOUGH NOT ALWAYS RELIABLE)
  - USE SHORT SESSION TIMEOUT
  - PROVIDE USER LOGOUT
  - DESTROY AN OLD AND CREATE A NEW SESSION WITH: `session_regenerate_id(true)`
  - SET PHP CONFIGURATION DIRECTIVE `session.use_only_cookies = 1`
  - PREVENT JAVASCRIPT ACCESS TO SESSION COOKIE WITH PHP CONFIGURATION DIRECTIVE `session.cookie_httponly = 1`

CROSS-SITE SCRIPTING

- DESCRIPTION
  - INJECTION OF HTML, CSS, OR SCRIPT CODE INTO A PAGE
    Ex: `<script>alert(document.cookie)</script>`
  - INSERTION COULD BE PERMANENT (INCORPORATED) OR VIA A LINK
  - JAVASCRIPT IS PARTICULARLY DANGEROUS BECAUSE OF ITS ABILITY TO:
    - REDIRECT THE USER
    - MODIFY THE PAGE
    - READ OUT COOKIES

- COUNTER-MEASURES
  - ESCAPE DATA BEFORE OUTPUTTING IT
    - `htmlspecialchars()`
      - DOES NOT ESCAPE SINGLE QUOTES BY DEFAULT; USE `ENT_QUOTES` OPTION.
    - `htmlentities()`
    - `strip_tags()`
  - WHITELISTING IS EFFECTIVE, BLACKLISTING IS NOT

CROSS-SITE REQUEST FORGERIES

- DESCRIPTION
  - A REQUEST GENERATED FROM A USER'S BROWSER WITHOUT THE USER'S KNOWLEDGE
  - RELIES ON WEB SITE TRUST OF LOGGED-IN USERS
  - AN ATTACK INVOLVES TRICKING A USER INTO TRANSMITTING 'BAD' HTML WITH A REQUEST, WHICH THEN RETURNS SENSITIVE DATA TO THE ATTACKER
  - EXECUTED VIA IFRAMES, `XmlHttpRequest` CALLS OR EMBEDDED IN TAGS SUCH AS:

    ```
    <script>, <object>, <embed>, <img>, ...
    ```

    EX:

    ```
    <form name="myForm">
    <input type="hidden" name="item_id" value="123" />
    <input type="hidden" name="quantity" value="1" />
    </form>
    <script>document.forms['myForm'].submit();</script>
    ```

- COUNTER-MEASURES
  - USE A UNIQUE FORM TOKEN IN A HIDDEN INPUT FIELD TO VERIFY THE REQUEST
  - REQUIRE RE-LOGIN BEFORE SENSITIVE OPERATIONS (EX: FINANCIAL)

SQL INJECTION

- DESCRIPTION
  - SQL CODE IS INJECTED INTO THE SQL QUERY
  - ALLOWS ATTACKER TO DO ALMOST ANYTHING THE DATABASE USER IS PERMITTED
  - EXAMPLE SQL STATEMENT WILL RETURN ALL THE DATA FROM THE 'USERS' TABLE:

```
$sql = "SELECT * FROM users WHERE
username='$user' AND password='$pass'";
$user and $pass contain the value ' OR 1=1"
```

  - FURTHER ATTACK POSSIBILITIES: INSERT DATA, DELETE DATA, READ DATA, DENIAL OF SERVICE...

- COUNTER-MEASURES
  - USE PREPARED STATEMENTS WHEN SUPPORTED BY THE DATABASE
  - USE DATABASE-SPECIFIC ESCAPING FUNCTIONS WHEN CREATING THE SQL STATEMENT

    EX: `mysqli_real_escape_string()`
  - `addslashes()` IS NOT A SUFFICIENT APPROACH

REMOTE CODE INJECTION

- REMOTE CODE INJECTIONS ATTEMPT TO RUN THE ATTACKER'S CODE ON A SERVER, OFTEN BY EXPLOITING THE FUNCTIONALITY OF THE `include` OR `require` FUNCTIONS
- THE `eval()`, `exec()`, `system()`, AND `shell_exec()` FUNCTIONS ARE VULNERABLE TO REMOTE CODE INJECTIONS
- INCLUDE / REQUIRE ATTACKS
  - OCCUR WHEN INCLUDING AND EXECUTING FILES
    - POSSIBLE FROM REMOTE SERVERS
    - INCLUDES REMOTE CODE EXECUTION

