

CS 473 - MDP

Mobile Device Programming

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Maharishi International
University

CS 473 - MDP

Mobile Device Programming

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Maharishi International
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CS 473 – MDP

Mobile Device Programming

Lesson 2

Kotlin Fundamentals



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Wholeness of this lesson

Lesson covers the fundamentals must know to write Kotlin code. Understand the features, declaring variables, constants and writing methods. The Kotlin language specifies rules for working with null safety. Objects have both data and behavior which support the intended purpose of the object. *Similarly, consciousness is established when the unmanifest value of the object is realized; everything perceived in terms of the Self.*

Agenda

- What is Kotlin?
- Kotlin Features
- main() function
- Mutable and Immutable
- Kotlin Strings
- Looping
- Null safety
- Class and Objects
- Inheritance, Interface and Data class

What is Kotlin?

- Kotlin is a JVM based language developed by JetBrains, a company known for creating IntelliJ IDEA, a powerful IDE for Java development.
- The Android team announced during Google I/O 2017 that Kotlin is an official language to develop Android Apps.
- Android Studio, the official Android IDE, is based on IntelliJ.
- Kotlin was created with Java developers in mind, and with IntelliJ as its main development IDE.
 - Learn more about from <https://developer.android.com/kotlin/index.html>
 - Try online : <https://try.kotlinlang.org/>
 - Find Answers about Kotlin from <https://developer.android.com/kotlin/faq.html>

Develop Android apps with Kotlin

- Write better Android apps faster with Kotlin. Kotlin is a modern statically typed programming language that will boost your productivity and increase your developer happiness.
- Reference resources :
 - <https://developer.android.com/kotlin/>
 - <https://developer.android.com/kotlin/faq>

Kotlin Features

- **Modern and expressive:** You can write more with much less code.
- **It's safer :** Kotlin is null safe, which means that we deal with possible null situations in compile time, to prevent run time exceptions.
- **Functional and object-oriented:** Kotlin is basically an object-oriented language, also gains the benefits of functional programming.
- **Statically typed:** This means the type of every expression in a program is known at compile time, and the compiler can validate that the methods and fields you're trying to access exist on the objects you're using.

Kotlin Features

- **Free and open source:** The Kotlin language, including the compiler, libraries, and all related tooling, is entirely open source and free to use for any purpose.
- **It's highly interoperable:** You can continue using most libraries and code written in Java, because the interoperability between both languages is excellent. It's even possible to create mixed projects, with both Kotlin and Java files coexisting. Easily convert the existing Java code into Kotlin by selecting Code → Convert Java File to Kotlin File
- **Multiplatform Mobile:** The natural way to share code between mobile platforms. <https://kotlinlang.org/docs/multiplatform-mobile-getting-started.html>

Kotlin Data Types

- Integer Data Types
 - Byte, Short, Int and Long
- Floating Point Data Types
 - Float, Double
- Boolean
 - Accepts true or false
- Character Data Type
 - Char
- String
- All the above data types are actually objects, each of which provides a range of functions and properties that may be used to perform a variety of different type specific tasks. These functions and properties are accessed using so-called dot notation.

main function in Kotlin

This is the main function, which is mandatory in every Kotlin application. The Kotlin compiler starts executing the code from the main function.

