Object Oriented Programming in JAVA

prepared by

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Course Objectives

On completion of this course we will be able to:

- ✔ Identify the importance of Java .
- ✔ Identify the additional features of Java compared to C++ .
- ✔ Identify the difference between Compiler and Interpreter .
- ✔ Identify the difference between applet and application .
- ✔ Apply Object Oriented Principles of Encapsulations , Data abstraction, Inheritance, Polymorphism.
- ✔ Program using java API (Application Programming Interface).
- ✔ Program using Exception Handling, Files and Threads .
- ✔ Program Using applets and swings .

Why Java is Important?

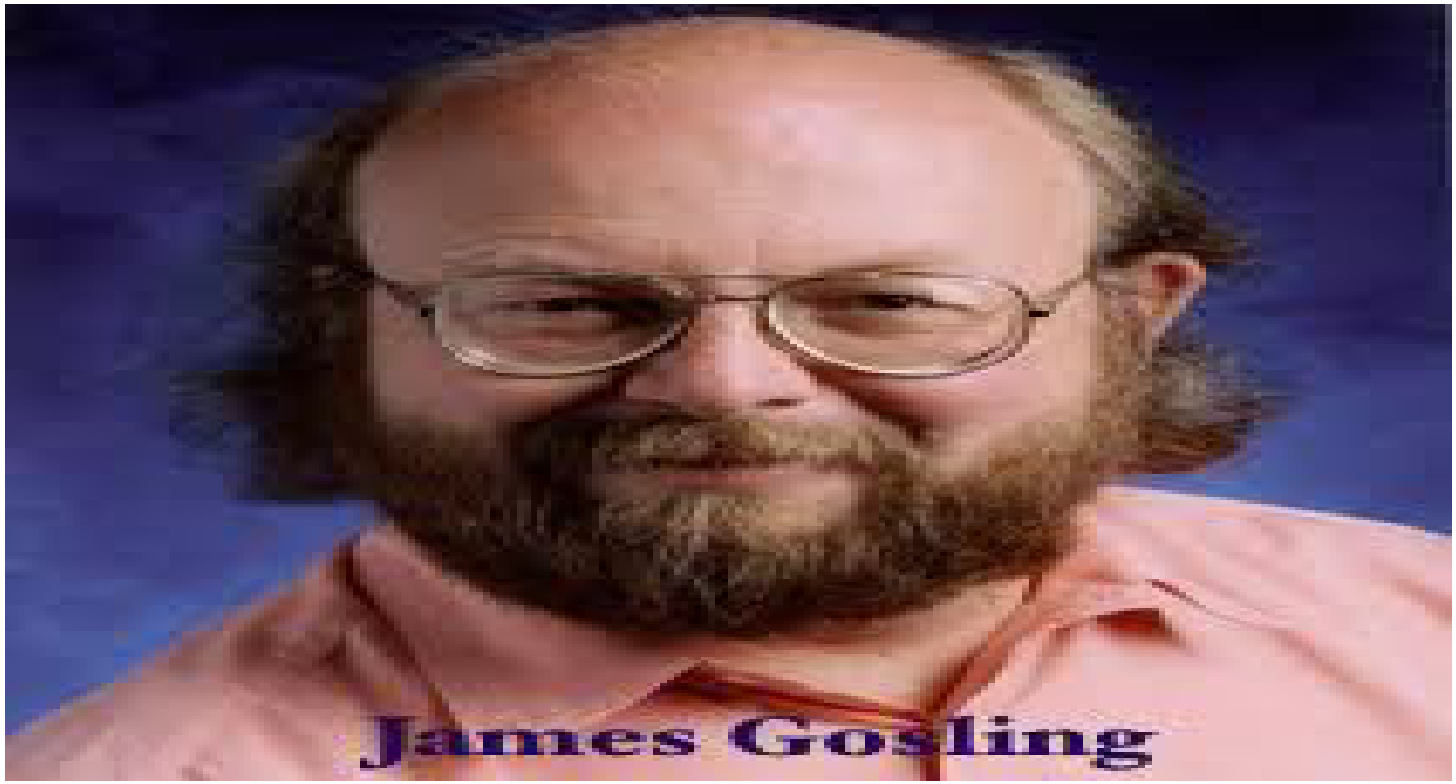
Two reasons :

- Trouble with C/C++ language is that they are not portable and are not platform independent languages.
- Emergence of World Wide Web, which demanded portable programs

Portability and security necessitated the invention of Java

History of Java

Java was developed by James Gosling, who is known as the father of Java, in 1995. James Gosling and his team members started the project in the early '90s. Currently, Java is used in internet programming, mobile devices, games, e-business solutions, etc.