- COUNTER-MEASURES
  - CHECK DATA AGAINST A WHITELIST
  - REMOVE PATHS USING `basename()`
  - SET `allow_url_include = Off` in `php.ini`
    - HELPS SOMEWHAT BUT NOT SUFFICIENT, AS SOME ATTACK VECTORS REMAIN OPEN

- DYNAMIC DATA CALL ATTACKS
  - CODE INJECTION CAN OCCUR WHEN USING DYNAMIC DATA IN CALLS TO `system()` AND RELATED

- COUNTER-MEASURES
  - LIMIT OR REMOVE USE OF `system()`, `exec()`, `eval()`, BACK TICK(‘), AND `shell_exec()`
  - `escapeshellarg()` TO ESCAPE ARGUMENTS
  - `escapeshellcmd()` TO ESCAPE COMMANDS

EMAIL INJECTION

- EMAIL / SMTP
  - DO NOT PROVIDE OPEN RELAYS
  - OPEN THE SMTP PORT ONLY IF ESSENTIAL
  - USE A "TARPITS" TECHNIQUE TO SLOW REQUESTS AS A MEANS OF DISSUADING ATTACKS

INPUT FILTERING

- INPUT IS EVERYTHING THAT COMES AS PART OF THE HTTP REQUEST
- SOME DATA DOES NOT SEEM TO BE INPUT, BUT MAY CONTAIN DATA ORIGINATING FROM THE USER, THUS MUST BE CONSIDERED AS INPUT (EX: SESSION DATA THAT WAS ORIGINALLY SUPPLIED BY THE USER)
- CHARACTER SET
  - Risk:
    - ATTACK VECTORS MAY EMPLOY A NON-STANDARD CHAR SET (EX: UTF-8 ENCODED) THAT MAY BE MISSED BY FILTERING, BUT EXECUTED BY THE BROWSER
  - Counter:
    - USE THE SAME CHAR SET FOR FILTERING AS THE TARGET PROCEDURE
    - CONVERT CHARSETS PRIOR TO FILTERING

      ```
      Content-Type: text/html; charset="UTF-8"
      ```

    - USE PHP'S FILTER EXTENSION
    - USE FILTERS NATIVE TO THE DATABASE (EX: DB QUOTING FUNCTIONS)

ESCAPE OUTPUT

- ONE OF TWO FUNDAMENTAL SECURITY RULES: (1) FILTER AND VALIDATE ALL INPUT; (2) ESCAPE OUTPUT
- ALWAYS ESCAPE OUTSIDE DATA UNLESS PREVIOUSLY FILTERED
- TYPICAL OUTPUT FORMATS THAT REQUIRE ESCAPING WHEN CONTAINING USER DATA: HTML, JSON, SQL
- NEVER RELY ON CLIENT SIDE (JAVASCRIPT) FILTERING
- FUNCTIONS USED TO ESCAPE DATA BEFORE OUTPUTTING WITHIN HTML:

```
htmlspecialchars()

htmlentities()

strip_tags()
```

PASSWORD HASHING API

- PASSWORD SECURITY
  - DO NOT SAVE PASSWORDS IN CLEARTEXT
  - LEGACY WAYS TO CREATE HASH VALUES:

    `md5()` 32 CHARACTERS, HEXADECIMAL

    `sha1()` 40 CHARACTERS, HEXADECIMAL

    - CANNOT BE REVERSED, BUT VULNERABLE TO A BRUTE-FORCE ATTACK, THUS NOT CONSIDERED SECURE
  - DO NOT USE HARD-CODING UNLESS VALUES ALSO HASHED
  - USE `crypt()` OR PASSWORD HASHING API (SEE NEXT SECTION)

    `password_hash($password, $algo[, $options])`

    HASHES A PASSWORD, GIVEN THE PROVIDED ALGORITHM (CURRENTLY DEFAULTS TO BCRYPT) AND OPTIONS

    `password_get_info($hash)`

    RETRIEVES INFORMATION ABOUT A HASH (ALGORITHM, OPTIONS USED)

