FUNCTIONS

DR. ANDREW BESMER

- Creation
- Function Use
- Variable Scope
- Passing Arguments
- Call stack
- More Functions

CREATION

CREATION

- To create (declare) a function you must provide several different pieces
  - Required:
    - **Keyword** - The keyword `function`
    - **Function Name** - This will be used when you want to call or invoke the function
    - **Body** - List of statements to be executed when the function is invoked
  - Optional:
    - **Parameters** - Variables that will be used in the function
    - **Return Statement** - Data to be passed back to caller

CREATION

- Identify the **keyword**, **function name**, **body**, **parameters**, and **return statement**

```php
<?php

function sayHello()
{
    echo "Hello World!";
}
```

CREATION

- Identify the **keyword**, **function name**, **body**, **parameters**, and **return statement**

```php
<?php

function sayHello($name)
{
    $message = "Hello $name";
    return $message;
}
```

PARAMETERS

- Specified as an ordered list
- In PHP, parameters can be unknown length (not covered)

```php
<?php

function sayHello($prefix, $postfix)
{
    return $prefix . " " . $postfix . "\n";
}
```

FUNCTION USE

FUNCTION USE

- Call or invoke function by using it’s name with ()

```
<?php

function sayHello()
{
    echo "Hello World!";
}

sayHello();
```

FUNCTION USE

- When invoking
  - Must provide **arguments** in the order matching the **parameters**
  - Must also provide the correct number
- Parameters differ from arguments
  - Parameter is the specification
  - Argument is providing the actual value while invoking

FUNCTION USE

- What will result be?

```php
<?php

function sayHello($prefix, $postfix)
{
    return $prefix . " " . $postfix . "\n";
}

echo sayHello("Hello", "World");

echo sayHello("World", "Hello");

echo sayHello("Hello");
```

DEFAULT ARGUMENTS

- Sometimes it is not desirable to force arguments to be provided each time
    - Specify the parameter as `NULL` or provide a default value
    - Must be constant expression
    - Can mix some required some not
    - Passing `NULL` as argument means `NULL`

DEFAULT ARGUMENTS

- What will happen?

```php
<?php

function sayHello($prefix = "Hello", $postfix = "there")
{
    return $prefix . " " . $postfix . "\n";
}

echo sayHello("Hello", "World");

echo sayHello("Hello");

echo sayHello();

echo sayHello(NULL, "World");

echo sayHello("Hello", NULL);

echo sayHello(NULL);
```

FUNCTION USE

- Functions can’t be redeclared
- What will happen?

```php
<?php

function sayHello()
{
    echo "Hello World!";
}

function sayHello()
{
    echo "Hello World!";
}

sayHello();
```

FUNCTION USE

- Can we do this?

```php
<?php

sayHello();

function sayHello()
{
    echo "Hello World!";
}
```

FUNCTION USE

- Function does not need to appear before using it unlike variables
  - Except:
    - When declared inside other functions
    - Conditionally declared
- All functions *once created* have global scope (can be used anywhere)
  - Except:
    - Classes/Namespaces (CSCI242)

FUNCTION USE

- The body can call other functions, even itself!

```php
<?php

function getNum()
{
    $num = getFive();
    return $num;
}

function getFive()
{
    return "five";
}

echo "High " . getNum() . "!";
```

FUNCTION USE

- Can call function as part of expression
- Can call function as argument for another function

```php
<?php

function getNum($num)
{
    return $num;
}

function getFive()
{
    return "five";
}

echo "High " . getNum(getFive()) . "!";
```

FUNCTION USE

- Functions can be called in the `return` statement

```php
<?php

function getNum()
{
    return getFive();
}

function getFive()
{
    return "five";
}

echo "High " . getNum() . "!";
```

RETURN STATEMENT

- Can only return a ‘single’ value
- Can provide multiple return statements
  - Only one can be returned though

```php
<?php

function isOvertime($hours)
{
    if($hours > 40)
    {
        return true;
    }
    else
    {
        return false;
    }
}

isOvertime(50); //Hmm...
```

RETURN STATEMENT

- Function exits at first return encountered
  - Be careful of bad logic
- What happens here?

```php
<?php

function isOvertime($hours)
{
    return NULL; //I'm not sure yet let me check

    if($hours > 40)
    {
        return true;
    }
    else
    {
        return false;
    }
}

echo isOvertime(50);
```

VARIABLE SCOPE

VARIABLE SCOPE

- Variable scope refers to the ability to reference a variable
- It’s an important concept to understand in order to effectively program

VARIABLE SCOPE

- In PHP there are three scopes
    - Local - Can only be used within the context it was created
    - Global - Depending on context of use may need to use `global` keyword or `$GLOBALS`
    - Super Global - Can be used anywhere within the program

VARIABLE SCOPE

- Local - Generally variables created in functions
- Global - Generally created within main application
- Super Global - Provided by PHP (there are 9)
    - `$GLOBALS`
    - `$_SERVER`
    - `$_GET`
    - `$_POST`
    - `$_FILES`
    - `$_COOKIE`
    - `$_SESSION`
    - `$_REQUEST`
    - `$_ENV`

VARIABLE SCOPE

- What will happen?

```php
<?php

function world()
{
    $world = "world";
}

echo "Hello " . $world;
```

VARIABLE SCOPE

- What will happen?

```php
<?php

function world()
{
    $world = "world";
}

world();
echo "Hello " . $world;
```

VARIABLE SCOPE

- What will happen?

```
<?php

function world()
{
    $world = "world";
}

echo "Hello " . world();
```

