OBJECT ORIENTED TECHNIQUES USING JAVA(ACSE0302)

Unit: 3

Packages, Exception Handling and String Handling

Course Details
(B.Tech 3rd Sem /2nd Year)

Ms.Neeti Taneja
Assistant Professor
CSE Department

Brief introduction of faculty Member

Neeti Taneja
Designation: Assistant Professor(CSE Department)
NIET, Greater Noida
Qualification:

- B.Tech(CSE) from SRMIET, Naraingarh affiliated to Kurukshetra University in 2011.
- M.E(CSE) from Chitkara University, Rajpura in 2015.
- Pursuing PhD from Sharda University, Greater Noida.

Teaching Experience: 6.5 years
Research Publication

Particulars	Journals
International	14
National	Nil

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Evaluation Scheme

Sl. No.	Subject Codes	Subject Name	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	TOTAL	PS	TE	PE		
WEEKS COMPULSORY INDUCTION PROGRAM													
1	AAS0301A	Engineering Mathematics-III	3	1	0	30	20	50		100		150	4
2	ACSE0306	Discrete Structures	3	0	0	30	20	50		100		150	3
3	ACSE0304	Digital Logic & Circuit Design	3	0	0	30	20	50		100		150	3
4	ACSE0301	Data Structures	3	1	0	30	20	50		100		150	4
5	ACSE0302	Object Oriented Techniques using Java	3	0	0	30	20	50		100		150	3
6	ACSE0305	Computer Organization & Architecture	3	0	0	30	20	50		100		150	3
7	ACSE0354	Digital Logic & Circuit Design Lab	0	0	2				25		25	50	1
8	ACSE0351	Data Structures Lab	0	0	2				25		25	50	1
9	ACSE0352	Object Oriented Techniques using Java Lab	0	0	2				25		25	50	1
10	ACSE0359	Internship Assessment-I	0	0	2				50			50	1
11	ANC0301/ ANC0302	Cyber Security*/ Environmental Science*(Non Credit)	2	0	0	30	20	50		50		100	0
12		MOOCs** (For B.Tech. Hons. Degree)											
		GRAND TOTAL										**1100**	**24**

Syllabus

UNIT-I	Introduction	8 Hours

Object Oriented Programming: Introduction and Features: Abstraction, Encapsulation, Polymorphism, and Inheritance.

Modeling Concepts: Introduction, Class Diagram and Object Diagram.

Control Statements: Decision Making, Looping and Branching, Argument Passing Mechanism: Command Line Argument

UNIT-II	Basics of Java Programming	8 Hours

Class and Object: Object Reference, Constructor, Abstract Class, Interface and its uses, Defining Methods, Use of "this" and "super" keyword, Garbage Collection and finalize () Method.

Inheritance: Introduction and Types of Inheritance in Java, Constructors in Inheritance.

Polymorphism: Introduction and Types, Overloading and Overriding.

Lambda expression: Introduction and Working with Lambda Variables.

Arrays: Introduction and its Types.

Syllabus

UNIT-III	Packages, Exception Handling and String Handling	8 hours
Packages: Introduction and Types, Access Protection in Packages, Import and Execution of Packages. Exception Handling, Assertions and Localizations: Introduction and Types, Exceptions vs. Errors, Handling of Exception. Finally, Throws and Throw keyword, Multiple Catch Block, Nested Try and Finally Block. Assertions and Localizations Concepts and its working. String Handling: Introduction and Types, Operations, Immutable String, Method of String class, String Buffer and String Builder class		

UNIT-IV	Concurrency in Java and I/O Stream	8 hours
Threads: Introduction and Types, Creating Threads, Thread Life-Cycle, Thread Priorities, Daemon Thread, Runnable Class, Synchronizing Threads. I/O Stream: Introduction and Types, Common I/O Stream Operations, Interaction with I/O Streams Classes. Annotations: Introduction, Custom Annotations and Applying Annotations.		

UNIT-V	GUI Programming, Generics and Collections	8 hours
GUI Programming: Introduction and Types, Applet, Life Cycle of Applet, AWT, Components and Containers, Layout Managers and User-Defined Layout and Event Handling. Generics and Collections: Introduction, Using Method References, Using Wrapper Class, Using Lists, Sets, Maps and Queues, Working with Generics.		

Text Books

Text Books:
(1) Herbert Schildt," Java - The Complete Reference", McGraw Hill Education 12th edition
(2) Herbert Schildt," Java: A Beginner's Guide", McGraw-Hill Education 2nd edition
(3) James Rumbaugh et. al, "Object Oriented Modeling and Design", PHI 2nd Edition
Reference Books:
(4) Cay S. Horstmann, "Core Java Volume I – Fundamentals", Prentice Hall
(5) Joshua Bloch," Effective Java", Addison Wesley
(6) E Balagurusamy, "Programming with Java A Primer", TMH, 4th edition.

Branch-wise Applications

Java can be used :

- Data import and export.
- Cleaning data.
- Statistical analysis.
- Machine learning and Deep learning.
- Deep learning.
- Text analytics (also known as Natural Language Processing or NLP).
- Data visualization.

Course Objectives

- The objective of this course is to understand the object-oriented methodology and its techniques to design and develop conceptual models and demonstrate the standard concepts of object-oriented techniques modularity, I/O. and other standard language constructs.

- The basic objective of this course is to understand the fundamental concepts of object-oriented programming in Java language and also implement the Multithreading concepts, GUI based application and collection framework.

Course Outcomes

After completion of this course students will be able to:

CO1	**Identify the concepts of object oriented programming and relationships among them needed in modeling.**
CO2	**Demonstrate the Java programs using OOP principles and also implement the concepts of lambda expressions.**
CO3	**Implement packages with different protection level resolving namespace collision and evaluate the error handling concepts for uninterrupted execution of Java program.**
CO4	Implement Concurrency control, I/O Streams and Annotations concepts by using Java program.
CO5	Design and develop the GUI based application, Generics and Collections in Java programming language to solve the real-world problem.

Program Outcomes

1. Engineering knowledge:
2. Problem analysis:
3. Design/development of solutions:
4.Conduct investigations of complex problems
5. Modern tool usage
6. The engineer and society
7. Environment and sustainability
8. Ethics:
9. Individual and team work
10. Communication:
11. Project management and finance
12. Life-long learning

CO-PO Mapping

Mapping of Course Outcomes and Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	**3**	**3**	**3**	**2**	**1**				**2**			**3**
CO.2	3	3	3	2	1				2			3
CO.3	3	3	3	2	1				2			3
CO.4	3	3	3	2	1				2			3
CO.5	3	3	3	2	1				2			3

Program Specific Outcomes

On successful completion of graduation degree the Engineering graduates will be able to:

PSO1: The ability to identify, analyze real world problems and design their ethical solutions using artificial intelligence, robotics, virtual/augmented reality, data analytics, block chain technology, and cloud computing.

PSO2: The ability to design and develop the hardware sensor devices and related interfacing software systems for solving complex engineering problems.

PSO3: The ability to understand inter disciplinary computing techniques and to apply them in the design of advanced computing.

PSO4: The ability to conduct investigation of complex problem with the help of technical, managerial, leadership qualities, and moder engineering tools provided by industry sponsored laboratories.

CO-PSO Mapping

Mapping of Course Outcomes and Program Specific Outcomes:

	PSO1	PSO2	PSO3	PSO4
Co.1	**2**	**3**	**2**	**1**
CO.2	**2**	**3**	**2**	**1**
CO.3	**2**	**3**	**2**	**1**
CO.4	2	3	2	1
CO.5	2	3	2	1

Program Educational Objectives

PEO1: To have an excellent scientific and engineering breadth so as to comprehend, analyze, design and provide sustainable solutions for real-life problems using state-of-the-art technologies.

PEO2: To have a successful career in industries, to pursue higher studies or to support entrepreneurial endeavors and to face global challenges.

PEO3: To have an effective communication skills, professional attitude, ethical values and a desire to learn specific knowledge in emerging trends, technologies for research, innovation and product development and contribution to society.

PEO4: To have life-long learning for up-skilling and re-skilling for successful professional career as engineer, scientist, entrepreneur and bureaucrat for betterment of society

Result Analysis

RESULT

SECOND YEAR ODD SEMESTER SESSION 2020-2021(3RD SEM)

sr.number	subject code	subject name	faculty name	pass perrcentage	average marks
1	AAS0301A	Engineering Mathematics-III	MR.RAMAN CHAUHAN/DR KANCHAN THYAGI	100	78.61
2	ACSE0301	Data Structures	DR AMBA / MR NARENDRA / MS NEHA YADAV	90	44.2
3	ACSE0302	Object Oriented Techniques using Java	MR GAURAV KUMAR/MS NANCY KANSAL	100	62.26
4	ACSE0304	Digital Logic & Circuit Design	MS KANIKA TANEJA / MS MD SAJED	100	86.58
5	ACSE0305	Computer Organization & Architecture	DR VIVEK KUMAR/MS SANCHALI	100	81.87
6	ACSE0306	Discrete Structures	MS SHRUTI SINHA / MR JAYCHAND /	94	52.77
8	ACSE0351	Data Structures Lab	DR AMBA / MR NARENDRA / MS NEHA YADAV	100	23.47
9	ACSE0352	Object Oriented Techniques using Java	MR GAURAV KUMAR/MS NANCY KANSAL	100	23.94
10	ACSE0354	Digital Logic & Circuit Design Lab	MS KANIKA TANEJA / MS MD SAJED	100	22.76
11	ACSE0359	Internship Assessment-I	all faculty	100	44.85
12	ANC0301	Cyber Security*	MS HARSHA GUPTA	100	36.4

End Semester Question Paper Templates (Offline Pattern/Online Pattern)

Printed page: .... **Subject Code: .....**

Roll No: | | | | | | | | | | | | |

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY ,GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech/B.Voc./MBA/MCA/M.Tech (Integrated)

(SEM: ….. THEORY EXAMINATION (2020-2021)

Subject ……..