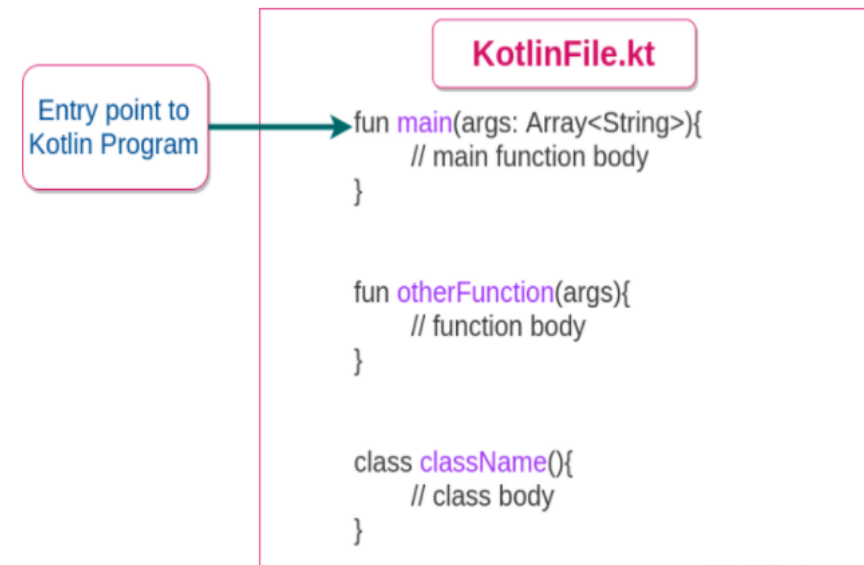
A main() can execute with the args of Array<String> or without arguments will work.

```
fun main() { }
```

```
fun main(args: Array<String>)
```

Replace void without return type or can use keyword Unit

```
fun f(): Unit {  
    println("Nothing return can use Unit similar like Void")  
}  
// If there is no return type mentioned work as void  
fun f1() {  
    println("No return type similar like Void")  
}
```



Mutable and Immutable (Variables and Constants)

- Kotlin is categorized as a statically typed programming language. Uses a technique referred to as *type inference* to identify the type of the variable.
- Mutable/Variable : type is not required.
`var answer = 42` is similar to \rightarrow `var answer: Int = 42`
- Immutable/ Constants :
`val answer = 42` is similar to \rightarrow `val answer: Int = 42`
- Refer : DataTypes.kt, GettingInput.kt

Kotlin Strings

- Strings in Kotlin represent an array of characters. Strings are immutable. It means operations on string produces new strings.
Eg: `val str = " Kotlin Strings"`
`println(str)`
- We can create a multi line string using `"""`
Eg: `val x: String = """Kotlin
supports
Multiline
Strings"""`
- The above code produce the intent spacing from the second line. To avoid spacing you can trim the space by giving
Eg: `val x: String = """|Kotlin
|supports
|Multiline
|Strings""".trimMargin()`

Kotlin Strings

- **String templates:** String templates is a powerful feature in Kotlin when a string can contain expression and it will get evaluated.

```
val x = "David"  
val y = "My name is $x"  
println(y)
```

```
Println("My name is $x with the length ${x.length}")
```

Output : My name is David

My name is David with the length 5

String operations

Eg:

```
var s: String = "Hello"  
println("Length of string $s is ${s.length}")  
println("Init cap of string is ${s.capitalize}") println("Lower case is ${s.toLowerCase}")  
println("Upper case is ${s.toUpperCase}")
```

Refer : [Strings.kt](https://kotlinlang.org/api/latest/jvm/stdlib/kotlin/-string/index.html)

<https://kotlinlang.org/api/latest/jvm/stdlib/kotlin/-string/index.html>

Kotlin Operators

Type	Operators
Arithmetic Operators	+ - * / %
Assignment Operators	+ = - = *= /= %=
Increment and decrement operators	++ --
Comparison and Equality Operators	> < >= <= == !=
Logical Operators	&&
Sign operators	+ and -. They are used to indicate or change the sign of a value.
Range Operator	.. (Eg: x..y → the range of numbers starting at x and ending at y.

Kotlin loops for, forEach, repeat, while, do-while

for : for loop iterates through anything that provides an iterator.