VARIABLE SCOPE

- What will happen?

```php
<?php

$hello = "hello";

function world()
{
    echo $hello . " world";
}

world();
```

VARIABLE SCOPE

- What will happen?

```php
<?php

$hello = "hello";

function world()
{
    global $hello;
    echo $hello . " world";
}

world();
```

VARIABLE SCOPE

- What will happen?

```php
<?php

$hello = "hello";

function world()
{
    echo $GLOBALS["hello"] . " world";
}

world();
```

VARIABLE SCOPE

- What will happen?

```php
<?php

function hello()
{
    $hello = "hello";
}

function world()
{
    $world = "world";
    echo $hello . " " . $world;
}

hello();
world();
```

VARIABLE SCOPE

- What will happen?

```php
<?php

function hello()
{
    $hello = "hello";
}

function world()
{
    hello();
    $world = "world";
    echo $hello . " " . $world;
}

world();
```

VARIABLE SCOPE

- What will happen?

```php
<?php

function world()
{
    echo $_SERVER["REQUEST_METHOD"];
}

world();
```

VARIABLE SCOPE

- Variable scope is highly related to how variables are passed and the call stack, our next topics!

PASSING ARGUMENTS

PASS BY VALUE

- When arguments are passed to functions they are passed by value or copied
  - Exception is objects (CSCI242)
- Even arrays are passed by value, this is different from many other languages

- What will happen?

```php
<?php

$x = 5;

function changeVar($x)
{
    $x = 12;
    return $x;
}

changeVar($x);

echo $x;
```

PASS BY VALUE

- What will happen?

```php
<?php

$x = 5;

function changeVar($x)
{
    $x = 12;
    return $x;
}

$x = changeVar($x);

echo $x;
```

PASS BY VALUE

- Advantage of this method is that function can not modify your variables leading to unexpected results
- Disadvantage is that it uses additional memory for each function call
- There is also overhead as we will see with call stack

PASS BY REFERENCE

- You can pass by reference using an `&` when defining the parameters
    - Some languages let you indicate pass by reference when invoking the function, PHP does not
- When you pass by reference the actual variable is used by the function
- Objects are implicitly by reference (CSCI241)

PASS BY REFERENCE

- What will happen?

```php
<?php

$x = 5;

function changeVar(&$x)
{
    $x = 12;
    return $x;
}

changeVar($x);

echo $x;
```

PASS BY REFERENCE

- What will happen?

```php
<?php

$x = 5;

function changeVar(&$x)
{
    $x = 10;
    changeVar2($x);
    return $x;
}

function changeVar2($x)
{
    $x = 9;
    return $x;
}

changeVar($x);
```

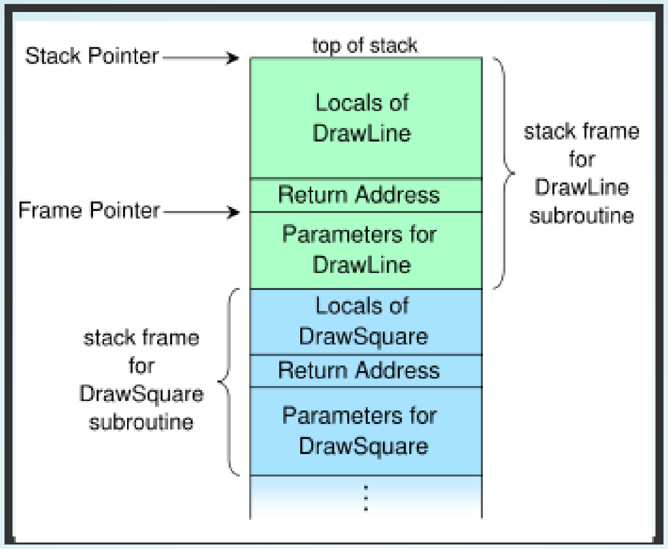
CALL STACK

CALL STACK

Call Stack: Contains information about the current active function calls

- When a function is called a **stack frame** is created and pushed onto call stack
  - Control is passed to the function called
- When a function returns the stack frame is popped off the call stack
  - The return value is given to the caller and control is passed back to the caller
  - All local variables in that frame cease to exist

CALL STACK


Stack Pointer
top of stack
Locals of DrawLine
Return Address
Frame Pointer
Parameters for DrawLine
stack frame for DrawLine subroutine
Locals of DrawSquare
Return Address
Parameters for DrawSquare
stack frame for DrawSquare subroutine

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CALL STACK

- Because of memory overhead it is possible to call to many functions at once
    - Particularly with recursion
- This is called **stack overflow** or **smashing the stack**
    - In PHP app will crash
    - In some lower level programming languages this may allow arbitrary execution of code

CALL STACK

- Example

```php
<?php

$x = 5;

function changeVar($x)
{
    $x = 12;
    return $x;
}

changeVar($x);

echo $x;
```

CALL STACK

- Example

```php
<?php

$x = 5;

function changeVar($x)
{
    $x = 12;
    return $x;
}

$x = changeVar($x);

echo $x;
```

CALL STACK

- Example

```php
<?php

$x = 5;

function changeVar(&$x)
{
    $x = 10;
    changeVar2($x);
    return $x;
}

function changeVar2($x)
{
    $x = 9;
    return $x;
}

changeVar($x);
```

MORE FUNCTIONS

MORE BUILT-IN

- `abs`
- `ceil`
- `floor`
- `max`
- `min`
- `round`
- `rand`

1. Wikipedia↩