Time: 3 Hours **Max. Marks:100**

General Instructions:

- All questions are compulsory. Answers should be brief and to the point.
- This Question paper consists of .....pages & ...8.....questions.
- It comprises of three Sections, A, B, and C. You are to attempt all the sections.
- **Section A** -Question No- 1 is objective type questions carrying 1 mark each, Question No- 2 is very short

End Semester Question Paper Templates (Offline Pattern/Online Pattern)

- Section B - Question No-3 is Long answer type -I questions with external choice carrying 6 marks each. You need to attempt any five out of seven questions given.
- Section C - Question No. 4-8 are Long answer type –II (within unit choice) questions carrying 10 marks each. You need to attempt any one part *a* or *b*.
- Students are instructed to cross the blank sheets before handing over the answer sheet to the invigilator.
- No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

End Semester Question Paper Templates (Offline Pattern/Online Pattern)

		SECTION – A		CO
1.	Attempt all parts-		[10×1=10]	
	1-a.	Question-	(1)	
	1-b.	Question-	(1)	
	1-c.	Question-	(1)	
	1-d.	Question-	(1)	
	1-e.	Question-	(1)	
	1-f.	Question-	(1)	
	1-g.	Question-	(1)	
	1-h.	Question-	(1)	
	1-i.	Question-	(1)	
	1-j.	Question-	(1)	

End Semester Question Paper Templates (Offline Pattern/Online Pattern)

2.	Attempt all parts-		[5×2=10]	CO
	2-a.	Question-	(2)	
	2-b.	Question-	(2)	
	2-c.	Question-	(2)	
	2-d.	Question-	(2)	
	2-e.	Question-	(2)	

End Semester Question Paper Templates (Offline Pattern/Online Pattern)

		SECTION – B		**CO**
3.	**Answer any five of the following-**		**[5×6=30]**	
	3-a.	**Question-**	**(6)**	
	3-b.	**Question-**	**(6)**	
	3-c.	**Question-**	**(6)**	
	3-d.	**Question-**	**(6)**	
	3-e.	**Question-**	**(6)**	
	3-f.	**Question-**	**(6)**	
	3-g.	**Question-**	**(6)**	

End Semester Question Paper Templates (Offline Pattern/Online Pattern)

	SECTION – C			**CO**
4	**Answer any one of the following-**		**[5×10=50]**	
	4-a.	**Question-**	**(10)**	
	4-b.	**Question-**	**(10)**	
5.	**Answer any one of the following-**			
	5-a.	**Question-**	**(10)**	
	5-b.	**Question-**	**(10)**	

End Semester Question Paper Templates (Offline Pattern/Online Pattern)

6.	Answer any one of the following-			
	6-a.	Question-	(10)	
	6-b.	Question-	(10)	
7.	Answer any one of the following-			
	7-a.	Question-	(10)	
	7-b.	Question-	(10)	
8.	Answer any one of the following-			
	8-a.	Question-	(10)	
	8-b.	Question-	(10)	

Prerequisite/Recap

- Student must know at least the basics of how to use a computer, and should be able to start a command line shell.
- Knowledge of basic programming concepts, as covered in ‘Programming Basic' course is necessary.
- Students must have basic understanding of computer programming and related programming paradigms

About the Subject with videos

- OOTS refers to languages that uses objects in programming.
- OOTS aims to implement real-world entities like inheritance, hiding, polymorphism etc in programming.
- The main aim of OOTS is to bind together the data and the functions that operate on them so that no other part of the code can access this data except that function

Link:	
Unit 1	https://www.youtube.com/watch?v=r59xYe3Vyks&list=PLS1QulWo1RIbfTjQvTdj8Y6yyq4R7g-Al
Unit 2	https://www.youtube.com/watch?v=ZHLdVRXIuC8&list=PLS1QulWo1RIbfTjQvTdj8Y6yyq4R7g-Al&index=18,
Unit 3	https://www.youtube.com/watch?v=hBh_CC5y8-s https://www.youtube.com/watch?v=OjdT2l-EZJA
Unit 4	https://www.youtube.com/watch?v=qQVqfvs3p48
Unit 5	https://www.youtube.com/watch?v=2qWPpgALJyw

Unit Contents

- Packages: - Introduction and Types
  Access Protection in Packages
  Import and Execution of Packages.
- Exception Handling, Assertions and Localizations:
  Introduction and Types
  Exceptions vs. Errors
  Handling of Exception. Finally
  Throws and Throw keyword
  Multiple Catch Block
  Nested Try and Finally Block
  Assertions and Localizations Concepts and its working.
- String Handling: Introduction and Types
  Operations
  Immutable String
  Method of String class
  String Buffer and String Builder class

Unit Objectives

- To learn about Packages concepts, how to import packages.
- To learn about Exception handling concepts.
- To understand try , catch, finally, throw and throws keywords.
- To learn string Handling concepts in java.

Topic Objectives

After you have read and studied this topic, you should be able to

- To learn about packages in Java.
- To learn the concept of how to import and execute packages.
- To understand the concept of event handling .
- To learn the concepts of Assertions and Localizations .
- To explore the knowledge of String Handling in Java.

Topic mapping with CO

Topic	CO
Packages:	CO3
Exception Handling, Assertions and Localizations:	CO3
Exceptions vs. Errors	CO3
Handling of Exception. Finally	CO3
Assertions and Localizations Concepts and its working.	CO3
String Handling:	CO3
Introduction and Types	CO3
Operations	CO3
Immutable String	CO3

Lecture 1

Packages: Introduction and Types

Access Protection in Packages

Import and Execution of Packages.

Packages

- A package is a collection of similar types of Java entities such as classes, interfaces, subclasses, exceptions, errors, and enum.
- A package can also contain sub-packages.

Packages are used for:

•Preventing naming conflicts. For example there can be two classes with name Employee in two packages, college. staff.cse.Employee and college.staff.ee.Employee.

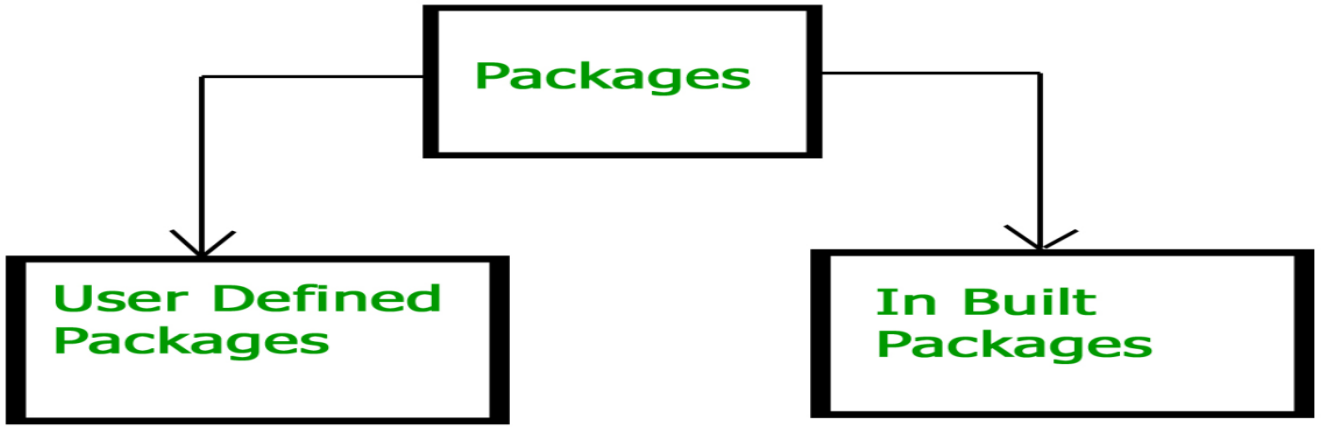
•Making searching/locating and usage of classes, interfaces, enumerations and annotations easier.

•Providing controlled access: protected and default have package level access control. A protected member is accessible by classes in the same package and its subclasses. A default member (without any access specifier) is accessible by classes in the same package only.

•Packages can be considered as data encapsulation (or data-hiding).