Syntax : `for (item in collection) { body }`

Example : `var daysOfWeek =`

`listOf("Sunday", "Monday", "Tuesday", "Wednesday", "Thursday", "Friday", "Saturday")`

Note : `listOf()` method returns a read-only list, you cannot add elements.

```
for(day in daysOfWeek){  
    println(day)  
}
```

for with index :

```
for ((index, value) in daysOfWeek.withIndex()) {  
    println("the element at $index is $value")  
}
```


Kotlin loops for, forEach, repeat, while, do-while

- **forEach** can be used to repeat a set of statement for each element in an iterable.

```
daysOfWeek.forEach{  
    println(it)  
}
```

- while and do..while work as usual in Java
- **repeat** : repeat statement is used when a set of statements must be executed N-number of times.

```
Eg: repeat(4) {  
    println("Hello World!")  
}
```

Refer : forloop.kt

Kotlin - Ranges, when expression

Ranges

- You can create a range in Kotlin via `..` operator.

- Example

```
for(i in 1..5) { print(i) } // Result: 1 2 3 4 5
```

- **downTo** : Using `downTo` function we can go reverse in a range.

```
for(i in 5 downTo 1) { print(i) } // Result: 5 4 3 2 1
```

- **step** : Using `step` function we can increase the step

```
for (i in 1..10 step 2) { print(i) } // Result: 1 3 5 7 9
```

if we want to exclude the last value in a range use `until`

```
for (i in 1 until 5) { print(i) } // Result: 1 2 3 4
```

Kotlin - Ranges, when expression

When expression

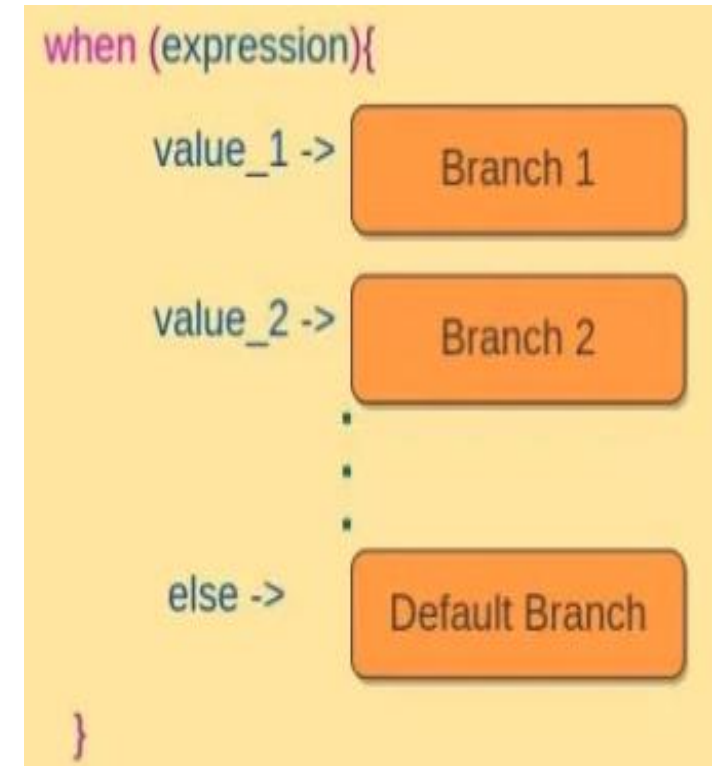
- Kotlin when expression is kind of switch case in Java, but concise in syntax, extended in functionality and more fun. Using “Any” object type with **when** expression makes is really broad in the usage.

Example

```
when (x) {  
    1 -> print("x == 1")  
    2 -> print("x == 2")  
    else -> { // Note the block  
        print("x is neither 1 nor 2")  
    }  
}
```

Refer : WhenExample.kt

<https://kotlinlang.org/docs/control-flow.html#when-expression>



Main Point 1

Lesson covers the fundamentals must know to write Kotlin code. Understand the features, declaring variables, constants and writing methods. The Kotlin language specifies rules for working with null safety. Objects have both data and behavior which support the intended purpose of the object. *Similarly, consciousness is established when the unmanifest value of the object is realized; everything perceived in terms of the Self.*

Kotlin - Null Safety

- Null Safety in Kotlin is to eliminate the risk of occurrence of NullPointerException in real time.
- Way to handle Null Safety in Kotlin
 1. Differentiate between nullable references and non-nullable references.
 2. User explicitly checks for a null if conditions
 3. Using a Safe Call Operator (?.)
 4. Elvis Operator (?:)
- Refer : NullabilityCheck.kt

Way to handle Null Safety in Kotlin

- **Way – 1** - Differentiate between nullable references and non-nullable references.
 - Kotlin's type system can differentiate between nullable references and non-nullable references. `?` operator is used during variable declaration for the differentiation.

