Exception in java pdf

I'm not robot!

```
1
1 2
1 2 3
1 2 3 4
1 2 3 4 5
1 2 3 4 5 6
1 2 3 4 5 6 7
```

```
1111111
1111122
1111333
1114444
1155555
1666666
7777777
```

```
1
1 2
1 2 3
1 2 3 4
1 2 3 4 5
1 2 3 4 5 6
1 2 3 4 5 6 7
1 2 3 4 5 6
1 2 3 4 5
1 2 3 4
1 2 3
1 2
1
```

```
1 2 3 4 5 6 7
1 2 3 4 5 6
1 2 3 4 5
1 2 3 4
1 2 3
1 2
1
1 2
1 2 3
1 2 3 4
1 2 3 4 5
1 2 3 4 5 6
1 2 3 4 5 6 7
```

```
7 6 5 4 3 2 1
7 6 5 4 3 2
7 6 5 4 3
7 6 5 4
7 6 5
7 6
7
```

```
7
7 6
7 6 5
7 6 5 4
7 6 5 4 3
7 6 5 4 3 2
7 6 5 4 3 2 1
```

```
1 2 3 4 5 6 7
1 2 3 4 5 6
1 2 3 4 5
1 2 3 4
1 2 3
1 2
1
```

```
1
1 2 1
1 2 3 2 1
1 2 3 4 3 2 1
1 2 3 4 5 4 3 2 1
1 2 3 4 5 6 5 4 3 2 1
1 2 3 4 5 6 7 6 5 4 3 2 1
```

```
1234567
 234567
  34567
   4567
    567
     67
      7
     67
    567
   4567
  34567
 234567
1234567
```

```
1 2 3 4 5 6 7
 2 3 4 5 6 7
  3 4 5 6 7
   4 5 6 7
    5 6 7
     6 7
      7
     6 7
    5 6 7
   4 5 6 7
  3 4 5 6 7
 2 3 4 5 6 7
1 2 3 4 5 6 7
```

```
1
10
101
1010
10101
101010
1010101
```

```
1010101
0101010
1010101
0101010
1010101
0101010
1010101
```

```
1
2 6
3 7 10
4 8 11 13
5 9 12 14 15
```

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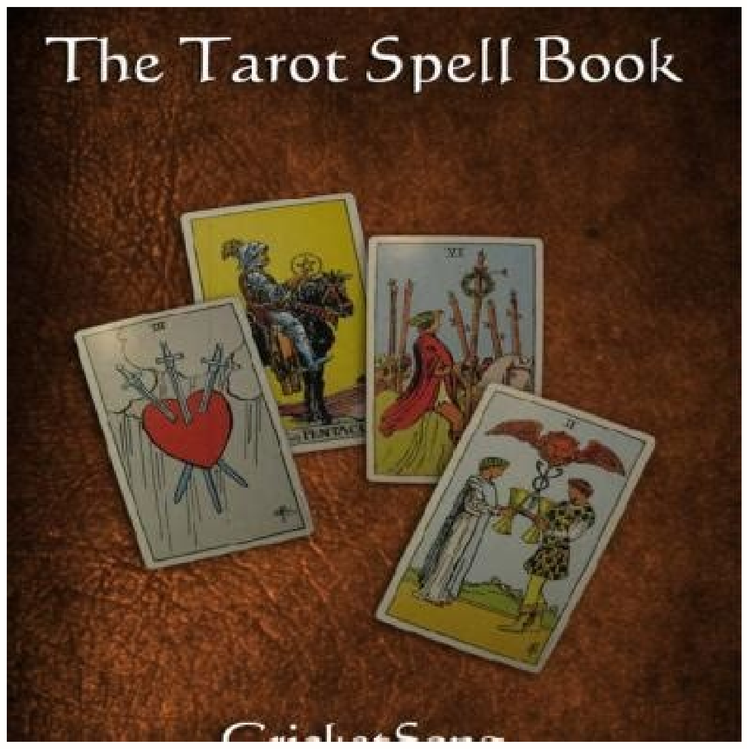
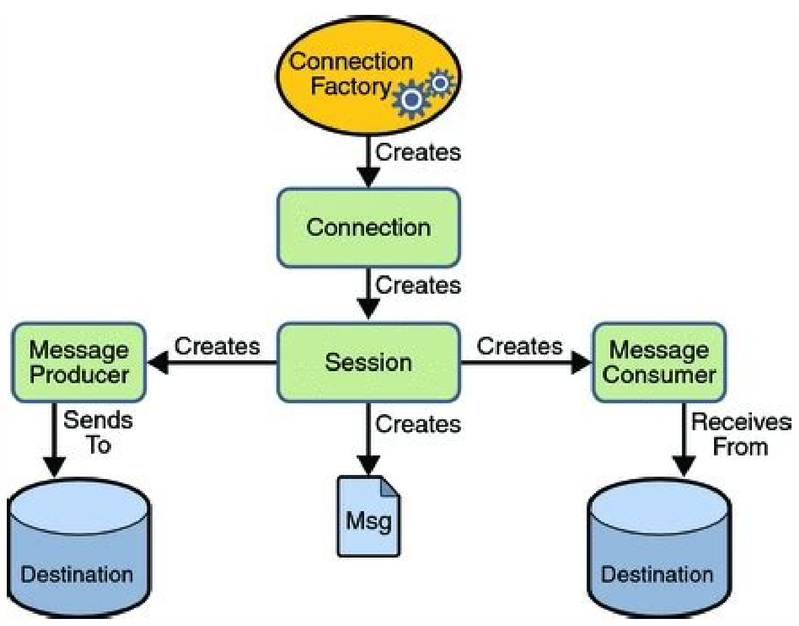
0000000
0100000
0020000
0003000
0000400
0000050
0000006
```





Special case: we are allowed to place catch block for Exception and Throwable even though they are not thrown from try block because they are super classes of both checked and unchecked exceptions.

```
void m1() {
    try{
    }
    catch(Exception e){
        System.out.println(e);
    }
}
```

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The Exception Handling in Java is one of the powerful mechanism to handle the runtime errors so that the normal flow of the application can be maintained. In this tutorial, we will learn about Java exceptions, it's types, and the difference between checked and unchecked exceptions. What is Exception 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 Exception Handling? Exception Handling is a mechanism to handle runtime errors such as ClassNotFoundException, IOException, SQLException, RemoteException, etc. The core advantage of exception handling is to maintain the normal flow of the application. An exception normally disrupts the normal flow of the application; that is why we need to handle exceptions. Let's consider a scenario: statement 1; statement 2; statement 3; statement 4; statement 5;//exception occurs statement 6; statement 7; statement 8; statement 9; statement 10; Suppose there are 10 statements in a Java program and an exception occurs at statement 5; the rest of the code will not be executed, i.e., statements 6 to 10 will not be executed. However, when we perform exception handling, the rest of the statements will be executed. That is why we use exception handling in Java. Do You Know? What is the difference between checked and unchecked exceptions? What happens behind the code int data=50/0;? Why use multiple catch block? Is there any possibility when the finally block is not executed? What is exception propagation? What is the difference between the throw and throws keyword? What are the 4 rules for using exception handling with method overriding? Hierarchy of Java Exception classes The java.lang.Throwable class is the root class of Java Exception hierarchy inherited by two subclasses: Exception and Error. The hierarchy of Java Exception classes is given below: 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: Checked Exception Unchecked Exception 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. Java Exception Keywords Java provides five keywords that are used to handle the exception. The following table describes each. KeywordDescription tryThe "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. catchThe "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. finallyThe "finally" block is used to execute the necessary code of the program. It is executed whether an exception is handled or not. throwThe "throw" keyword is used to throw an exception. throwsThe "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. Java