    `password_needs_rehash($hash, $algo[, $options])`

    REHASHES A HASH IF IT DOES NOT MET THE ALGORITHM AND OPTIONS

    `password_verify($password, $hash)`

    VERIFIES WHETHER A HASH MATCHES A PASSWORD
  - OPTIONS: ARRAY WITH VALUES

    `cost`

    ALGORITHMIC COST OF THE HASHING; DEFAULTS TO 10; LIMIT THIS VALUE AS IT CAN BE CPU INTENSIVE

FILE UPLOADS

- `$_FILES` IS FILLED WITH USER-SUPPLIED DATA, AND THEREFORE POSES RISK
  - RISK: FILE NAME CAN BE FORGED
  - COUNTER: USE CHECKS AND `basename()`
  - RISK: MIME TYPE CAN BE FORGED
  - COUNTER: IGNORE
  - RISK: TEMP FILE NAME CAN BE FORGED UNDER CERTAIN CONDITIONS
  - COUNTER: USE `*_uploaded_file()` FUNCTIONS (`* = is, move`)

DATA STORAGE

- DATABASE CONNECTIONS
  - IF USING SQL TO MAKE CONNECTIONS, THE CODE IS SUBJECT TO SQL INJECTIONS (SEE SQL INJECTION SECTION)

- DATABASE DESIGN
  - EMPLOY PRINCIPLE OF LIMITED RIGHTS - ASSIGN ONLY THOSE PRIVILEGES THAT ARE NEEDED BY USER
  - DO NO EXPOSE DB SERVER TO THE INTERNET
  - ISOLATE DATABASES WITH SENSITIVE INFORMATION TO SEPARATE NETWORK SEGMENTS
  - REQUIRE PERIODIC PASSWORD CHANGES AND ENCRYPT BEFORE STORING
  - READ THE LOGS

SSL

- SECURE SOCKET LAYER (SSL) ENCRYPTION PROTECTS DATA AS IT IS TRANSMITTED BETWEEN CLIENT AND SERVER
- SSH (SECURE SHELL PROTOCOL) ENCRYPTS THE NETWORK CONNECTION BETWEEN THE CLIENT AND THE DATABASE SERVER

- AUGMENT DATA ENCRYPTION AS CIPHERTEXT USING `openSSL_encrypt(<params>)` AND `openssl_decrypt(<params>)`
  - ENCRYPT DATA BEFORE INSERTION AND DECRYPT WITH RETRIEVAL

- STORE SENSITIVE DATA AS A HASHED VALUE

TEST YOUR KNOWLEDGE : QUESTIONS

1 What is the recommended setting for error_reporting for production servers?

A: E_ALL & ~E_DEPRECATED & ~E_STRICT
B: E_ALL & ~E_NOTICE
C: E_STRICT
D: OFF

2 How can you make it harder for JavaScript code to read out session IDs? (Choose 2)

A: Use the session_regenerate_id() function
B: Use the session_set_cookie_params() function
C: Use the session.cookie_httponly php.ini setting
D: Use the session.use_only_cookies php.ini setting

3 Which of the following measures provides good protection against Cross-Site Request Forgery?

A: Relying on HTTP POST only
B: Relying on HTTP reference header
C: Relying on a one-time token
D: Relying on the user agent

4

Which potential security vulnerability is/vulnerabilities are in the following code? (Choose 2)

```
<?php
    echo htmlspecialchars($_GET['name']);
?>
<a href="<?php echo $_SERVER['PHP_SELF'] ?>">Reload</a>
```

A: Cross-Site Scripting (XSS)
B: Cross-Site Request Forgeries (CSRF)
C: Provoking an error message
D: None of the above

5

Which of PHP's database extensions does not support prepared statements?

A: ext/mysqli
B: ext/oci8
C: ext/pgsql
D: ext/sqlite

6

Which function does NOT provide ANY protection from remote command injection?

A: escapeshellcmd()
B: escapeshellarg()
C: htmlspecialchars()
D: strip_tags()

7

Your PHP application sends an email with data provided by the user, using PHP's mail() function. How can an attacker inject a custom BCC header to that email?

A: Adding "\rBcc: email@example.com" to the subject
B: Adding "\nBcc: email@example.com" to the mail body
C: Adding "\r\nBcc: email@example.com" to the sender's address
D: None of the above

8

Which of the following data may be altered by the user and should be Filtered?

A: Query string data
B: HTTP referer
C: Browser identification string
D: All of the above

9

What is the output of the following code?

```
<?php
echo strlen(shal('0', true));
?>
```

???