//Non- nullable – You cannot assign null to //the non-null variable

```
var a: String = "Hello"
```

```
a = null // compilation error
```

// If you want to assign null value use ? operator

```
var a: String? = "Hello"
```

```
a = null // OK
```

Way to handle Null Safety in Kotlin

■ Way – 2 – Nullable Check

- The Kotlin system will tell you an error if you want to call a method from a nullable variable. Always check before accessing whether it is null or not.

```
var a: String? = "Hello"
```

```
val l = if (a != null) a.length else -1
```

Way to handle Null Safety in Kotlin

■ Way – 3 - Safe Calls (?.)

- The safe call operator returns the variables property only if the variable is not null, else it returns null. So, the variable holding the return value should be declared nullable.

```
fun main(args: Array){  
    var b: String? = "Hi !" // variable is declared as nullable  
    var len: Int?  
    len = b?.length  
    println("b is : $b")  
    println("length is : $len")  
    b = null  
    len = b?.length  
    println("b is : $b")  
    println("length is : $len")  
}
```

Result for the Code

```
b is : Hi !  
length is : 4  
b is : null  
length is : null
```


Way to handle Null Safety in Kotlin

- Way – 4 – Elvis Operator (?:)
 - If reference to a variable is not null, use the value, else use some default value that is not null. This might sound same as explicitly checking for a null value.

```
fun main(args: Array){  
    var b: String? = " David" // variable is declared as nullable  
    val len = b?.length ?: -1  
    println("length is : $len")  
    b= null  
    val noname = b?: "No one knows me"  
    println("Name is : $noname")  
}
```

Result for the Code

length is : 5

Name is : No one knows me

The !! Operator (not-null assertion operator)

- Despite the safety measures Kotlin provides to handle NPE, if you need NPE so badly to include in the code use !! operator.
- You can use this operator, if you are 100% sure that variable holds a non null value, or else you will get
NullPointerException(NPE)

The !! Operator (not-null assertion operator)

```
fun main(args: Array){  
    var b: String? = "Hello"    // variable is declared  
as nullable  
    var blen = b!!.length  
    println("b is : $b")  
    println("b length is : $blen")  
    b = null  
    println("b is : $b")  
    blen = b!!.length // Throws NullPointerException  
    println("b length is : $blen")  
}
```

Result for the code

b is : Hello

b length is : 5

b is : null

Exception in thread "main"

kotlin.KotlinNullPointerException at
ArrayaddremoveKt.main
(Arrayaddremove.kt:9)

Arrays

```
var myArray = arrayOf(1, 2, 3)
var arraySize = "myArray has ${myArray.size} items"
var firstItem = "The first item is ${myArray[0]} "
```

```
var temp = intArrayOf(4,6,7,8)
    for(index in temp){
        println(index)
    }
```

The provided classes are ByteArray, CharArray, ShortArray, IntArray, LongArray, BooleanArray, FloatArray, and DoubleArray.