Exception Handling Example Let's see an example of Java Exception Handling in which we are using a try-catch statement to handle the exception. JavaExceptionExample.java public class JavaExceptionExample{ public static void main(String args[]){ try{ //code that may raise exception int data=100/0; }catch(ArithmeticException e){System.out.println(e);} //rest code of the program System.out.println("rest of the code..."); } } Test it Now Output: Exception in thread main java.lang.ArithmeticException:/ by zero rest of the code... In the above example, 100/0 raises an ArithmeticException which is handled by a try-catch block. Common Scenarios of Java Exceptions There are given some scenarios where unchecked exceptions may occur. They are as follows: 1) A scenario where ArithmeticException occurs If we divide any number by zero, there occurs an ArithmeticException. int a=50/0;//ArithmeticException If we have a null value in any variable, performing any operation on the variable throws a NullPointerException. String s=null; System.out.println(s.length());//NullPointerException If the formatting of any variable or number is mismatched, it may result into NumberFormatException. Suppose we have a string variable that has characters; converting this variable into digit will cause NumberFormatException. String s="abc"; int i=Integer.parseInt(s);//NumberFormatException When an array exceeds to it's size, the ArrayIndexOutOfBoundsException occurs. there may be other reasons to occur ArrayIndexOutOfBoundsException. Consider the following statements. int a[]=new int[5]; a[10]=50; //ArrayIndexOutOfBoundsException Next TopicJava Try catch block Exception Handling in Java is one of the effective means to handle the runtime errors so that the regular flow of the application can be preserved. Java Exception Handling is a mechanism to handle runtime errors such as ClassNotFoundException, IOException, SQLException, RemoteException, etc.Exception is an unwanted or unexpected event, which occurs during the execution of a program, i.e. at run time, that disrupts the normal flow of the program's instructions. Exceptions can be caught and handled by the program. When an exception occurs within a method, it creates an object. This object is called the exception object. It contains information about the exception, such as the name and description of the exception and the state of the program when the exception occurred.Major reasons why an exception OccursInvalid user inputDevice failureLoss of network connectionPhysical limitations (out of disk memory)Code errorsOpening an unavailable fileErrors represent irrecoverable conditions such as Java virtual machine (JVM) running out of memory, memory leaks, stack overflow errors, library incompatibility, infinite recursion, etc. Errors are usually beyond the control of the programmer, and we should not try to handle errors.Let us discuss the most important part which is the differences between Error and Exception that is as follows: Error: An Error indicates a serious problem that a reasonable application should not try to catch.Exception: Exception indicates conditions that a reasonable application might try to catch.Exception HierarchyAll exception and error types are subclasses of class Throwable, which is the base class of the hierarchy. One branch is headed by Exception. This class is used for exceptional conditions that user programs should catch. NullPointerException is an example of such an exception. Another branch, Error is used by the Java run-time system(JVM) to indicate errors having to do with the run-time environment itself(JRE). StackOverflowError is an example of such an error.Types of Exceptions Java defines several types of exceptions that relate to its various class libraries. Java also allows users to define their own exceptions.Exceptions can be categorized in two ways:Built-in ExceptionsChecked ExceptionUnchecked Exception User-Defined ExceptionsLet us discuss the above-defined listed exception that is as follows:A. Built-in Exceptions:Built-in exceptions are the exceptions that are available in Java libraries. These exceptions