10

Escaping output may help protect from which common security vulnerabilities? (Choose 2)

A: Clickjacking
B: Cross-Site Scripting
C: Cross-Ste Request Forgery
D: SQL Injection

11

What does the max_file_uploads configuration option contain?

A: The maximum number of file uploads per session
B: The maximum number of file uploads per request
C: The maximum number of file uploads per user
D: The maximum number of file uploads before the web service process is restarted

12

You are writing a PHP application that is used by thousands of people. You need to store database credentials in a secure fashion, but also want to make sure that the application can be easily deployed. What is the best way to achieve that?

A: In a .txt file inside the web folder
B: In an .inc file inside the web folder
C: In a .php file inside the web folder
D: In a .php file outside the web folder

13

What is the safest way to transport a password entered in a web form to the server?

A: Use JavaScript to hash the value, then send it to the server

B: Use JavaScript to encrypt the value, then send it to the server

C: Use an HTTPS connection to the server

D: Use HTTP-only cookies

TEST YOUR KNOWLEDGE : ANSWERS

1

A: E_ALL & ~E_DEPRECATED & ~E_STRICT

2

B: Use the session_set_cookie_params() function
C: Use the session.cookie_httponly php.ini setting

3

C: Relying on a one-time token

4

A: Cross-Site Scripting (XSS)
C: Provoking an error message

5

D: ext/sqlite

6

D: strip_tags()

7

D: None of the above

TEST YOUR KNOWLEDGE : ANSWERS

8 D: All of the above

9 20

10 B: Cross-Site Scripting (XSS)
D: SQL Injection

11 B: The maximum number of file uploads per request

12 C: In a .php file inside the web folder

13 C: Use an HTTPS connection to the server

TOPIC TEN: WEB FEATURES

Sessions

Forms

GET and POST Data

FILE Uploads

Cookies

HTTP Headers and Codes

SESSIONS

- DEFINITION
  - WAY OF PRESERVING DATA ACROSS A SERIES OF WEB SITE ACCESSES BY THE USER
    - SESSION SUPPORT IS ENABLED BY DEFAULT
    - CONFIGURATION OPTIONS SET IN PHP.INI
    - `SID(STRING)` IS A PRE-DEFINED CONSTANT WITHIN THIS EXTENSION

- SESSION ID
  - USER ASSIGNED A UNIQUE IDENTIFIER, THE "SESSION ID"
    - SESSION ID IS STORED IN A COOKIE ON THE CLIENT OR IN THE URL
  - SITE ACCESS BY USER TRIGGERS SESSION ID CHECK THROUGH ONE OF THESE MECHANISMS:
    - AUTOMATICALLY … IF `session.auto_start = 1`
    - UPON REQUEST … USING `session_start()`

- VARIABLES:
  - `$_SESSION` IS AVAILABLE AS A GLOBAL VARIABLE

- SECURITY MEASURES
  - ENABLE `session.use_only_cookies` TO ENFORCE COOKIE USAGE (AND PREVENT SESSION IDS IN THE URL)
  - ENABLE `session.cookie_httponly` TO PREVENT JAVASCRIPT COOKIE ACCESS (AND HELP PREVENT SESSION HIJACKING VIA XSS)

- SESSION FUNCTIONS (PARTIAL LIST)

`session_destroy()`	DESTROYS ALL DATA REGISTERS TO A SESSION
`session_id()`	GET/SET CURRENT SESSION ID
`session_start()`	INITIALIZE SESSION DATA

FORMS (PHP and HTML)

- DEFINITION
  - WAY OF COLLECTING DATA ONLINE FROM USER ACCESSING A WEB SITE

- FORM ELEMENTS
  - FORM DATA AUTOMATICALLY AVAILABLE TO PHP SCRIPTS
  - DOTS AND SPACES IN VARIABLE NAMES CONVERTED TO UNDERSCORES
    - Ex: FORM FIELD "`foo.x`" BECOMES `$_GET["foo_x"]` OR `$_POST["foo_x"]`
  - FORM DATA CAN BE MADE INTO AN ARRAY USING THE FOLLOWING SYNTAX `<input name="FormArray[]">`
    - GROUP ELEMENTS BY ASSIGNING THE SAME ARRAY NAME TO DIFFERENT ELEMENTS; CAN SPECIFY KEYS