There are given significant points that describe the history of Java.

James Gosling, Mike Sheridan, and Patrick Naughton initiated the Java language project in June 1991.

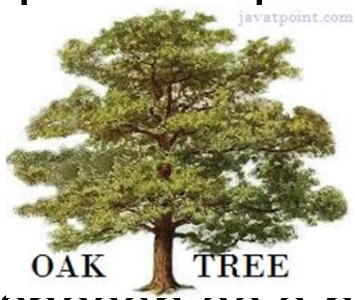
1)The small team of sun engineers called Green Team.

2) Initially designed for small, embedded systems in electronic appliances like set-top boxes.

3) Firstly, it was called "Greentalk" by James Gosling, and the file extension was .gt.

4) After that, it was called Oak and was developed as a part of the Green project.

Why Java named "Oak"?



5) Why Oak? Oak is a symbol of strength and chosen as a national tree of many countries like the U.S.A., France, Germany, Romania, etc.

6) In 1995, Oak was renamed as "Java" because it was already a trademark by Oak Technologies.

Why Java Programming named "Java"?

7) Why had they chosen java name for Java language? The team gathered to choose a new name. The suggested words were " dynamic", "revolutionary", "Silk", "jolt", "DNA", etc. They wanted something that reflected the essence of the technology: revolutionary, dynamic, lively, cool, unique, and easy to spell and fun to say.

According to James Gosling, "Java was one of the top choices along with Silk". Since Java was so unique, most of the team members preferred Java than other names.

8) Java is an island of Indonesia where the first coffee was produced (called java coffee). It is a kind of espresso bean. Java name was chosen by James Gosling while having coffee near his office.

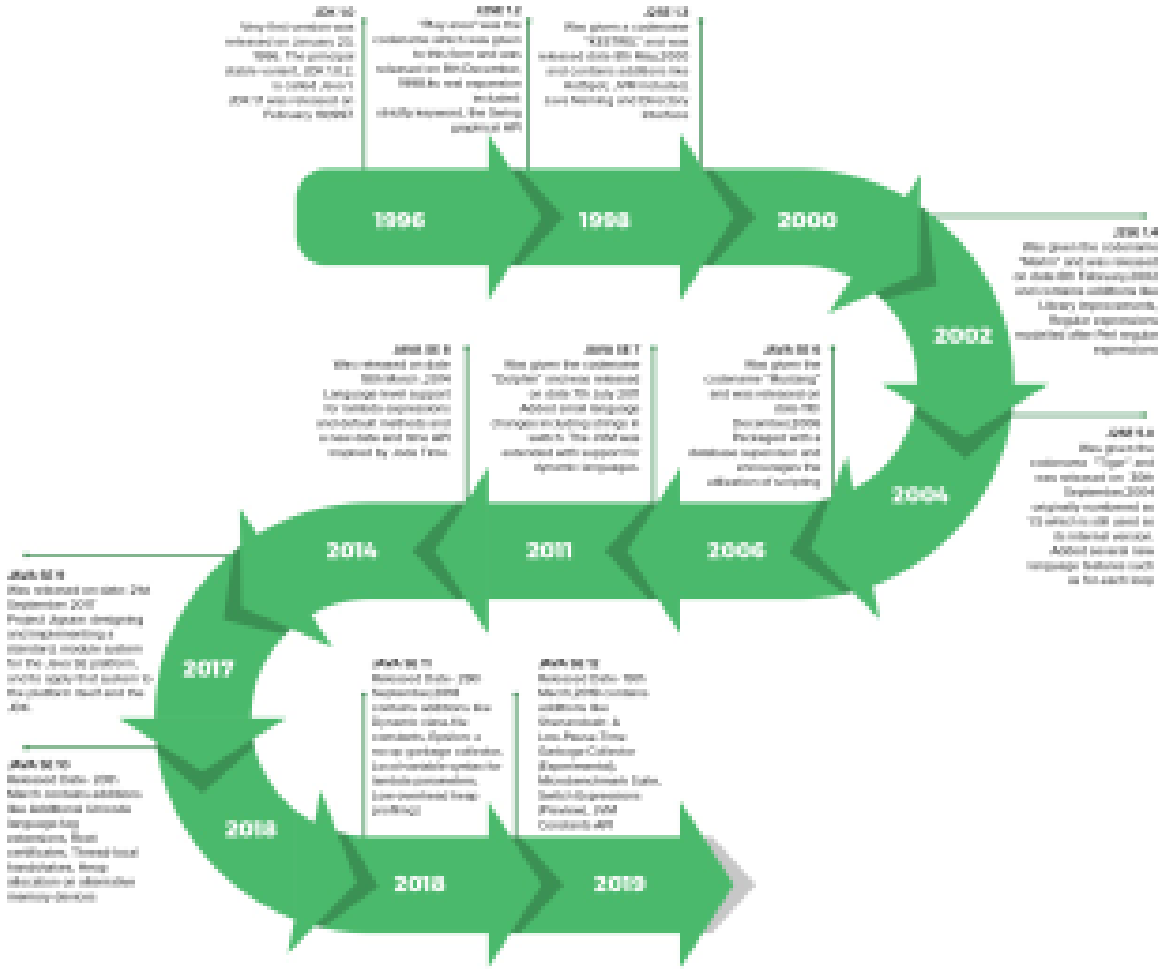
9) Notice that Java is just a name, not an acronym.