For String : Array<String> or arrayOf("String1","String2");

Ref: ArrayandList.kt

String Arrays

```
var lang : Array<String> = arrayOf("C++","Java","Kotlin","Python","Scala")
println("Language Array")
lang.forEach { println(it)
}

println("Name Array")
var names = arrayOf("James","Anne","Bruce","Tom","Benny")
for ((ind,v) in names.withIndex()) {
    println("$ind" + " Index = $v")
}
```

ArrayList

```
// ArrayList
println("Language ArrayList")
var llist = ArrayList<String>(arrayListOf
("C++", "Java", "HTML"))
llist.add("Kotlin")
llist.add("Scala")
llist.add("Ruby")
println(llist)
```

Declaring own Functions

Function name

Parameters

Return type

```
fun max(a: Int, b: Int): Int {  
  return if (a > b) a else b  
}
```

Function body

Example 1 – functions contain other functions

```
fun main(args: Array<String>) {  
    val name = "John"  
    val count = 5  
    fun displayString() {  
        for (index in 0..count) {  
            println(name)  
        }  
    }  
    displayString()  
}
```

Refer : Functions.kt

Example 2- Variable Number of Function Parameters

Kotlin handles this possibility using the *vararg* keyword to indicate that the function accepts an arbitrary number of parameters of a specified data type.

```
fun displayStrings(vararg strings: String){  
    for (string in strings) {  
        println(string)  
    }  
}  
  
displayStrings("one", "two", "three", "four")  
Refer : VaragsDemo.kt
```

Example 3-Declaring Default Function Parameters

Kotlin provides the ability to designate a default parameter value to be used if the value is not provided as an argument when the function is called.

```
fun buildMessageFor(name: String = "Customer", count: Int = 0): String {  
    return("$name, you are customer number $count")  
}
```

// Calling Functions

```
val message = buildMessageFor("John",10) //Valid  
val message = buildMessageFor("John") // Valid
```

If parameter names are not used within the function call, however, only the trailing arguments may be omitted:

```
val message = buildMessageFor(10) // Invalid  
val message = buildMessageFor(count = 10) // Valid
```

Refer : Functions.kt

Example 4 :Single Expression Function

- When a function contains a single expression, it is not necessary to include the braces around the expression. All that is required is an equal sign (=) after the function declaration followed by the expression.

- Way 1

```
fun multiply(x: Int, y: Int): Int {    return x * y }
```

- Way 2

```
fun multiply(x: Int, y: Int): Int = x * y
```

- Way 3 – no need to specify return type

```
fun multiply(x: Int, y: Int) = x * y
```

Main Point 2

- Kotlin is a powerful object oriented and functional programming language features that is easier to use, faster development and more secured. *Science of Consciousness: Transcendental Meditation is an easy and effortless technique to make a mind clear and more powerful so that we can make life easier.*

Quiz

1. Kotlin Strings are mutable
 - a) True b) False
2. Kotlin data types are object type.
 - a) True b) False

Kotlin Modifiers

- Classes, objects, interfaces, constructors, functions, properties and their setters can have visibility modifiers. There are four visibility modifiers in Kotlin: private, protected, internal and public.
- **public: default**
 - The public modifiers means that the declarations are visible everywhere.
 - In Kotlin the default visibility modifier is public
- **internal (Modules not covered in this course)**
 - internal means that the declarations are visible inside a module. A module in Kotlin is a set of Kotlin files compiled together.
- **private**
 - With private declarations are only visible in the class
- **protected**
 - Declarations are only visible in its class and in its sub classes

Declaring a Kotlin Class

- Kotlin provides extensive support for developing object-oriented applications.
- The basic syntax for a new class is as follows:

```
class NewClassName {  
    // Properties  
    // Methods  
}
```

Class and Object [Example – 1]

■ Simple Java class Person

```
public class Person {  
    private String name;  
    public Person(String name) {  
        this.name = name;  
    }  
    public String getName() {  
        return name;  
    }  
    public void setName() {  
        this.name = name;  
    }  
}
```

Note : No need of semicolon in the end of the line

■ Simple Kotlin class Person

//If you have only one constructor - Primary

```
class Person(val name: String)
```

//If you have many constructor

```
class Person {  
    var name:String  
    var age:Int = 0  
    constructor(name:String) {  
        this.name = name  
    }  
    constructor(name:String, age:Int) {  
        this.name = name  
        this.age = age  
    }  
}
```


Constructors [Example – 2]

- There could be only one **Primary constructor** for a class in Kotlin.
- The primary constructor comes right after the class name in the header part of the class.
- Constructors that are written inside the Body of Class are called **Secondary constructors**.
- Secondary Constructor should call primary constructor or other secondary constructors using **this** keyword.