Types of Packages

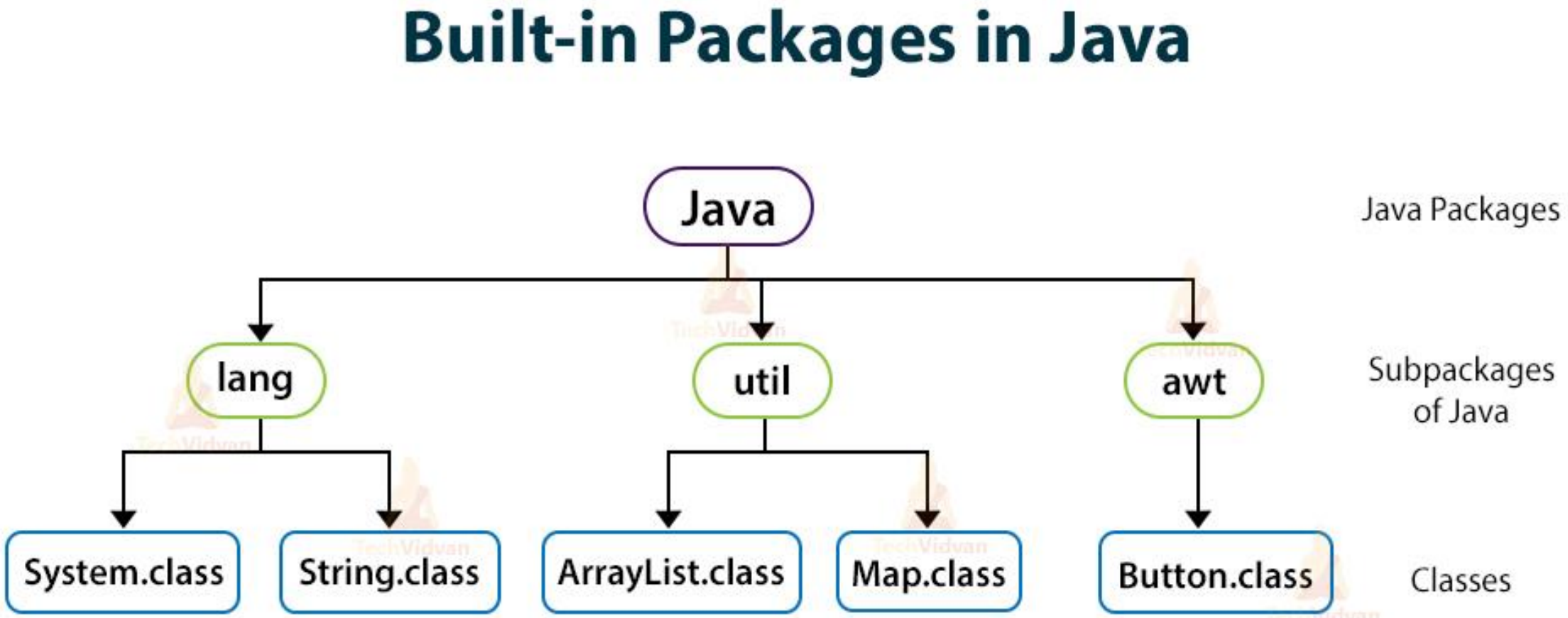
.



1. User-defined Package

- The package which is defined by the user is called a User-defined package.
- It contains user-defined classes and interfaces.
- We create a directory whose name should be the same as the name of the package. Then we create a class inside the directory.

Types of Packages



Types of Packages

2. Java API packages or built-in packages

Java provides a large number of classes grouped into different packages based on a particular functionality.

Examples:

- **java.lang:** It contains classes for primitive types, strings, math functions, threads, and exceptions.
- **java.util:** It contains classes such as vectors, hash tables, dates, Calendars, etc.
- **java.io:** It has stream classes for Input/Output.
- **java.awt:** Classes for implementing Graphical User Interface – windows, buttons, menus, etc.
- **java.net:** Classes for networking
- **java. Applet:** Classes for creating and implementing applets

Types of Packages

Creating a Package in Java

- To create a package, we choose a package name and to include the classes, interfaces, enumerations, etc, inside the package, we write the package with its name at the top of every source file.

- There can be only one package statement in each type of file. If we do not write class, interfaces, inside any package, then they will be placed in the current default package.

Example of Java Package

- We can create a Java class inside a package using a **package** keyword.

```
package Mypackage.packagedemo; //package
class Example
{
    public static void main(String args[])
    {
        System.out.println("Welcome to OOT using Java Class");
    }
}
```

Output:

Welcome to OOT using Java Class

How do Packages in Java work?

- The names of packages and the directory structure are closely related to each other.
- For example, if a package name is ***university.engineering.csede***pt, then there are three directories- *university*, *engineering*, and *csedept* such that *csedept* is present in engineering and engineering is present in university.
- The package ***university*** can be considered as a top-level package while ***engineering*** is a subpackage of university and ***csedept*** is a sub-package of engineering.

How do Packages in Java work?

Access protection in java packages

- In java, the access modifiers define the accessibility of the class and its members. For example, private members are accessible within the same class members only. Java has four access modifiers, and they are default, private, protected, and public.

- In java, the package is a container of classes, sub-classes, interfaces, and sub-packages. The class acts as a container of data and methods. So, the access modifier decides the accessibility of class members across the different packages.

- In java, the accessibility of the members of a class or interface depends on its access specifiers. The following table provides information about the visibility of both data members and methods.

How do Packages in Java work?

Access control for members of class and interface in java

Accessibility / Access Specifier	Same Class	Same Package		Other Package	
		Child class	Non-child class	Child class	Non-child class
Public	Yes	Yes	Yes	Yes	Yes
Protected	Yes	Yes	Yes	Yes	No
Default	Yes	Yes	Yes	No	No
Private	Yes	No	No	No	No

Lecture 2

- Exception Handling, Assertions and Localizations:

  Introduction and Types

  Exceptions vs. Errors

Exceptions in Java

- **DICTIONARY MEANING:** Exception is an abnormal condition.

- In Java, an exception is an event that disrupts the normal flow of the program. It is an object which is thrown at runtime.

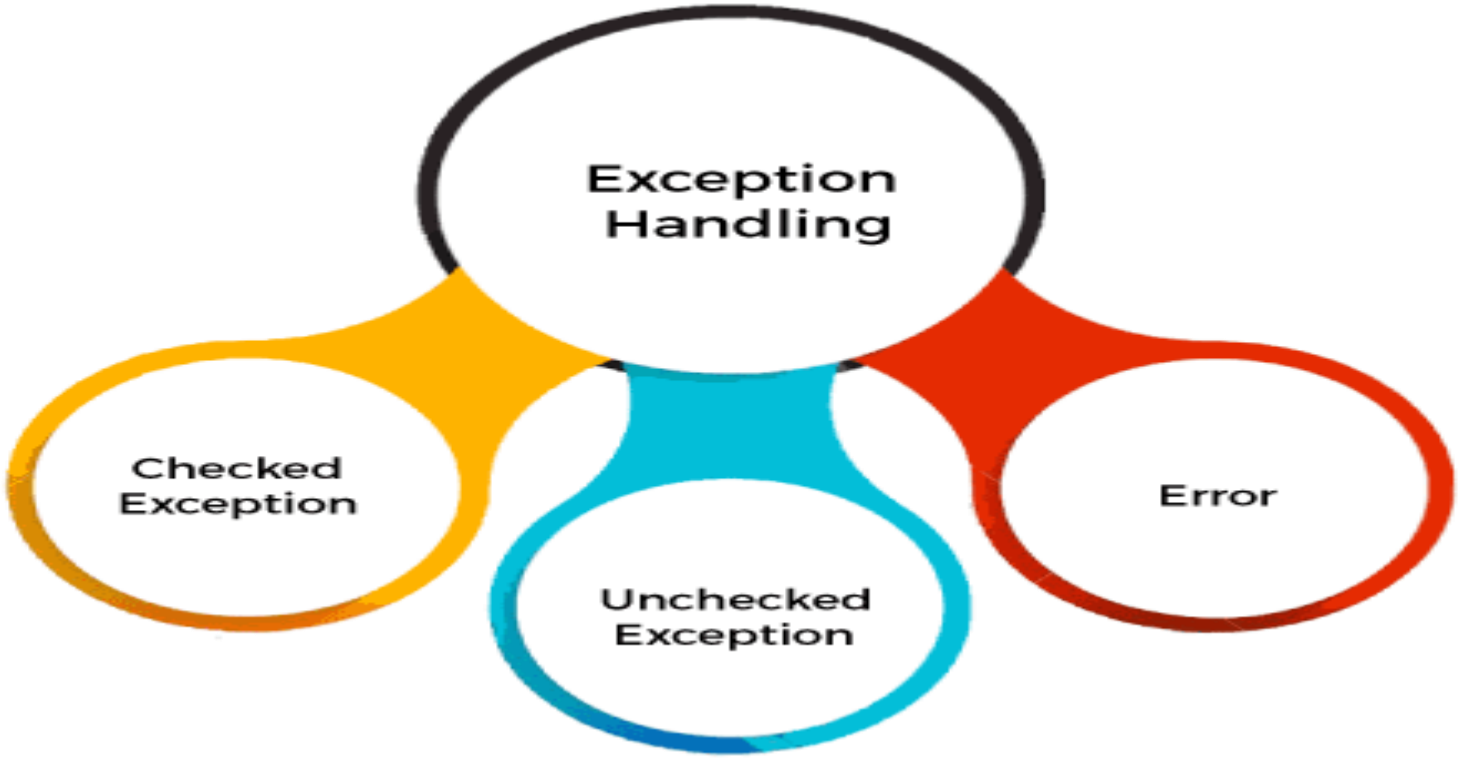
WHAT IS AN EXCEPTION HANDLING?

- Exception Handling is a mechanism to handle runtime errors such as ClassNotFoundException, IOException, SQLException, RemoteException, etc.

Types of Java Exceptions

- There are mainly two types of exceptions: checked and unchecked.
- An error is considered as the unchecked exception.
- However, according to Oracle, there are three types of exceptions namely:

1. Checked Exception
2. Unchecked Exception
3. Error



Difference Between Checked and Unchecked Exceptions

1. Checked Exception

The classes that directly inherit the Throwable class except RuntimeException and Error are known as checked exceptions. For example, IOException, SQLException, etc. Checked exceptions are checked at compile-time.