10) Initially developed by James Gosling at Sun Microsystems (which is now a subsidiary of Oracle Corporation) and released in 1995.

11) In 1995, Time magazine called Java one of the Ten Best Products of 1995.

12) JDK 1.0 released in(January 23, 1996). After the first release

History



Java Editions

- **J2SE(Java 2 Standard Edition)** - to develop client side standalone applications or applets.
- **J2ME(Java 2 Micro Edition)** - to develop applications for mobile devices such as cellphones.
- **J2EE(Java 2 Enterprise Edition)** - to develop server-side applications such as Java servlets and Java Server Pages.

What is Java?

- A general-purpose object-oriented language.
- Write Once Run Anywhere (WORA).
- Designed for easy Web/Internet applications.
- Widespread acceptance.

Differences

	C++	java	c
1.Program paradigm	oops	purely oops	procedural
2.Origin	c	c++	Assembly langugae
3.Devoloper	Brian Stroustrup (1979)	James Gosling(1991)	Dennis Ritchie(1972)
4.Translator --	Compiler	Compiler& Interpreter	compiler
5.Platform Independent	dependent	JVM- independent	dependent
6.Code &Execution	direct .exe	.class	direct .exe
7.Aprroach	Bottom-up	bottom-up	top-dwn
8.Preprocessor Directives	#tag	import #tag	
9.Keyword	63	50	32
10.Datatype	sruct and union	no	struct and union
11.Inheritance	yes	yes	no
12.Overloading	yes	yes	no
13.Pointers	yes	no	yes
14.Memory allocation	new,delete	garbage collector	malloc,realloc,free
15.Exception Handling	yes	yes	no
16.Templates	yes	no	no
17.Destructor	yes	no	no
18.Multi-threaded	no	yes	no
19.DB connectivity	no	yes	no
20.Storage classes	yes	no	yes

How is Java different from C…

C Language:

Major difference is that C is a structure oriented language and Java is an object oriented language and has mechanism to define classes and objects.

- ✔ Java does not support an explicit pointer type
- ✔ Java does not have preprocessor, so we cant use #define, #include and #ifdef statements.
- ✔ Java does not include structures, unions and enum data types.
- ✔ Java does not include keywords like goto, sizeof and typedef.
- ✔ Java adds labeled break and continue statements.
- ✔ Java adds many features required for object oriented programming.

How is Java different from C++…

Features removed in java:

- Java doesn't support pointers to avoid unauthorized access of memory locations.
- Java does not include structures, unions and enum data types.
- Java does not support operator over loading.
- Preprocessor plays less important role in C++ and so eliminated entirely in java.
- Java does not perform automatic type conversions that result in loss of precision.
- Java does not support global variables. Every method and variable is declared within a class and forms part of that class.
- Java does not allow default arguments.
- Java does not support inheritance of multiple super classes by a sub class (i.e., multiple inheritance). This is accomplished by using 'interface' concept.
- It is not possible to declare unsigned integers in java.
- In java objects are passed by reference only. In C++ objects may be passed by value or reference.

New features added in Java:

- Multithreading, that allows two or more pieces of the same program to execute concurrently.
- C++ has a set of library functions that use a common header file. But java replaces it with its own set of API classes.
- It adds packages and interfaces.
- Java supports automatic garbage collection.
- break and continue statements have been enhanced in java to accept labels as targets.
- The use of unicode characters ensures portability.