Refer : Item.kt & TestItem.kt

Constructors [Example – 2]

```
fun main(args: Array<String>){  
    var person_1 = Person("David",25, "Teaching")  
    person_1.printPersonDetails()  
}
```

// Kotlin Primary Constructors

```
class Person (var name: String, var age: Int){  
    var profession: String = "Not Mentioned"
```

// Kotlin Secondary Constructors

```
    constructor (name: String, age: Int, profession: String): this(name,age){  
        this.profession = profession  
    }
```

```
    fun printPersonDetails(){  
        println("$name whose profession is $profession, is $age years old.")  
    }  
}
```

Output : David whose profession is Teaching, is 25 years old.

Class and Object [Example – 3]

```
class BankAccount {  
    var accountBalance: Double = 0.0  
    var accountNumber: Int = 0  
    var lastName: String = ""  
    constructor(number: Int, balance: Double) {  
        accountNumber = number  
        accountBalance = balance  
    }  
    constructor(number: Int, balance: Double, name: String ) {  
        accountNumber = number  
        accountBalance = balance  
        lastName = name  
    }  
    fun displayBalance() {  
        println("Number $accountNumber")  
        println("Current balance is $accountBalance")  
    }  
}
```

Object Creation

```
val account1: BankAccount = BankAccount(456456234, 342.98, "Smith")
```

Custom Accessors

- Accessors that are provided automatically by Kotlin.
- In addition to these default accessors, it is also possible to implement *custom accessors* that allow calculations or other logic to be performed before the property is returned or set.
- Example

```
class BankAccount (val accountNumber: Int, var accountBalance: Double) {  
    val fees: Double = 25.00  
    var balanceLessFees: Double  
    get() {  
        return accountBalance - fees  
    }  
    set(value) {  
        accountBalance = value - fees  
    }..  
}
```

The following code gets the current balance less the fees value before setting the property to a new value:

```
val balance1 = account1.balanceLessFees // getter  
account1.balanceLessFees = 12123.12 // setter
```

Refer : Account.kt and TestAccount.kt

Kotlin Inheritance and Sub classing

Sub classing Syntax

- As a safety measure designed to make Kotlin code less prone to error, before a subclass can be derived from a parent class, the parent class must be declared as open. This is achieved by placing the *open* keyword within the class header:

```
open class MyParentClass {  
    var myProperty: Int = 0  
}
```

With a simple class of this type, the subclass can be created as follows:

```
class MySubClass : MyParentClass() {  
}
```

Deal with Parent class primary constructors in subclass

- For classes containing primary or secondary constructors, the rules for creating a subclass are slightly more complicated.
- Consider the following parent class which contains a primary constructor:

```
open class MyParentClass(var myProperty: Int) { }
```

- In order to create a subclass of this class, the subclass declaration references any base class parameters while also initializing the parent class using the following syntax:

```
class MySubClass(myProperty: Int) : MyParentClass(myProperty) {  
}
```

Example – BankAccount and SavingAccount

- Refer same BankAccount class and use open keyword to achieve inheritance and if you want to override a method, declare the method as **open**.

```
open class BankAccount {  
    var accountNumber = 0  
    var accountBalance = 0.0  
    constructor(number: Int, balance: Double) {  
        accountNumber = number  
        accountBalance = balance  
    }  
    open fun displayBalance(){ // To Override use open  
        println("Number $accountNumber")  
        println("Current balance is $accountBalance")  
    }  
}
```