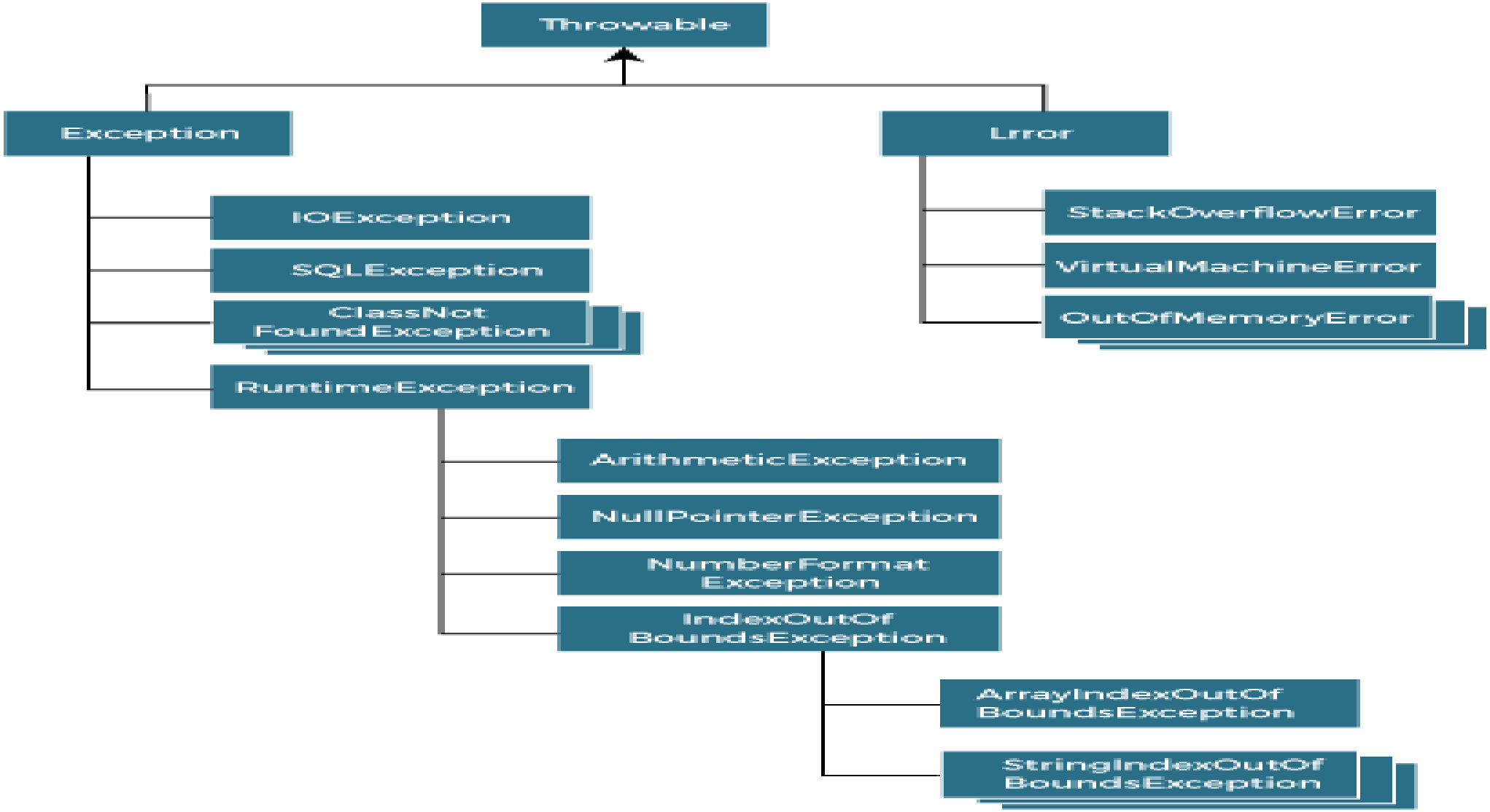
2. Unchecked Exception

The classes that inherit the RuntimeException are known as unchecked exceptions.
For example, ArithmeticException, NullPointerException, ArrayIndexOutOfBoundsException, etc. Unchecked exceptions are not checked at compile-time, but they are checked at runtime.

3. Error

Error is irrecoverable. Some example of errors are OutOfMemoryError, VirtualMachineError, AssertionError etc.

Hierarchy of Java Exception Classes



Java Exception Keywords

Keyword	Description
try	The "try" keyword is used to specify a block where we should place an exception code. It means we can't use try block alone. The try block must be followed by either catch or finally.
catch	The "catch" block is used to handle the exception. It must be preceded by try block which means we can't use catch block alone. It can be followed by finally block later.
finally	The "finally" block is used to execute the necessary code of the program. It is executed whether an exception is handled or not.
throw	The "throw" keyword is used to throw an exception.
throws	The "throws" keyword is used to declare exceptions. It specifies that there may occur an exception in the method. It doesn't throw an exception. It is always used with method signature.

Lecture 3

- Handling of Exception. Finally

  Throws and Throw keyword

  Multiple Catch Block

  Nested Try and Finally Block

try-catch block

- Java **try** block is used to enclose the code that might throw an exception. It must be used within the method.

- If an exception occurs at the particular statement in the try block, the rest of the block code will not execute. So, it is recommended not to keep the code in try block that will not throw an exception.

- Java try block must be followed by either catch or finally block.

Conti……

SYNTAX OF TRY-CATCH BLOCK

```
try{
//code that may throw an exception
}catch(Exception_class_Name ref){}
```

SYNTAX OF TRY-FINALLY BLOCK

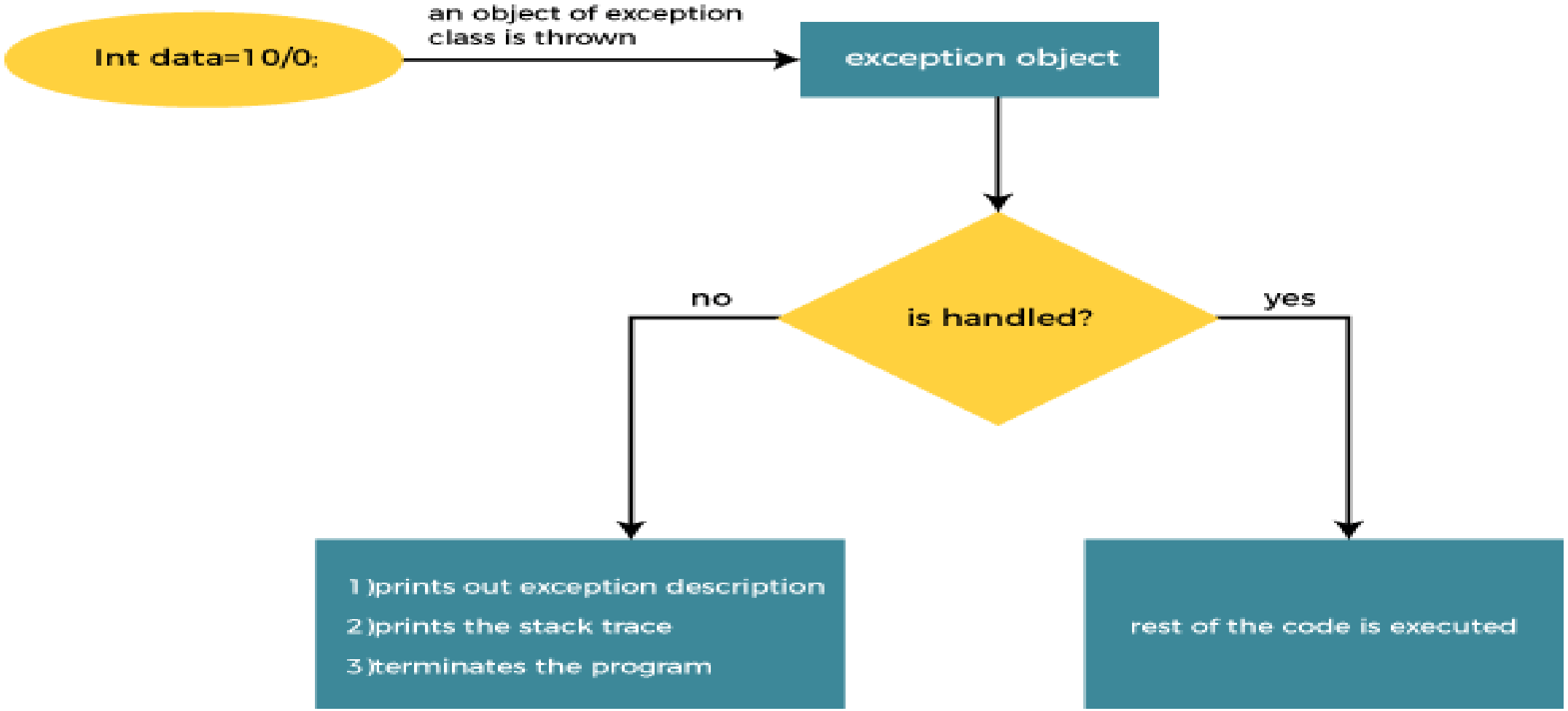
```
try{
//code that may throw an exception
}finally{}
```

Catch block

- Java catch block is used to handle the Exception by declaring the type of exception within the parameter. The declared exception must be the parent class exception (i.e., Exception) or the generated exception type. However, the good approach is to declare the generated type of exception.

- The catch block must be used after the try block only. You can use multiple catch block with a single try block.

Internal working of Java try-catch block



Internal working of Java try-catch block

The JVM firstly checks whether the exception is handled or not. If exception is not handled, JVM provides a default exception handler that performs the following tasks:

- Prints out exception description.
- Prints the stack trace (Hierarchy of methods where the exception occurred).
- Causes the program to terminate.
- But if the application programmer handles the exception, the normal flow of the application is maintained, i.e., rest of the code is executed.