- SUPERGLOBAL ARRAYS
  - `$_POST` SUPERGLOBAL CONTAINS ALL POST DATA; PAIRED WITH POST METHOD
  - `$_GET` SUPERGLOBAL CONTAINS ALL GET DATA
  - `$_REQUEST` IS INDEPENDENT OF DATA SOURCE, AND MERGES INFORMATION FROM SOURCES LIKE GET, POST, AND COOKIES; USAGE IS NOT RECOMMENDED

ENCODING / DECODING

- IMPLEMENT AT KEY STAGES IN FORM SUBMISSION PROCESS
  - HTML INTERPRETATION: `htmlspecialchars()` FUNCTION ENCODES SPECIAL CHARACTERS IN DATA, AS A SECURITY MEASURE
  - URL: ENCODE DATA WITH `urlencode()` TO INTERPRET AS ONE ITEM

FILE UPLOADS

- POST METHOD ALLOWS FOR BOTH TEXT AND BINARY FILE UPLOAD
  - USED IN CONJUNCTION WITH AUTHENTICATION AND FILE FUNCTIONS
  - FORM MUST CONTAIN ATTRIBUTE `enctype='multipart/form-data` FOR UPLOADS TO WORK
- GLOBAL `$_FILES` ARRAY/S WILL CONTAIN ALL UPLOADED FILE INFORMATION

`$_FILES ['filename'][.......]`

WHERE	`['name']`	CLIENT-SIDE FILE NAME
	`['type']`	MIME TYPE
	`['size']`	FILE SIZE
	`['error']`	ERROR CODE FOR UPLOAD
	`['tmp_name']`	TEMPORARY FILENAME OF FILE IN WHICH THE UPLOADED FILE WAS STORED ON THE SERVER

COOKIES

- DEFINITION
  - WAY OF STORING DATA IN A BROWSER TO ID / TRACK A USER
- USING COOKIES
  - CREATE (SET) COOKIES WITH THE `setcookie()` OR `setrawcookie()` FUNCTION
    - MUST BE CALLED BEFORE SENDING ANY OUTPUT TO BROWSER
    - CAN DELAY SCRIPT OUTPUT USING OUTPUT BUFFERING, TO ALLOW TIME TO DECIDE TO SET COOKIES OR SEND HEADERS
  - `setcookie()` PARAMS ARE DEFINED ACCORDING TO SPECIFICATIONS:

`$name=`*VALUE*	STRING
`$value=`*VALUE*	STRING
`$expire=`*DATE*	OPTIONAL; DEFAULT IS SESSION END
`$path=`*PATH*	SPECIFIES URLS IN A DOMAIN FOR WHICH COOKIE IS VALID
`$domain=`*DOMAIN_NAME*	CHECK ON DOMAIN ATTRIBUTES OF COOKIES AGAINST HOST INTERNET DOMAIN NAME
`$secure`	COOKIE ONLY TRANSMITTED VIA SECURE CHANNELS (HTTPS); BOOLEAN
`$httponly`	COOKIE ONLY MADE ACCESSIBLE VIA HTTP PROTOCOL, NOT JAVASCRIPT; BOOLEAN

  - ACCESS WITH `$_COOKIE` OR `$_REQUEST` SUPERGLOBALS
    - COOKIE DATA FROM THE CLIENT IS AUTOMATICALLY SENT TO `$_COOKIE`, IF PARAMS OF `variables_order()` INCLUDE "C" (ENVIRONMENT/GET/POST/COOKIE/SERVER)
    - WILL OVERWRITE ITSELF IF NAME, PATH, DOMAIN, SECURE, AND `HTTP_ONLY` ARE IDENTICAL
  - COOKIES ARE PART OF THE HTTP HEADER
  - AS WITH SESSIONS, MULTIPLE VALUES CAN BE ASSIGNED TO AN ARRAY
    - TO ASSIGN ALL VALUES TO ONLY ONE COOKIE, CAN USE `serialize()` OR `implode()` WITH FIRST VALUE

HTTP HEADERS AND CODE

`header()`	SETS AN HTTP HEADER PARAMS: LOCATION, OVERWRITE, STATUS CODE `header('Location: http://www.roguewave.com/', false, 200);`
`headers_list()`	LIST OF HEADERS SENT OR TO BE SENT; INDEXED ARRAY
`headers_sent()`	CONFIRMATION OF WHETHER HEADERS SENT OR NOT
`header_remove()`	REMOVES PREVIOUSLY SET HEADER