Features that differ:

- Though C++ and java supports Boolean data type, C++ takes any nonzero value as true and zero as false. True and false in java are predefined literals that are values for a boolean expression.
- Java has replaced the destructor function with a finalize() function.
- C++ supports exception handling that is similar to java's.

Characteristics of Java

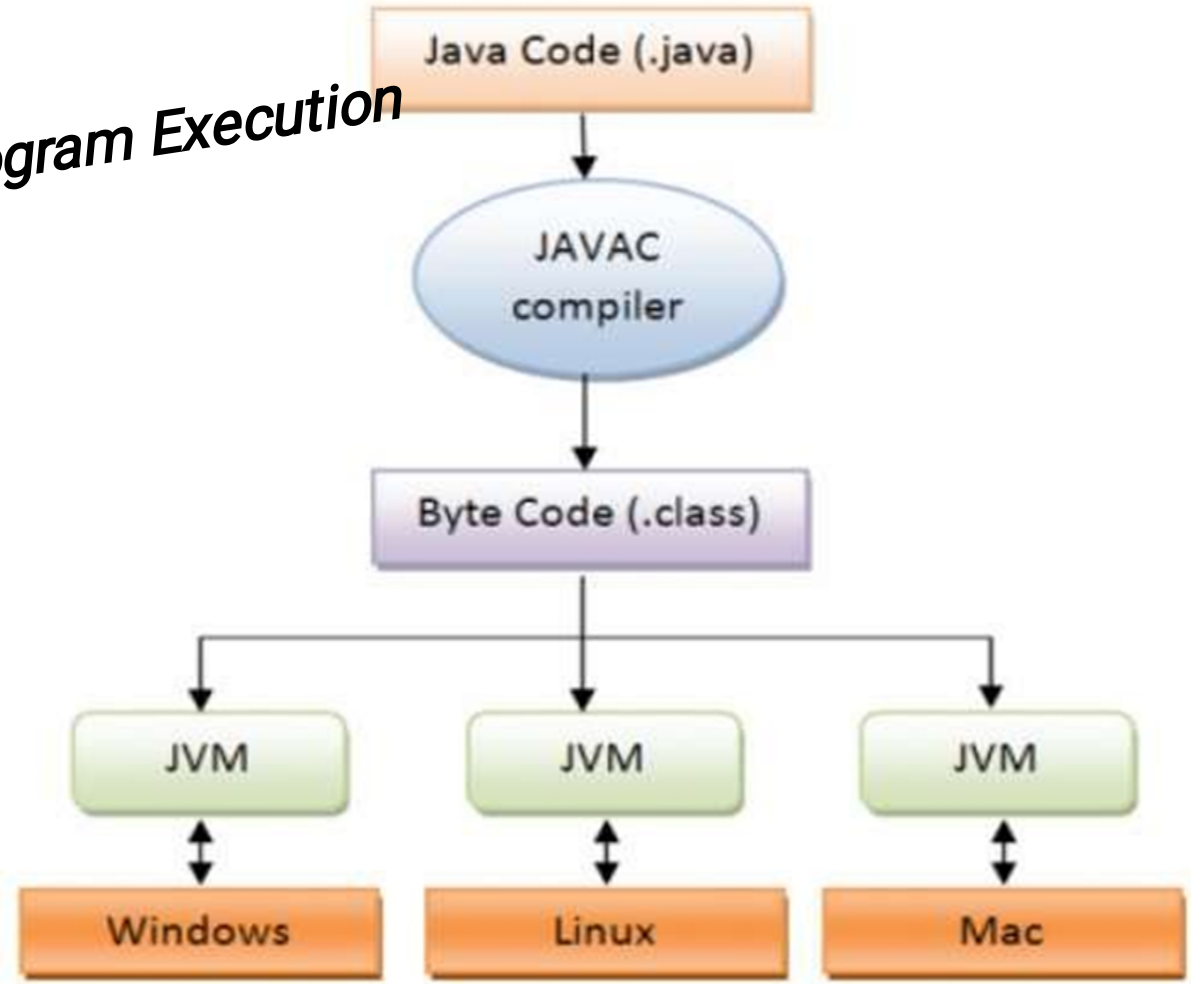
- ✔ Java is simple
- ✔ Java is object-oriented
- ✔ Java is distributed
- ✔ Java is interpreted
- ✔ Java is robust
- ✔ Java is architecture-neutral
- ✔ Java is portable
- ✔ Java's performance
- ✔ Java is multithreaded
- ✔ Java is dynamic
- ✔ Java is secure