Nested try block

- In Java, using a try block inside another try block is permitted. It is called as nested try block. Every statement that we enter a statement in try block, context of that exception is pushed onto the stack.
- For example, the **inner try block** can be used to handle **ArrayIndexOutOfBoundsException** while the **outer try block** can handle the **ArithemeticException** (division by zero).

Why use nested try block?

- Sometimes a situation may arise where a part of a block may cause one error and the entire block itself may cause another error. In such cases, exception handlers have to be nested.

Syntax of Nested try-catch block

```
try // Outer try block
{
  statements;
  statements;
try // Inner try block
{
  statements;
  statements;
}
catch(Exception1 e1) // Inner catch block
{
  statements;
  statements;
 }
}
catch(Exception2 e2) // Outer catch block
{
  statements;
  statements;
}
```

Finally block

- **Java finally block** is a block used to execute important code such as closing the connection, etc.

- Java finally block is always executed whether an exception is handled or not. Therefore, it contains all the necessary statements that need to be printed regardless of the exception occurs or not.

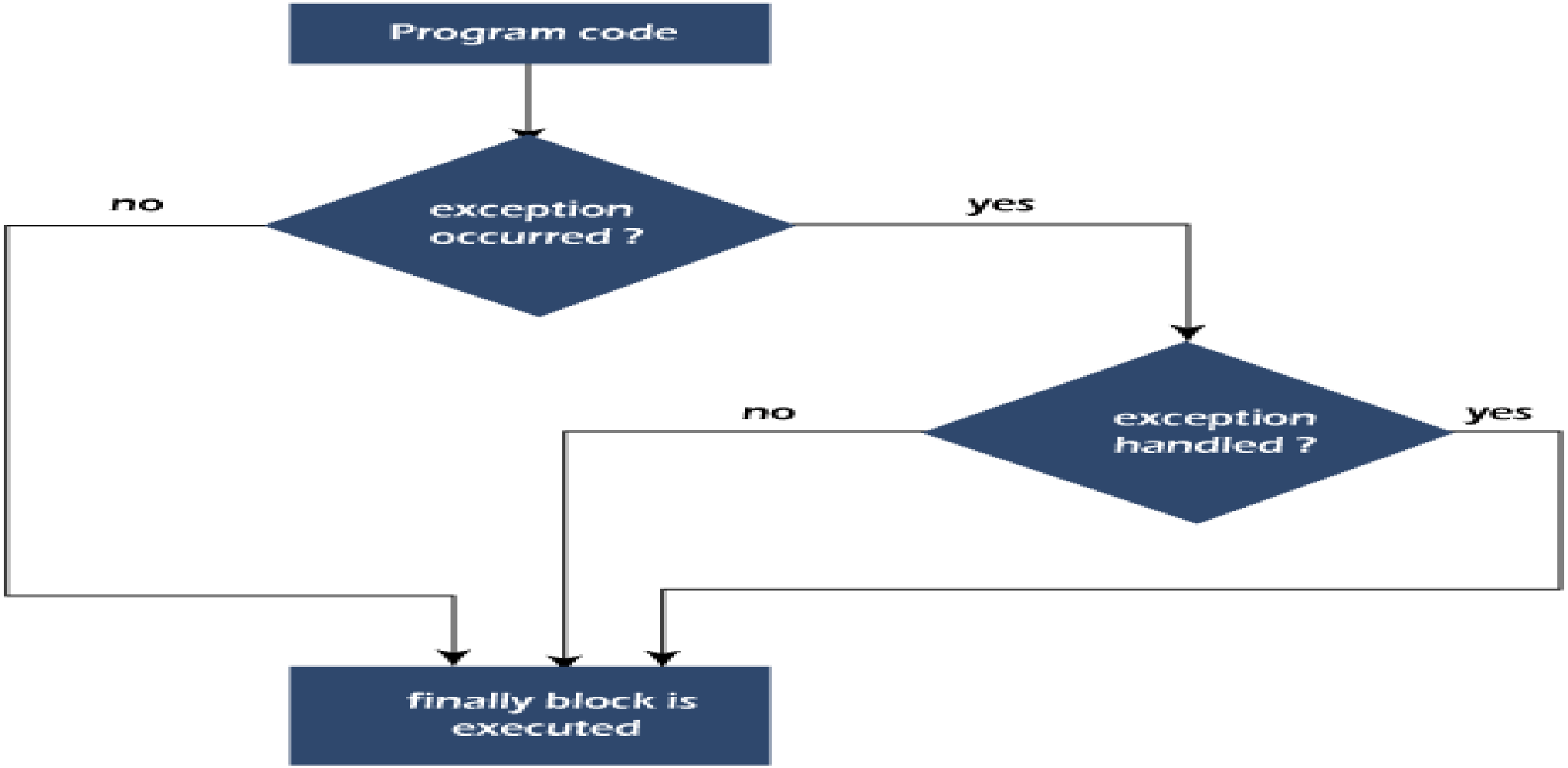
- The finally block follows the try-catch block.

Why use Java finally block?

•finally block in Java can be used to put "**cleanup**" code such as closing a file, closing connection, etc.

•The important statements to be printed can be placed in the finally block.

Flowchart of finally block



Throw Keyword

- The Java throw keyword is used to throw an exception explicitly.
- We specify the **exception** object which is to be thrown. The Exception has some message with it that provides the error description. These exceptions may be related to user inputs, server, etc.
- We can throw either checked or unchecked exceptions in Java by throw keyword. It is mainly used to throw a custom exception. We will discuss custom exceptions later in this section.
- We can also define our own set of conditions and throw an exception explicitly using throw keyword. For example, we can throw ArithmeticException if we divide a number by another number. Here, we just need to set the condition and throw exception using throw keyword.

The syntax of the Java throw keyword is given below.

- **throw new** exception_class("error message");

Throws Keyword

- The **Java throws keyword** is used to declare an exception. It gives an information to the programmer that there may occur an exception. So, it is better for the programmer to provide the exception handling code so that the normal flow of the program can be maintained.
- Exception Handling is mainly used to handle the checked exceptions. If there occurs any unchecked exception such as NullPointerException, it is programmers' fault that he is not checking the code before it being used.

Syntax of Java throws

return_type method_name() **throws** exception_class_name{
//method code
}

Lecture 4

- Assertions and Localizations Concepts and its working.

Assertions in Java

- An assertion allows testing the correctness of any assumptions that have been made in the program.
- Assertion is achieved using the **assert** statement in Java. While executing assertion, it is believed to be true. If it fails, JVM throws an error named **AssertionError.** It is mainly used for testing purposes during development.
- The **assert** statement is used with a Boolean expression and can be written in two different ways.

First way :

assert expression;

Second way :

assert expression1 : expression2;

Why to use Assertions?

- Wherever a programmer wants to see if his/her assumptions are wrong or not.
- To make sure that an unreachable looking code is actually unreachable.
- To make sure that assumptions written in comments are right

```
if ((x & 1) == 1)

{  }

else // x must be even

{ assert (x % 2 == 0); }
```

- To make sure default switch case is not reached.
- To check object's state.
- In the beginning of the method
- After method invocation.

Usage of Assertions

Where to use Assertions

- Arguments to private methods. Private arguments are provided by developer's code only and developer may want to check his/her assumptions about arguments.
- Conditional cases.
- Conditions at the beginning of any method.

Where not to use Assertions

- Assertions should not be used to replace error messages
- Assertions should not be used to check arguments in the public methods as they may be provided by user. Error handling should be used to handle errors provided by user.
- Assertions should not be used on command line arguments.

Localization

- **Localization** is also abbreviated as I10N because there are total 10 characters between the first letter 'L' and last letter 'N'. Localization is the mechanism to create such an application that can be adapted to a specific language and region by adding locale-specific text and component.

- There are three constructors of Locale class. They are as follows:

1. Locale(String language)
2. Locale(String language, String country)
3. Locale(String language, String country, String variant)

Localization

- There are given commonly used methods of Locale class.

1. **public static Locale getDefault()** it returns the instance of current Locale
2. **public static Locale[] getAvailableLocales()** it returns an array of available locales.
3. **public String getDisplayCountry()** it returns the country name of this locale object.
4. **public String getDisplayLanguage()** it returns the language name of this locale object.
5. **public String getDisplayVariant()** it returns the variant code for this locale object.
6. **public String getISO3Country()** it returns the three letter abbreviation for the current locale's country.
7. **public String getISO3Language()** it returns the three letter abbreviation for the current locale's language.

Lecture 5

- String Handling:

  Introduction and Types

  Operations

  Immutable String

  Method of String class

  String Buffer and String Builder class

String Handling

- In Java, string is basically an object that represents sequence of char values. An array of characters works same as Java string.

```
char[] ch={'j','a','v','a','t','p','o','i','n','t'};
String s=new String(ch);
```

is same as:

```
String s="javatpoint";
```

- Generally, String is a sequence of characters. But in Java, string is an object that represents a sequence of characters. The java.lang.String class is used to create a string object.

How to create a string object?