are suitable to explain certain error situations.Checked Exceptions: Checked exceptions are called compile-time exceptions because these exceptions are checked at compile-time by the compiler. Unchecked Exceptions: The unchecked exceptions are just opposite to the checked exceptions. The compiler will not check these exceptions at compile time. In simple words, if a program throws an unchecked exception, and even if we didn't handle or declare it, the program would not give a compilation error.Note: For checked vs unchecked exception, see Checked vs Unchecked Exceptions B. User-Defined Exceptions:Sometimes, the built-in exceptions in Java are not able to describe a certain situation. In such cases, users can also create exceptions, which are called 'user-defined Exceptions'. The advantages of Exception Handling in Java are as follows:Provision to Complete Program ExecutionEasy Identification of Program Code and Error-Handling CodePropagation of ErrorsMeaningful Error ReportingIdentifying Error TypesMethods to print the Exception information:1.printStackTrace()– This method prints exception information in the format of Name of the exception: description of the exception, stacktrace.import java.io.*;class GFG {   public static void main (String[] args) {   int a=5;   int b=0;   try{   System.out.println(a/b);   }   catch(ArithmeticException e){   e.printStackTrace();   }   }}Output:java.lang.ArithmeticException: / by zero at GFG.main(File.java:10)2.toString() – This method prints exception information in the format of Name of the exception: description of the exception.import java.io.*;class GFG1 {   public static void main (String[] args) {   int a=5;   int b=0;   try{   System.out.println(a/b);   }   catch(ArithmeticException e){   System.out.println(e.toString());   }   }}Output:java.lang.ArithmeticException: / by zero3.getMessage() -This method prints only the description of the exception.import java.io.*;class GFG1 {   public static void main (String[] args) {   int a=5;   int b=0;   try{   System.out.println(a/b);   }   catch(ArithmeticException e){   System.out.println(e.getMessage());   }   }}Output:/ by zeroHow Does JVM handle an Exception?Default Exception Handling: Whenever inside a method, if an exception has occurred, the method creates an Object known as an Exception Object and hands it off to the run-time system(JVM). The exception object contains the name and description of the exception and the current state of the program where the exception has occurred. Creating the Exception Object and handling it in the run-time system is called throwing an Exception. There might be a list of the methods that had been called to get to the method where an exception occurred. This ordered list of the methods is called Call Stack. Now the following procedure will happen. The run-time system searches the call stack to find the method that contains a block of code that can handle the occurred exception. The block of the code is called an Exception handler.The run-time system starts searching from the method in which the exception occurred, and proceeds through the call stack in the reverse order in which methods were called.If it finds an appropriate handler, then it passes the occurred exception to it. An appropriate handler means the type of the exception object thrown matches the type of the exception object it can handle.If the run-time system searches all the methods on the call stack and couldn't have found the appropriate handler, then the run-time system handover the Exception Object to the default exception handler, which is part of the run-time system. This handler prints the exception information in the following format and terminates the program abnormally.Exception in thread "xxx" Name of Exception : Description ... . // Call StackLook at the below diagram to understand the flow of the call stack. Illustration:class GFG {   public static void main(String args[])   {   String str = null;   System.out.println(str.length());   }}Output:Let us see an example that illustrates how a run-time system searches for appropriate exception handling code on the call