Java Environment

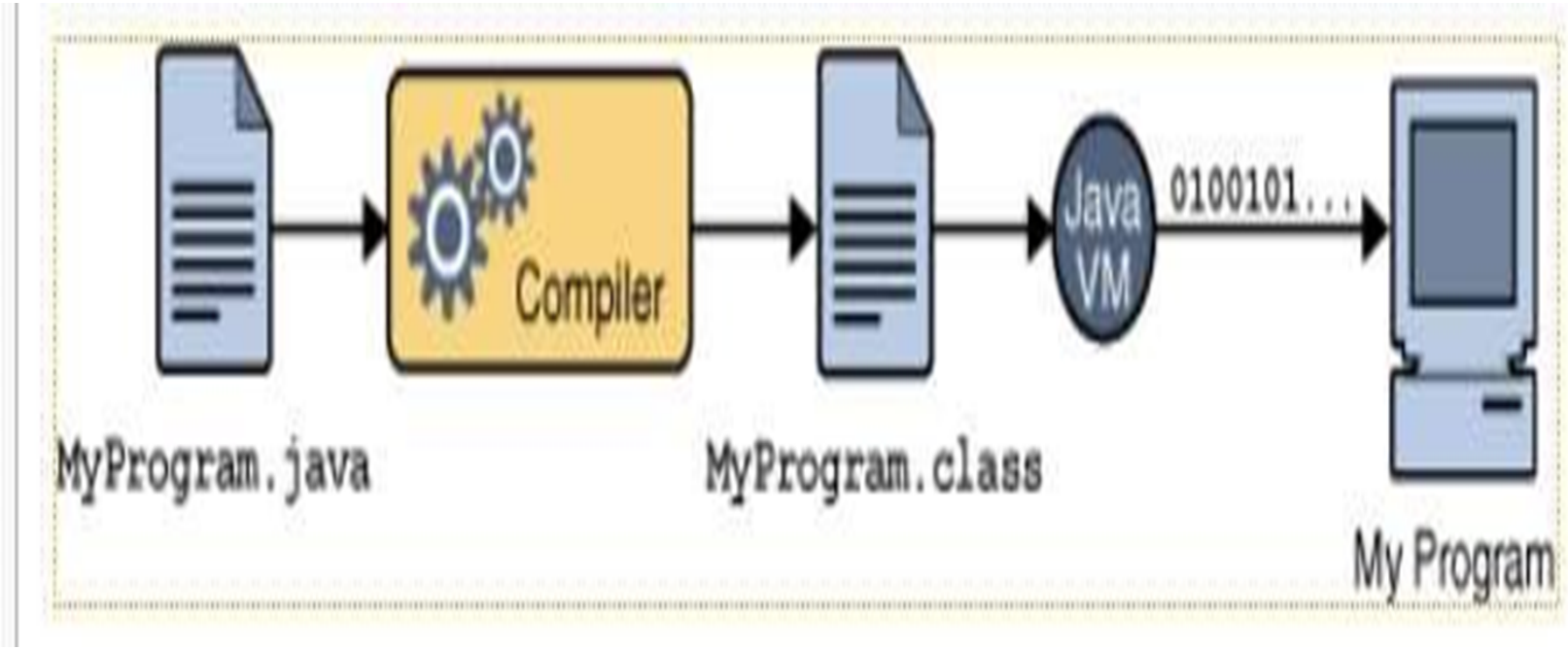
- Java includes many development tools, classes and methods
- Development tools are part of Java Development Kit (JDK) and The classes and methods are part of Java Standard Library (JSL),also known as Application Programming Interface (API).
- JDK constitutes of tools like java compiler, java interpreter and many.
- API includes hundreds of classes and methods grouped into several packages according to their functionality.

JAVA is Architectural Neutral

JAVA program Execution



WORA(Write Once Run Anywhere)



Introduction

Object oriented programming is the principle of design and development of programs using modular approach.

- Object oriented programming approach provides advantages in creation and development of software for real life application.
- The basic element of object oriented programming is the data.
- The programs are built by combining data and functions that operate on the data.
- Some of the OOP's languages are C++, Java, C #, Smalltalk, Perl, and Python.