- There are two ways to create String object:

1. By string literal
2. By new keyword

String Literal

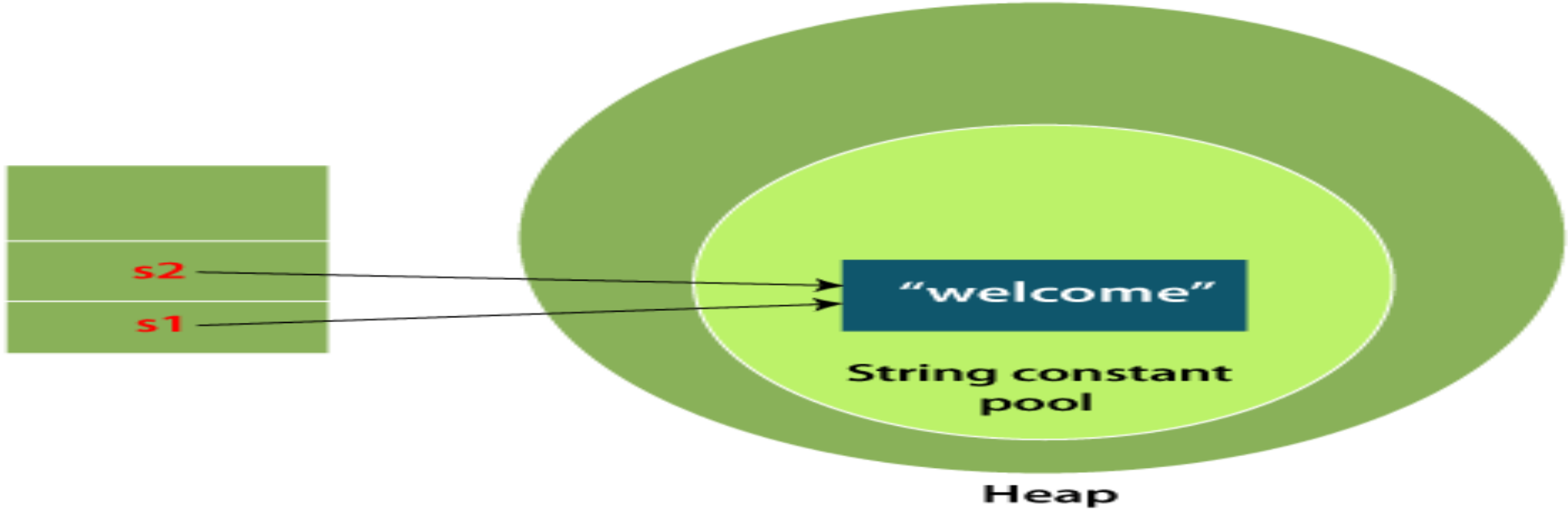
- Java String literal is created by using double quotes.

For Example: String s="welcome";

- Each time you create a string literal, the JVM checks the "string constant pool" first. If the string already exists in the pool, a reference to the pooled instance is returned. If the string doesn't exist in the pool, a new string instance is created and placed in the pool. For example:

```
String s1="Welcome";
String s2="Welcome";//It doesn't create a new instance
```

Example



In the above example, only one object will be created. Firstly, JVM will not find any string object with the value "Welcome" in string constant pool that is why it will create a new object. After that it will find the string with the value "Welcome" in the pool, it will not create a new object but will return the reference to the same instance.

How to create a string object?

By new keyword

String s=**new** String("Welcome");//creates two objects and one

reference variable

- In such case, JVM will create a new string object in normal (non-pool) heap memory, and the literal "Welcome" will be placed in the string constant pool. The variable s will refer to the object in a heap (non-pool).

Immutable String in Java

- A String is an unavoidable type of variable while writing any application program. String references are used to store various attributes like username, password, etc. In Java, String objects are immutable. Immutable simply means unmodifiable or unchangeable.

- Once String object is created its data or state can't be changed but a new String object is created.

Example

- Now it can be understood by the diagram given below. Here Sachin is not changed but a new object is created with Sachin Tendulkar. That is why String is known as immutable.
- As you can see in the above figure that two objects are created but ***s*** reference variable still refers to "Sachin" not to "Sachin Tendulkar".
- But if we explicitly assign it to the reference variable, it will refer to "Sachin Tendulkar" object.

String Class Methods

- The **java.lang.String** class provides a lot of built-in methods that are used to manipulate **string in Java**. By the help of these methods, we can perform operations on String objects such as trimming, concatenating, converting, comparing, replacing strings etc.

1. String toUpperCase() and toLowerCase() method

- The Java String toUpperCase() method converts this String into uppercase letter and String toLowerCase() method into lowercase letter.

OOA:2Application Analysis

2. String trim() method

- The String class trim() method eliminates white spaces before and after the String.

3. String startsWith() and endsWith() method

- The method startsWith() checks whether the String starts with the letters passed as arguments and endsWith() method checks whether the String ends with the letters passed as arguments.

4. String charAt() Method

The String class charAt() method returns a character at specified index.

5. String length() Method

- The String class length() method returns length of the specified String.

OOA:2Application Analysis

6. String valueOf() Method

- The String class valueOf() method coverts given type such as int, long, float, double, boolean, char and char array into String.

7. String replace() Method

- The String class replace() method replaces all occurrence of first sequence of character with second sequence of character.

String Buffer Class

- Java StringBuffer class is used to create mutable (modifiable) String objects. The StringBuffer class in Java is the same as String class except it is mutable i.e. it can be changed.

Constructors of StringBuffer Class

Constructor	Description
StringBuffer()	It creates an empty String buffer with the initial capacity of 16.
StringBuffer(String str)	It creates a String buffer with the specified string..
StringBuffer(int capacity)	It creates an empty String buffer with the specified capacity as length.

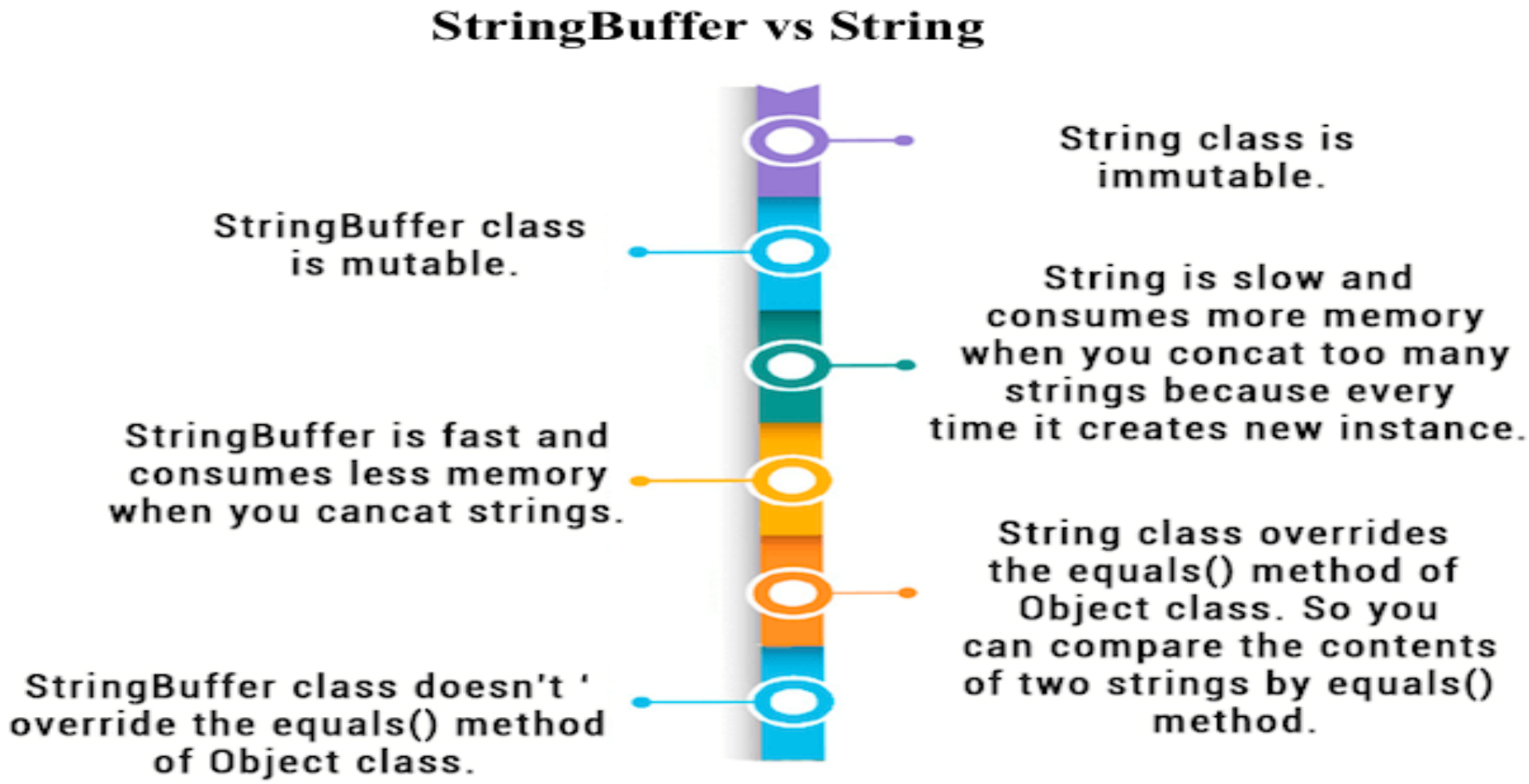
String Builder Class

- Java StringBuilder class is used to create mutable (modifiable) String. The Java StringBuilder class is same as StringBuffer class except that it is non-synchronized.

Constructors of StringBuilder class

Constructor	Description
StringBuilder()	It creates an empty String Builder with the initial capacity of 16.
StringBuilder(String str)	It creates a String Builder with the specified string.
StringBuilder(int length)	It creates an empty String Builder with the specified capacity as length.