stack.Example:class GFG {   static int divideByZero(int a, int b)   {   int i = a / b;   return i;   }   static int computeDivision(int a, int b)   {   int res = 0;   try {   res = divideByZero(a, b);   }   catch (NumberFormatException ex) {   System.out.println("NumberFormatException is occurred");   }   return res;   }   public static void main(String args[])   {   int a = 1;   int b = 0;   try {   int i = computeDivision(a, b);   }   catch (ArithmeticException ex)   {   System.out.println(ex.getMessage());   }   }}How Programmer Handles an Exception?Customized Exception Handling: Java exception handling is managed via five keywords: try, catch, throw, throws, and finally. Briefly, here is how they work. Program statements that you think can raise exceptions are contained within a try block. If an exception occurs within the try block, it is thrown. Your code can catch this exception (using catch block) and handle it in some rational manner. System-generated exceptions are automatically thrown by the Java run-time system. To manually throw an exception, use the keyword throw. Any exception that is thrown out of a method must be specified as such by a throws clause. Any code that absolutely must be executed after a try block completes is put in a finally block.Tip: One must go through control flow in try catch finally block for better understanding. Need for try-catch clause(Customized Exception Handling)Consider the below program in order to get a better understanding of the try-catch clause.Example:class GFG {   public static void main(String[] args)   {   int[] arr = new int[4];   int i = arr[4];   System.out.println("Hi, I want to execute");   }}Output: Output explanation: In the above example, an array is defined with size i.e. you can access elements only from index 0 to 3. But you trying to access the elements at index 4(by mistake) that's why it is throwing an exception. In this case, JVM terminates the program abnormally. The statement System.out.println("Hi, I want to execute"); will never execute. To execute it, we must handle the exception using try-catch. Hence to continue the normal flow of the program, we need a try-catch clause. How to Use the try-catch Clause?try { // block of code to monitor for errors // the code you think can raise an exception } catch (ExceptionType1 exOb) { // exception handler for ExceptionType1 } catch (ExceptionType2 exOb) { // exception handler for ExceptionType2 } // optional finally { // block of code to be executed after try block ends }Certain below key points are needed to be remembered that are as follows: In a method, there can be more than one statement that might throw an exception, So put all these statements within their own try block and provide a separate exception handler within their own catch block for each of them.If an exception occurs within the try block, that exception is handled by the exception handler associated with it. To associate the exception handler, we must put a catch block after it. There can be more than one exception handlers. Each catch block is an exception handler that handles the exception to the type indicated by its argument. The argument, ExceptionType declares the type of exception that it can handle and must be the name of the class that inherits from the Throwable class.For each try block, there can be zero or more catch blocks, but only one final block.The finally block is optional. It always gets executed whether an exception occurred in try block or not. If an exception occurs, then it will be executed after try and catch blocks. And if an exception does not occur, then it will be executed after the try block. The finally block in java is used to put important codes such as clean up code e.g., closing the file or closing the connection.The summary is depicted via visual aid below as follows: Related Articles: This article is contributed by Nitsdheerendra and Gaurav Miglani. If you like GeeksforGeeks and would like to contribute, you can also write an article using write.geeksforgeeks.org or mail your article to review-team@geeksforgeeks.org. 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