Procedural programming

- The procedural programming focuses on **processing** of instructions in order to perform a desired computation.
- The top-down concepts to decompose main
- functions into lower level components for modular coding purpose.
- Therefore it emphasizes more on doing things like algorithms.
- This technique is used in a conventional programming language such as C and Pascal.

Object oriented programming

- Object oriented programming (OOP) is a concept that combines both the data and the functions that operate on that data into a single unit called the object.

  object=data+functions

- An object is a collection of set of data known as member data and the functions that operate on these data known as member function.

- OOP follows bottom-up design technique.

- Class is the major concept that plays important role in this approach. Class is a template that

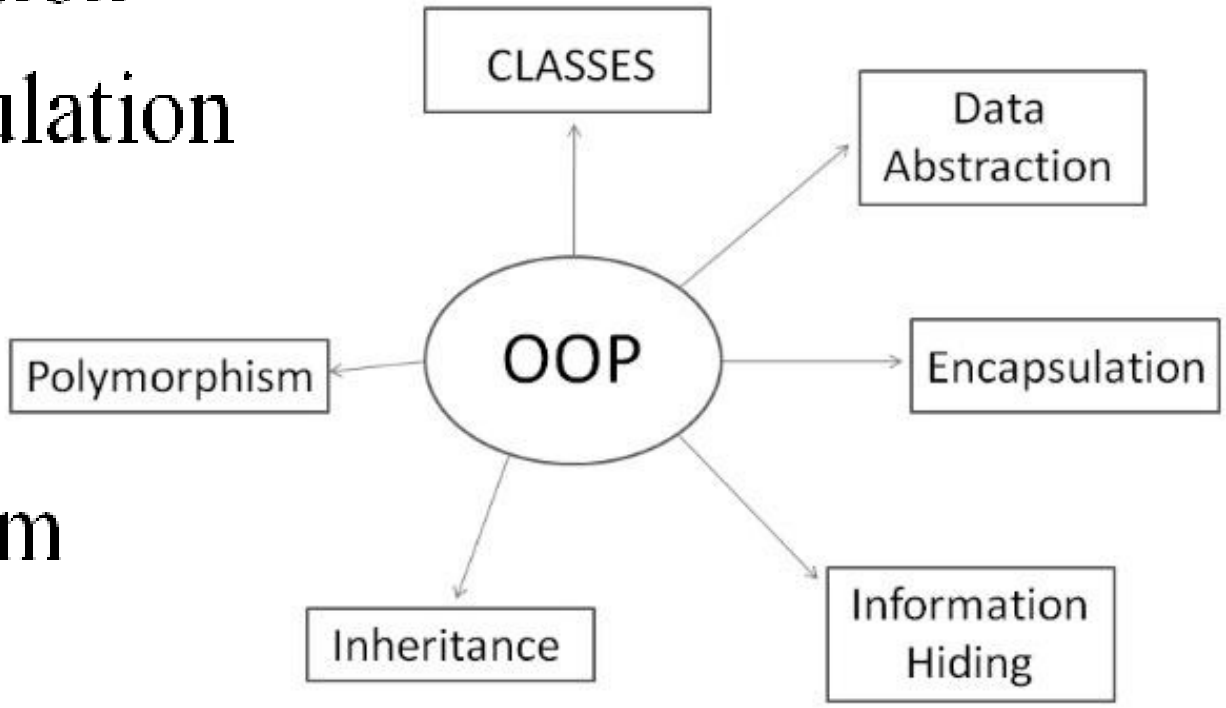
Differences

Procedural Programming	Object Oriented Programming
Large programs are divided into smaller programs known as functions	Programs are divided into objects
Data is not hidden and can be accessed by external functions	Data is hidden and cannot be accessed by external functions
Follow top down approach in the program design	Follows bottom-up approach in the program design
Data may communicate with each other through functions	Objects may communicate with each other through functions.
Emphasize is on procedure rather than data	Emphasize is on data rather than procedure

Basic Concepts of OOP's

The following are the major characteristics of OOP's:

- Objects
- Class
- Data abstraction
- Data encapsulation
- Inheritance
- Overloading
- Polymorphism
- Dynamic Binding
- Message Passing