String Buffer Vs String



Daily Quiz

Q1.Which statement is true?[CO3]

A. catch(X x) can catch subclasses of X where X is a subclass of Exception.

B. Any statement that can throw an Exception must be enclosed in a try block.

C. The Error class is a Runtime Exception.

D. Any statement that can throw an Error must be enclosed in a try block.

Q2.Which exception is thrown when divide by zero statement executes?[CO3]

A.NumberFormatException

B. NullPointerException

C. ArithmeticException

D. None of these

Daily Quiz

3. Which of these class is superclass of String and StringBuffer class?[CO3]
   a) java.util
   b) java.lang
   c) ArrayList
   d) None of the mentioned

4. Which of these keywords must be used to handle the exception thrown by try block in some rational manner?

A. Finally
B. throw
C. catch
D. try

5. In which of the following package Exception class exist?

A. java.file
B. java.lang
C. java.io
D. java.util

Weekly Assignment

Q1 Explain packages and types of packages in java.[CO3]

Q2. Explain try and catch block in java with example.[CO3]

Q3. Explain the difference between checked and unchecked exceptions.[CO3]

Q4. Explain Assertion in java and the use of assertion in java.[CO3]

Q5. Explain String Handling and how to create a string object.[CO3]

Q6. Explain the difference between Throw and Throws Keyword.[CO3]

Topic Links

- https://www.youtube.com/watch?v=hBh_CC5y8-s
- https://www.youtube.com/watch?v=Ak_FjM_cbbk
- https://www.youtube.com/watch?v=W-N2ltgU-X4

MCQs

Q1.Which of these operators can be used to concatenate two or more String objects?[CO3]

a) +

b) +=

c) &

d) ||

Q2. Which of this method of class String is used to obtain a length of String object?[CO3]

a) get()

b) Sizeof()

c) lengthof()

d) length()

MCQs

Q3. What is the use of try & catch?[CO3]

a) It allows us to manually handle the exception
b) It allows to fix errors
c) It prevents automatic terminating of the program in cases when an exception occurs
d) All of the mentioned

Q4. Which of these keywords are used for the block to be examined for exceptions?[CO3]

a) try
b) catch
c) throw
d) check

MCQs

Q5.Which of the following methods of the "StringBuffer" class is used to find the length of a String?[CO3]

A length()

B Length()

C Capacity()

D capacity()

Q6.The name of a package is the name of the ___ in Java.[CO3]

A) folder

B) All parent folders separated by DOT symbols

C) All parent packages separated by DOT symbols

D) All the above

MCQs

Q7. Which of these access specifiers can be used for a class so that its members can be accessed by a different class in the different package?[CO3]

a) Public

b) Protected

c) Private

d) No Modifier

Q8. Which of the following is an incorrect statement about packages?[CO3]

a) Package defines a namespace in which classes are stored

b) A package can contain other package within it

c) Java uses file system directories to store packages

d) A package can be renamed without renaming the directory in which the classes are stored

MCQs

Q9. Which of this method of class String is used to obtain a length of String object?[CO3]

a) get()
b) Sizeof()
c) lengthof()
d) length()

Q10**.** Which of these method of class String is used to extract a single character from a String object?[CO3]

a) CHARAT()
b) chatat()
c) charAt()
d) ChatAt()

MCQs

Q11. Which of these keywords is used to define packages in Java?[CO3]

a) pkg
b) Pkg
c) package
d) Package

Q12.Which of these is a mechanism for naming and visibility control of a class and its content?[CO3]

a) Object
b) Packages
c) Interfaces
d) None of the Mentioned.

Q13. Which of the following is the correct way of importing an entire package ‘pkg’?[CO3]

a) import pkg.
b) Import pkg.
c) import pkg.*
d) Import pkg.*

MCQs

Q14. When does Exceptions in Java arises in code sequence?[CO3]

a. Run Time

b.Compilation Time

c.Can Occur Any Time

d.None of the mentioned

Q15.Which of these keywords is not a part of exception handling?[CO3]

a. Finally

b.thrown

c. catch

d. try

MCQs

Q16. Which of these keywords must be used to handle the exception thrown by try block in some rational manner?

A. Finally
B. throw
C. catch
D. try

Q17. In which of the following package Exception class exist?

A. java.file
B. java.lang
C. java.io
D. java.util

Glossary Questions

1. **Attempt all the parts. Pick the correct option from glossary.** [CO3]

i) Exception Handling ii)Finally iii) Catch iv) Packages

1. ----------A Java keyword used to declare a block of statements to be executed in the event that a Java exception, or run time error, occurs in a preceding try block.

2. ----------A block of code that reacts to a specific type of *exception*.
3. ----------A Java keyword that executes a block of statements regardless of whether a Java Exception, or run time error, occurred in a block defined previously by the try keyword.
4. ----------A group of Classes, Interfaces.

Sessional Paper-1

Printed page: 2 Subject Code: ACSE0302

Roll No: | | | | | | | | | | | | |

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY ,GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B. Tech (AI / AIML / IOT / DS)

(SEM:III SESSIONAL EXAMINATION – I)(2021-2022)

Subject Name: OBJECT ORIENTED TECHNIQUES USING JAVA

Time: 1.15 Hours Max. Marks:30

General Instructions:

- All questions are compulsory. Answers should be brief and to the point.
- This Question paper consists of 2 pages & 5 questions.
- It comprises of three Sections, A, B, and C. You are to attempt all the sections.
- Section A -Question No- 1 is objective type questions carrying 1 mark each, Question No- 2 is very short answer type carrying 2 mark each. You are expected to answer them as directed.
- Section B - Question No-3 is short answer type questions carrying 5 marks each. You need to attempt any two out of three questions given.
- Section C - Question No. 4 &5are Long answer type (within unit choice) questions carrying 6marks each. You need to attempt any one part a or b.
- Students are instructed to cross the blank sheets before handing over the answer sheet to the invigilator.
- No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

		SECTION – A	[8]	
1.	Attempt all parts.		(4×1=4)	CO
	a.	The type of Arguments the main method accepts is ____. a) integer[ ] b) String c) float[ ] d) String[ ]	(1)	CO2
	b.	The default value for data field of a boolean type, numeric type is _____ , _____ respectively. a) false, 1 b) true, 0 c) false, 0 d) true, 1	(1)	CO1
	c.	Using _____, we can force immediate termination of a loop. a) break b) continue c) return d) goto	(1)	CO1
	d.	The _____ statement is used to explicitly return from a method. a) break b) continue c) return d) goto	(1)	CO2
2.	Attempt all parts.		(2×2=4)	CO
	a.	Write a JAVA program to check whether the number entered by user is even or odd by using if-else. (Use the Scanner class to enter the integer	(2)	CO1

Page 1 of 2

Conti….

		number)		

	b.	What is the output of the following Java code snippet?
		int i=0;
		for(i=1; i <= 6; i++)
		{
		if (i % 3 = = 0)
		continue;
		System.out.print (i+",");
		}
			(2)	CO1

		SECTION – B		
3.	Answer any two of the following-		[2×5=10]	CO
	a.	Draw a class diagram of Student class and explain how the access modifiers are represented in the class diagrams?	(5)	CO1
	b.	Discuss different levels of access specifiers available in JAVA.	(5)	CO1
	c.	What is the purpose of constructors? Explain all the types of constructors in JAVA with the help of example of your choice.	(5)	CO2
		SECTION – C		
4	Answer any one of the following-(Any one can be applicative if applicable)		[2×6=12]	CO
	a.	Explain the four pillars of Object-Oriented Programming with the help of examples.	(6)	CO1
	b.	Write a JAVA program to display all even numbers from 100 to 50 using all the loops statements you have studied.	(6)	CO1
5.	Answer any one of the following-			
	a.	Write a program in JAVA that takes arguments name, department and marks of 4 subjects from the user and then print total and average marks obtained. (Use command line arguments for giving input).	(6)	CO1
	b.	Write a JAVA program to display the reverse of an input number. (Use Scanner class to input the positive integer)	(6)	CO1

Sessional Paper-2

Printed page: 2 **Subject Code:ACSE0302**

Roll No: | | | | | | | | | | | | | |

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute)

Affiliated to Dr. A.P. J. Abdul Kalam Technical University, Uttar Pradesh, Lucknow

Course ...B.Tech.....Branch...IT....

Semester.....III...Sessional Examination.....II.....Year- (2021 - 2022)

Subject Name: OBJECTS ORIENTED TECHNIQUES USING JAVA

Time: 1.15Hours **[SET- A]** **Max. Marks:30**

General Instructions:

- This Question paper consists of 2 pages & 5 questions.It comprises of three Sections, A, B, and C
- Section A -Question No- 1 is objective type questions carrying 1 mark each, Question No- 2 is very short answer type carrying 2 mark each. You are expected to answer them as directed.
- Section B - Question No-3 is Short answer type questions carrying 5 marks each. Attempt any two out of three questions given.
- Section C -Question No. 4 &5are Long answer type (within unit choice) questions carrying 6marks each. Attempt any one part *a* or *b*.

Conti….

		SECTION – A	[08Marks]	
1.	All questions are compulsory		(4×1=4)	
	a.	Identify the correct way to call the constructor of class "Super" that is inherited by the class "Child". (i) class Child extends Super{ Child(){ Super();}} (ii) class Child extends Super{ Child(){ super();}} (iii) class Child extends Super{ Child() { super.Super();}} (iv) All the ways are correct.	(1)	CO2
	b.	Total abstraction can be achieved using? (i) abstract class (ii) interface (iii) both (iv) total abstraction cannot be achieved	(1)	CO2
	c.	The …….. class inherits all the properties of the …… class? (i) base, derived (ii) derived base (iii) base, initial (iv) base, final	(1)	CO2
	d.	Runtime polymorphism is also known as: (i) Dynamic binding (ii) Static binding (iii) Early binding (iv) None of the above	(1)	CO2
2.	All questions are compulsory		(2×2=4)	
	a.	Explain a simple program showing garbage collection.	(2)	CO2
	b.	Explain the concept of interface using suitable example.	(2)	CO2

Conti..