- HTTP HEADERS: INCLUDES A SET OF METHODS… EXAMPLES:

`isError BOOLEAN;`	CHECK IF STATUS CODE IS AN ERROR (CLIENT 4XX OR SERVER 5XX)
`isSuccessful BOOLEAN;`	CHECKS IF STATUS CODE IS SUCCESSFUL (2XX)
`setHeader BOOLEAN;`	DEFAULT VALUE FOR "LAST- MODIFIED" HEADER IS CURRENT DATA / TIME

- OTHER HTTP HEADER CODES:

1XX	INFORMATIONAL
3XX	REDIRECTION

HTTP AUTHENTICATION

- SPECIFIC HOOKS ONLY AVAILABLE WHEN RUNNING THE APACHE MODULE
- CAN USE `header()` FUNCTION TO SEND A MESSAGE TO THE CLIENT BROWSER TO CAUSE A USERNAME + PASSWORD WINDOW TO DISPLAY
- UPON ENTRY, A PHP SCRIPT RUNS WITH SET VARIABLES IN THE `$_SERVER`
- ARRAY

`PHP_AUTH_USER`	USER
`PHP_AUTH_PW`	PASSWORD
`AUTH_TYPE`	AUTHENTICATION TYPE

- `PHP_AUTH` VARIABLES ARE NOT SET IF EXTERNAL AUTHENTICATION IS ENABLED FOR A PAGE, AND SAFE MODE IN GENERAL, FOR PASSWORD PROTECTION
- BASIC ACCESS AUTHENTICATION SCHEME :
  - PRESCRIPTS:

    USERNAME APPENDED WITH COLON `":"` BEFORE TRANSMISSION

    STRING IS THEN BASE64 ENCODED (TO DEAL WITH NON-HTTP COMPATIBLE CHARACTERS)

TEST YOUR KNOWLEDGE : QUESTIONS

1 **What is the default timeout of a PHP session cookie?**

- A: Depends on the web server
- B: 10 minutes
- C: 20 minutes
- D: Until the browser is closed

2 **If a form's action attribute is set to an empty string, where is data usually sent to?**

- A: /
- B: the current URI
- C: index.php
- D: the default page of the current directory

3 **Which HTTP method is commonly used for file uploads?**

- A: CONNECT
- B: GET
- C: OPTIONS
- D: POST

4

How many HTTP requests are required to determine, without JavaScript, whether a client supports cookies or not?

A: 0
B: 1
C: 2
D: Impossible to achieve without JavaScript

5

Which class of HTTP status codes is used for error conditions?

A: 1XX
B: 3XX
C: 5XX

6

Which encryption method is used when using HTTP Basic Authentication?

A: None
B: Hashing
C: Asymmetric-key encryption
D: Symmetric-key encryption

TEST YOUR KNOWLEDGE : ANSWERS

1. D: Until the browser is closed

2. B: The current URI

3. D: POST

4. C: 2

5. C: 5XX

6. A: None

TOPIC ELEVEN: ERROR HANDLING

ERROR LEVELS

ERROR DISPLAY

USER-DEFINED ERRORS

EXCEPTION HANDLING

ERROR CLASS

ERROR LEVELS

- PHP SUPPORTS SEVERAL TYPES OF ERRORS
  - NOTICES AT RUNTIME
  - ERRORS DURING PARSING (PREVENTS CODE EXECUTION)
  - WARNINGS AT RUNTIME
  - FATAL ERRORS AT RUNTIME (STOP CODE EXECUTION)
  - CORE ERRORS AND WARNINGS
  - USER-DEFINED NOTICES, WARNINGS, AND ERRORS

- PHP CONFIGURATION SETTING `error_reporting`, OR PHP's `error_reporting()` FUNCTION MAY BE USED TO DEFINE WHICH KINDS OF ERRORS SHALL BE REPORTED

- VALUE IS AN INTEGER, OR – MUCH MORE CONVENIENT – A BITMASK BASED ON PRE-DEFINED CONSTANTS
  - E_NOTICE, E_PARSE, E_WARNING, E_ERROR
  - E_CORE_WARNING, E_CORE_ERROR
  - E_USER_NOTICE, E_USER_WARNING ,E_USER_ERROR
  - E_STRICT („BEST PRACTICES“ NOTICES)
  - E_DEPRECATED (FEATURES THAT MIGHT DISAPPEAR IN FUTURE PHP VERSIONS)
  - E_ALL (EVERYTHING)
  - AND SOME MORE