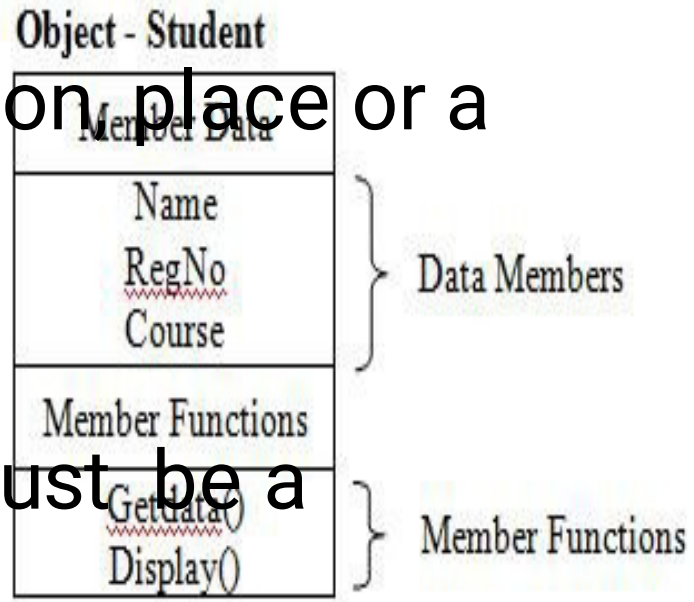


Objects

- Objects are basic building blocks for designing programs.

Object is a instance of a class

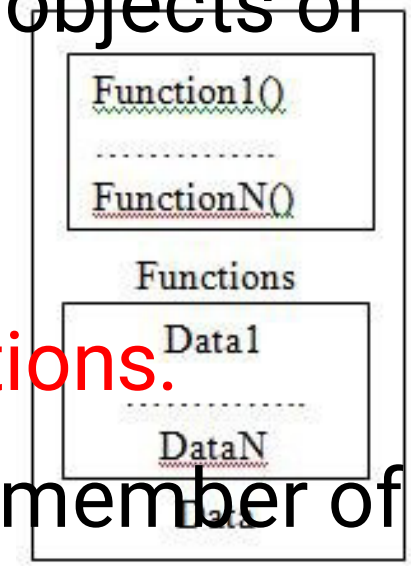
- ***An object is a collection of data members and associated member functions.***
- An object may represent a person, place or a table of data.
- Each object is identified by a unique name. Each object must be a member of a particular class.
- Example: Apple, orange, mango are the



Classes

- The objects can be made user defined data types with the help of a class.
- ***A class is a collection of objects that have identical properties, common behavior and shared relationship.***
- Once class is defined, any number of objects of that class is created.
- Classes are user defined data types.

  A class can hold both data and functions.
- For example: Planets, sun, moon are member of class solar system.



Class:

If u create then u can create any number of object

ex Student s1=new Student();

Student s2=new Student();

.

.

Object:

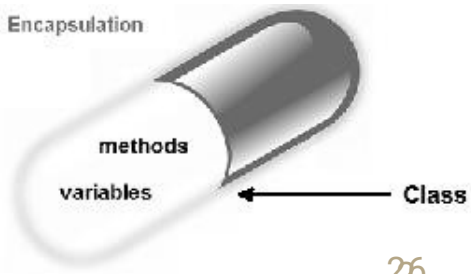
Object holds a memory,used to access all the data from the class

Object uniquely identified→

It will accessed only when class(data+functions)

DataAbstraction, Encapsulation & Data Hiding

- **Data Abstraction**
  - Data Abstraction refers to the process of representing essential features without including background details or explanations.
- **Data Encapsulation**
  - The wrapping of data and functions into a single unit (class) is called data encapsulation.
  - Data encapsulation enables data hiding and information hiding.
- **Data Hiding**
  - Data hiding is a method used in object oriented programming to hide information within computer code.



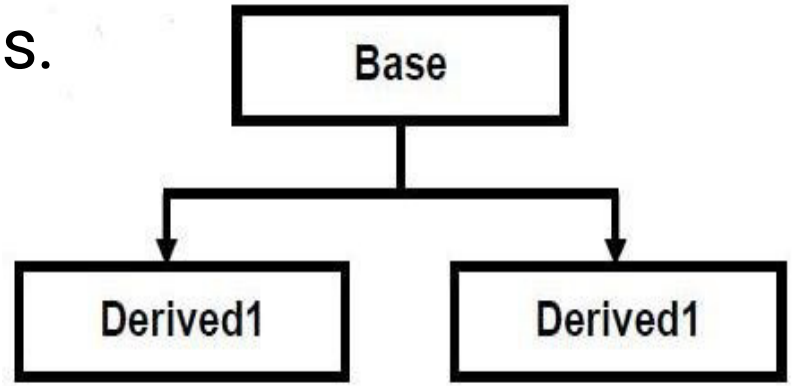
Inheritance

Inheritance is the process by which one object can acquire and use the properties of another object.