SECTION – B			**[10Marks]**	
3.	**Answer any two of the following-**		**(2×5=10)**	
	a.	**Explain the types of polymorphism in java using suitable examples for each type.**	**(5)**	**CO2**
	b.	**Explain the difference between interface and abstract class in java using suitable example.**	**(5)**	**CO2**
	c.	**Explain inheritance in java. Explain all types of inheritance supported by java using suitable examples.**	**(5)**	**CO2**
SECTION – C			**[12Marks]**	
4	**Answer any one of the following-**		**(1×6=6)**	
	a.	**Explain the working of "this" and "super" keyword in java. Illustrate each using suitable example.**	**(6)**	**CO2**
	b.	**Explain abstract class. State the use of abstract class with suitable example. Also write the names of OOPs concepts that is used to implement abstract class and that is implemented using abstract class.**	**(6)**	**CO2**
5.	**Answer any one of the following-**		**(1×6=6)**	
	a.	**Explain the concept of access modifiers (public, private, protected) using packages.**	**(6)**	**CO3**
	b.	**Explain overloading and overriding of methods? Illustrate overloading and overriding of methods in Java with suitable examples.**	**(6)**	**CO2**

NOTE: No example should be repeated.

Old University Question Paper

Printed Page:-

Subject Code:- ACSE0302

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech.

SEM: III - THEORY EXAMINATION (2021 - 2022)

Subject: Object Oriented Techniques using Java

Time: 03:00 Hours

Max. Marks: 100

General Instructions:

1. All questions are compulsory. It comprises of three Sections A, B and C.

- Section A - Question No- 1 is objective type question carrying 1 mark each & Question No- 2 is very short type questions carrying 2 marks each.
- Section B - Question No- 3 is Long answer type - I questions carrying 6 marks each.
- Section C - Question No- 4 to 8 are Long answer type - II questions carrying 10 marks each.
- No sheet should be left blank. Any written material after a Blank sheet will not be evaluated/checked

Old University Question Paper

SECTION A 20

1. Attempt all parts:-

1-a. In JAVA main method returns value of type _____ [CO1] 1

1. float
2. int
3. void
4. String

1-b. What is bytecode in Java? [CO1] 1

1. Code generated by a Java compiler
2. Code generated by a Java Virtual Machine
3. Name of Java source code file
4. Block of code written inside a class

1-c. If same message is passed to objects of several different classes and all of those can respond in a different way, what is this feature called? [CO2] 1

1. Inheritance
2. Overloading
3. Polymorphism
4. Overriding

1-d. Java _____ is invoked at the time of object creation. [CO2] 1

1. constructor
2. class
3. method
4. array

1-e. Which of these keywords must be used to monitor for exceptions? [CO3] 1

1. try
2. catch
3. throw
4. finally

1-f. An _____ statement can be used to access the classes and interface of a different package from the current package. [CO3] 1

1. instanceOf
2. import
3. extends
4. implement

Old University Question Paper

1-e. Which of these keywords must be used to monitor for exceptions? [CO3] 1

1. try
2. catch
3. throw
4. finally

1-f. An _____ statement can be used to access the classes and interface of a different package from the current package. [CO3] 1

1. instanceOf
2. import
3. extends
4. implement

1-g. The keyword that is used to protect the methods from simultaneous access in Threads is _____ [CO4] 1

1. save
2. synchronized
3. Both
4. This task is not possible in threads

1-h. Which of these classes are used by Byte streams for input and output operation? [CO4] 1

1. Input Stream
2. InputOutputStream
3. Reader
4. All of the mentioned

1-i. A _____ dictates the style of arranging the components in a container. [CO5] 1

1. border layout
2. grid layout
3. panel
4. layout manager

1-j. _____ interface provides the capability to store objects using a key-value pair. [CO5] 1

1. Java.util.Map
2. Java.util.Set
3. Java.util.List
4. Java.util.Collection

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2. Attempt all parts:-

2-a.	What is JVM? [CO1]	2
2-b.	What is the use of final keyword in JAVA? [CO2]	2
2-c.	What is an assertion in Java? How is it different from if - else conditions? [CO3]	2
2-d.	Describe any two Annotations from the Java Standard Library. [CO4]	2
2-e.	What Are Wrapper Classes? Why do we need wrapper classes in JAVA? [CO5]	2

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SECTION B 30

3. Answer any five of the following:-

3-a.	What is the difference between object diagrams and class diagrams? Draw a class diagram of order management system. [CO1]	6
3-b.	How to take an input from a user with the help of scanner class in JAVA? Explain using JAVA code. [CO1]	6
3-c.	Explain Abstract class concept with an example program. [CO2]	6
3-d.	Compare overloading and overriding of methods in java using proper examples. [CO2]	6
3-e.	Write a method to check if input string is Palindrome? [CO3]	6
3-f.	Explain the concept of multithreading in java and explain how even and odd numbers can be printed by using multithreading concept. (CO4)	6
3-g.	Examine ArrayList with Example. [CO5]	6

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	SECTION C	50
4. Answer any one of the following:-		
4-a.	What are command line arguments? How are they useful? Write a program to compute the sum of the digits of an input number (Using command line arguments) eg if 4523 is an integer then the sum of digits displayed will be 14. [CO1]	10
4-b.	Write a JAVA program that takes values of name, age, department and marks of 4 subjects from the user. Display the name, total and average of marks computed. [CO1]	10
5. Answer any one of the following:-		
5	Explain the following with respect to JAVA: [CO2] a) super keyword b) Garbage collection c) Interface d) Static data members e) final keyword	10
5	What is the lambda expression in Java and what are the features of a lambda expression? Briefly explain its use with the help of suitable example. [CO2]	10

Old University Question Paper

6. Answer any one of the following:-

6	Write the differences between String, StringBuffer and StringBuilder classes. With proper syntax, explain the following methods. [CO3] 1. Method to extract a particular character of a string. 2. Reverse a String.	10
6	What is the difference between an error and exception? Write the following Java program for illustrating the use of throw keyword. Write a class ThrowExample contains a method checkEligibilty(int age, int weight) which throw an ArithmeticException with a message "Student is not eligible for registration" when age < 12 and weight < 40, otherwise it prints "Student Entry is Valid!!". [CO3]	10

7. Answer any one of the following:-

7-a.	What is the difference between thread and a process? Explain the concept of Inter Thread Communication and describe the role of wait(), notify(), and notifyAll() methods in inter thread communication. [CO4]	10

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7-b.	While reading a file, how would you check whether you have reached to the end of file? Write a JAVA program to copy the content of "file1.txt" to "file2.txt". [CO4]	10

8. Answer any one of the following:-

8-a.	Discuss some general rules for using layout managers. Describe the various layout managers available in AWT. [CO5]	10
8-b.	Differentiate between List and ArrayList. Create a class TestArrayList having main method. Perform following functionality. [CO5]	10

1. Create an ArrayList having fruits name of type String.
2. Store different fruit names. (Try to add duplicate fruit names).
3. Print all fruit names.
4. Print the first and last fruit names.
5. Print the size of ArrayList.
6. Remove a particular fruit from ArrayList.

Expected Questions

1. What is a Java Exception and its Types? [CO3]
2. Explain about try, catch, statements with examples. [CO3]
3. Demonstrate Nested try statements with an example. [CO3]
4. List Java's Built-in Exception? Write the importance of finally block. [CO3]
5. Explain Exception handling fundamentals. [CO3]
6. Explain Java exception hierarchy. [CO3]
7. What is a String Buffer class and how does it differs from string class? [CO3]
8. Define a package, and give the list of steps used to create a package in Java. Explain with a sample code. [CO3]
9. Define String? Explain different String declarations with an example. [CO3]
10. Write a java program to check the given string is palindrome or not. [CO3]
11. Write the difference between String and String Buffer classes. [CO3]

Old Question Papers

- https://www.iare.ac.in/sites/default/files/IARE_JAVA_MODEL_QP.pdf
- https://www.manaresults.co.in/jntuh/download.php?subcode=133BM

Recap of Unit

- A package is a collection of similar types of Java entities such as classes, interfaces, subclasses, exceptions, errors, and enum.
- In this Unit, we have studied Java exceptions, it's types, and the difference between checked and unchecked exceptions.
- Exception Handling is a mechanism to handle runtime errors such as Class Not Found Exception, IO Exception, SQL Exception, Remote Exception, etc.
- An assertion allows testing the correctness of any assumptions that have been made in the program.
- **String Handling in java**

References

Text Books:

(1) Herbert Schildt," Java - The Complete Reference", McGraw Hill Education 12th edition

(2) Herbert Schildt," Java: A Beginner's Guide", McGraw-Hill Education 2nd edition

(3) James Rumbaugh et. al, "Object Oriented Modeling and Design", PHI 2nd Edition

Reference Books:

(4) Cay S. Horstmann, "Core Java Volume I – Fundamentals", Prentice Hall

(5) Joshua Bloch," Effective Java", Addison Wesley

(6) E Balagurusamy, "Programming with Java A Primer", TMH, 4th edition.

Thank You