Example – BankAccount and SavingsAccount

```
class SavingsAccount : BankAccount {  
    var interestRate: Double = 0.0  
    constructor(accountNumber: Int, accountBalance: Double) :  
        super(accountNumber, accountBalance)  
  
    constructor(accountNumber: Int, accountBalance: Double, rate: Double) :  
        super(accountNumber, accountBalance) {  
        interestRate = rate  
    }  
  
    fun calculateInterest(): Double  
    {  
        return interestRate * accountBalance  
    }  
    override fun displayBalance() // Override from parent  
    {  
        println("Number $accountNumber")  
        println("Current balance is $accountBalance")  
        println("Prevailing interest rate is $interestRate")  
    }  
}
```


main function

```
fun main(args: Array<String>) {  
    val savings1 = SavingsAccount(12311, 600.00, 0.07)  
    println(savings1.calculateInterest())  
    savings1.displayBalance()  
}
```

Console output

42.01

Number 12311

Current balance is 600.0

Prevailing interest rate is 0.07

Refer : inheritancedemo Package

Interface

- An interface is essentially a contract that a class may choose to sign; if it does, the class is obliged to provide implementations of the properties and functions of the interface.
- However, an interface may provide a default implementation of some or all its properties and functions.
- If a property or function has a default implementation, the class may choose to override it, but it doesn't have to.

Interface

Example

```
interface MyInterface {  
    val test: Int  
    // Abstract method  
    fun print() : String  
  
    // default implementation  
    fun hello(name: String) {  
        println("Hello there, $name!")  
    }  
}  
  
class InterfaceImp : MyInterface {  
    override val test: Int = 25  
    override fun print() = "Kotlin"  
}
```

```
fun main(args: Array<String>) {  
    val obj = InterfaceImp()  
  
    println("test = ${obj.test}")  
    print("Calling hello(): ")  
  
    obj.hello("Tim")  
    print("Calling and printing print(): ")  
    println(obj.print())  
}
```

Refer : interfacedemo package

Data Class

- While building any application, we often need to create classes whose primary purpose is to hold data/state.
- These classes generally contain the same old boilerplate code in the form of getters, setters, equals(), hashCode() and toString() methods.
- Will look into Kotlin data classes and how concise they are compared to POJOs (Plain Old Java Objects) and how much boilerplate we can get rid of by moving to Kotlin data classes during the Android app development.
- In Kotlin, this is called a data class and is marked as data

```
data class Person (val fname:String, val lname:String, var age:Int)
```

Rules for Creating Data Classes

- The Kotlin documentation on data classes notes that there are some basic restrictions in order to maintain consistency/behavior of generated code:
 - The primary constructor needs to have at least one parameter;
 - All primary constructor parameters need to be marked as `val` or `var`;
 - Data classes cannot be abstract, open, sealed(Not covered in this course) or inner;
 - Refer : `Person.kt` and `TestPerson.kt`
 - <https://kotlinlang.org/docs/reference/data-classes.html>

Quiz

1. The primary constructor comes right after the class name in the header part of the class.
a) True b) False
2. If you want Inherit, in Kotlin you have declare the parent class with the keyword _____
a) extends b) open c) Inherit

Main Point 3

- In the OO paradigm of programming, execution of a program involves objects interacting with objects. Each object has a type, which is embodied in a Kotlin *class*. The Kotlin language specifies syntax rules for the coding of classes, and also for how objects are to be created based on their type (class). *By using more and more of the intelligence of Nature, we are able to successfully manage all complexity in life, and live a life of success, harmony and fulfillment.*

UNITY CHART

CONNECTING THE PARTS OF KNOWLEDGE WITH THE WHOLENESS OF KNOWLEDGE

Take the right angle and let go

1. Understand the fundamentals before writing the code is important to develop Android applications.
2. Kotlin provides extensive support for developing object-oriented applications.

-
3. *Transcendental consciousness* is when our mind is in contact with the deepest underlying reality, the unified field.
 4. *Impulses within the Transcendental field:* the infinitely dynamism of the unified field constantly expresses itself and becomes all aspects of the universe.
 5. *Wholeness moving within itself:* In Unity Consciousness, one experiences that this infinite dynamism is nothing but the self.