The existing class is known as ***base class or super*** class.

The new class is known as ***derived class or sub class.***

The derived class shares some of the properties of the base class. Therefore a code from a base class can be reused by a derived class.

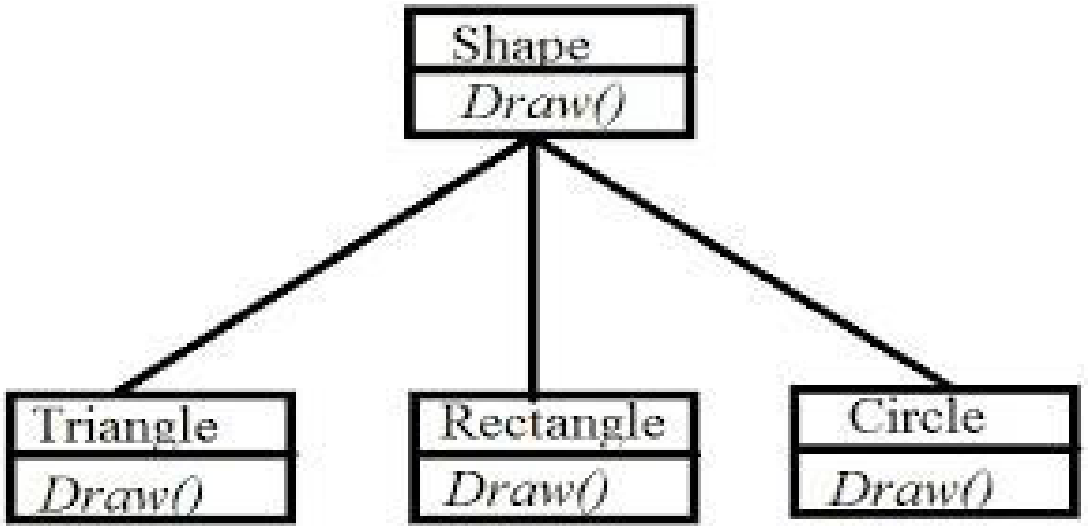


Overloading

- ***Overloading allows objects to have different meaning depending upon context.***
- There are two types of overloading viz.
  - Function Overloading
- When an existing operator operates on new data type is called ***operator overloading.***
- ***Function overloading*** *means two or more function have same name, but differ in the number of* arguments or data type of arguments.

Polymorphism

- ***The ability of an operator and function to take***
- ***multiple forms is known as Polymorphism.***
- The different types of polymorphism are operator
- overloa



Dynamic binding & Message Passing

Dynamic binding:

- Binding is the process of connecting one program to another.
- Dynamic binding is the process of linking the procedure call to a specific sequence of code or function at run time or during the execution of the program.

Message Passing:

- In OOP's, processing is done by sending message to objects.
- A message for an object is request for execution of procedure.
- Message passing involves specifying the name of the object, the name of the function (message) and the

Advantage of OOP's

- The programs are modularized based on the principles of **classes** and **objects.**
- Linking code & object allows related objects to share common code. This reduces **code duplication** and **code reusability**.
- Creation and implementation of OOP code is easy and reduces software development time.
- The concept of data abstraction separates object specification and object implementation.
- **Data encapsulated** along with functions. Therefore external non- member function cannot access or modify data, thus proving data security.
- Easier to develop complex software, because complexity can be minimized through inheritance.
- OOP can communicate through message passing which interface description with outside system, e.g.

Disadvantageof OOP's

- Larger program size: OOP's typically involves more lines of code than procedural programs.
- Slower Programs: OOP's typically slower than procedure based programs, as they typically require more instructions to be executed.
- Not suitable for all types of programs.
- To convert a real world problem into an object oriented model is difficult.
- OOP's software development, debugging and testing tools are not standardized.
- Polymorphism and dynamic binding also requires processing time, due to overload of function calls during run time.

Application of OOP's

- Computer graphics applications.
- CAD/CAM software
- Object-oriented database.
- User-Interface design such as windows
- Real-time systems.
- Simulation and Modeling
- Artificial intelligence and expert systems.

Thank you


CLASSES
Data Abstraction
OOP
Polymorphism
Encapsulation
All the best
Inheritance
Information Hiding