- TYPICAL PRODUCTION SETTING: E_ALL & ~E_DEPRECATED & ~E_STRICT

ERROR DISPLAY

- BY DEFAULT, ALL ERRORS INCLUDED IN `error_reporting` ARE REPORTED IN PHP´S OUTPUT

- THIS BEHAVIOR CAN – AND SHOULD – BE DEACTIVATED ON PRODUCTION SYSTEMS USING THE `display_errors = Off` PHP.INI SETTING

- ERRORS SHOULD STILL BE LOGGED, USING THE `log_errors = On` PHP.INI SETTING

- THE ERROR LOG IS A FILE SET IN THE `error_log` PHP CONFIGURATION SETTING. IF SET TO `syslog`, ERRORS ARE LOGGED IN THE SYSTEM LOG INDEPENDENT ON THE OPERATING SYSTEM USED.

USER-DEFINED ERRORS

- USERLAND CODE MAY TRIGGER CUSTOM ERRORS:

```
trigger_error(
    "something went wrong",
    E_USER_WARNING);
```

- THESE ERRORS MAY BE HANDLED WITH A CUSTOM ERROR HANDLER FUNCTION:

```
function myHandler($code, $text, $file, $line) {
    if ($code == E_USER_WARNING)
    {
        echo 'WARNING: ' .
        htmlspecialchars($text);
        return true;
    }
    return false;
}
```

- IF THE CUSTOM ERROR HANDLER FUNCTION RETURNS `true`, PHP´S ERROR HANDLING DOES NOT KICK IN.

- CUSTOM ERROR HANDLER FUNCTION NEEDS TO BE REGISTERED USING `set_error_handler("myHandler")`.

EXCEPTION HANDLING

- EXCEPTIONS OR ERRORS (MORE ON THAT SEE BELOW) END CODE EXECUTION, UNLESS THEY ARE HANDLED WITH TRY-CATCH

```
try {
    // code that throws an Exception
} catch (Exception $ex) {
    // Exception is handled, code
continues
}
```

- SEVERAL `catch` STATEMENTS MAY BE USED TO DIFFERENTIATE BETWEEN SEVERAL KINDS OF EXCEPTIONS AND ERRORS

```
try {
    // code that throws an Exception
} catch (CustomExceptionClass $ex) {
    // custom Exception is handled
} catch (Exception $ex) {
    // Exception is handled
} catch (Error $err) {
    // Error is handled
}
```

- SEVERAL ERRORS MAY BE HANDLED WITH THE SAME CODE

```
try {
    // code that throws an Exception
} catch (Exception | CustomException $ex)
{
    // custom Exception and Exception
}
```

- OPTIONAL `finally` BLOCK CONTAINS CODE THAT RUNS AFTER THE TRY-CATCH BLOCK, NO MATTER WHETHER AN ERROR WAS CAUGHT OR NOT

ERROR CLASS

- SINCE PHP 7, MANY ERRORS PHP REPORTS NOW THROW AN `Error` EXCEPTION, NOT A FATAL ERROR AS BEFORE.
- SUBCLASSES OF `Error` EXIST FOR THE SPECIFIC TYPE OF ERROR, SUCH AS `ParseError` OR `TypeError`.
- TO FACILITATE BACKWARDS COMPATIBILITY, `Error` IS NOT DERIVED FROM `Exception`.
- BOTH `Error` AND `Exception` IMPLEMENT THE `Throwable` INTERFACE

TEST YOUR KNOWLEDGE : QUESTIONS

1

Given the following class/interface hierarchy ...

```
Throwable          (1)
|
|__Error           (2)
    |
    |__Exception   (3)
```

... which entry is at an incorrect position?

A: 1
B: 2
C: 3

2

Given the following function ...

```
function doSomething($a, $b) {
  return $a / $b;
}
```

... and the following code ...

```
try {
  doSomething(1);
} catch (Exception $ex) {
  echo 1;
} catch (ArgumentCountError $ace) {
  echo 2;
} catch (DivisionByZeroError $dbze) {
  echo 3;
}
```

... what will be the output after the code runs?

A: 1
B: 2
C: 3

TEST YOUR KNOWLEDGE : ANSWERS

1

C: 3

2

B: 2