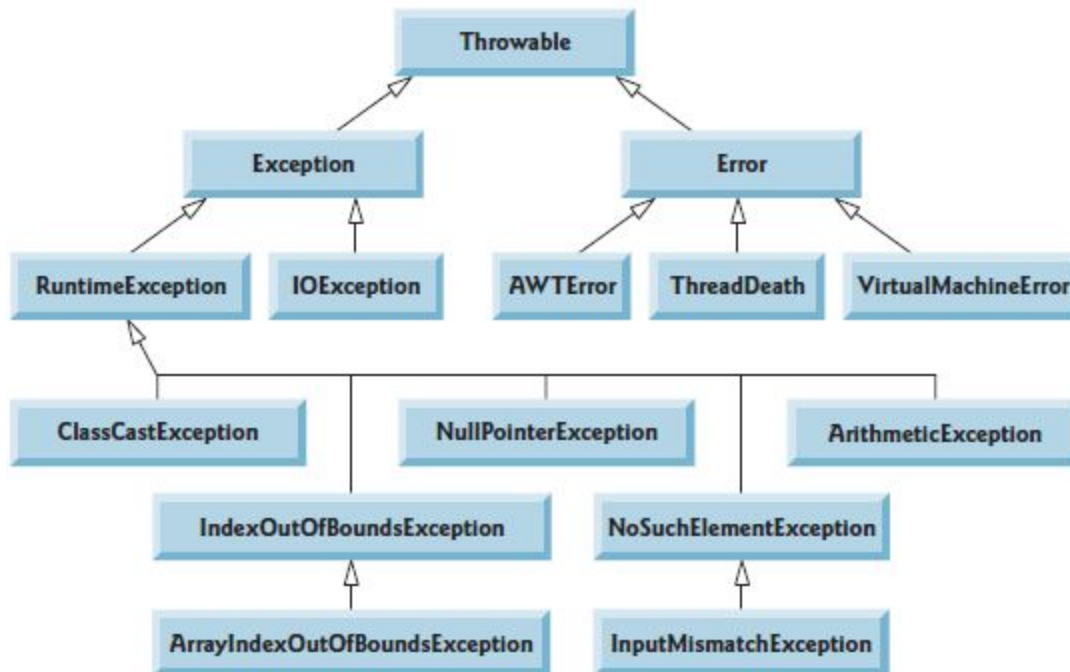


Exception Hierarchy



Example: 1 Divided By Zero Exception

```
// Integer division without exception handling.
import java.util.Scanner;

public class DivideByZeroNoExceptionHandling
{
    // demonstrates throwing an exception when a divide-by-zero occurs
    public static int quotient(int numerator, int denominator)
    {
        return numerator / denominator; // possible division by zero
    }

    public static void main(String[] args)
    {
        Scanner scanner = new Scanner(System.in);

        System.out.print("Please enter an integer numerator: ");
        int numerator = scanner.nextInt();
        System.out.print("Please enter an integer denominator: ");
```

```

        int denominator = scanner.nextInt();

        int result = quotient(numerator, denominator);
        System.out.printf(
            "%nResult: %d / %d = %d%n", numerator, denominator, result);
    }
} // end class DivideByZeroNoExceptionHandling

```

Example: 2 Divided By Zero with Exception Handling

```

// Handling ArithmeticExceptions and InputMismatchExceptions.
import java.util.InputMismatchException;
import java.util.Scanner;

public class DivideByZeroWithExceptionHandling
{
    // demonstrates throwing an exception when a divide-by-zero occurs
    public static int quotient(int numerator, int denominator)
        throws ArithmeticException
    {
        return numerator / denominator; // possible division by zero
    }

    public static void main(String[] args)
    {
        Scanner scanner = new Scanner(System.in);
        boolean continueLoop = true; // determines if more input is needed
    }
}

```

```

do
{
    try // read two numbers and calculate quotient
    {
        System.out.print("Please enter an integer numerator: ");
        int numerator = scanner.nextInt();
        System.out.print("Please enter an integer denominator: ");
        int denominator = scanner.nextInt();

        int result = quotient(numerator, denominator);
        System.out.printf("%nResult: %d / %d = %d%n", numerator,
            denominator, result);
        continueLoop = false; // input successful; end looping
    }
    catch (InputMismatchException inputMismatchException)
    {
        System.err.printf("%nException: %s%n",
            inputMismatchException);
        scanner.nextLine(); // discard input so user can try again
        System.out.printf(
            "You must enter integers. Please try again.%n%n");
    }
    catch (ArithmeticException arithmeticException)
    {
        System.err.printf("%nException: %s%n", arithmeticException);
        System.out.printf(
            "Zero is an invalid denominator. Please try again.%n%n");
    }
} while (continueLoop);
}
} // end class DivideByZeroWithExceptionHandling

```

Example: 3 Using try catch and finally

/ Fig. 11.5: UsingExceptions.java
 // try...catch...finally exception handling mechanism.

```

public class UsingExceptions
{
    public static void main(String[] args)

```

```

{
    try
    {
        throwException();
    }
    catch (Exception exception) // exception thrown by throwException
    {
        System.err.println("Exception handled in main");
    }

    doesNotThrowException();
}

// demonstrate try...catch...finally
public static void throwException() throws Exception
{
    try // throw an exception and immediately catch it
    {
        System.out.println("Method throwException");
        throw new Exception(); // generate exception
    }
    catch (Exception exception) // catch exception thrown in try
    {
        System.err.println(
            "Exception handled in method throwException");
        throw exception; // rethrow for further processing

        // code here would not be reached; would cause compilation errors
    }
    finally // executes regardless of what occurs in try...catch
    {
        System.err.println("Finally executed in throwException");
    }

    // code here would not be reached; would cause compilation errors
}

// demonstrate finally when no exception occurs
public static void doesNotThrowException()
{
    try // try block does not throw an exception
    {
        System.out.println("Method doesNotThrowException");
    }
}

```

```

    }
    catch (Exception exception) // does not execute
    {
        System.err.println(exception);
    }
    finally // executes regardless of what occurs in try...catch
    {
        System.err.println(
            "Finally executed in doesNotThrowException");
    }

    System.out.println("End of method doesNotThrowException");
}
} // end class UsingExceptions

```

Example: 4 Obtaining data from exception object

```

// Fig. 11.6: UsingExceptions.java
// Stack unwinding and obtaining data from an exception object.

public class UsingExceptions
{
    public static void main(String[] args)
    {
        try
        {
            method1();
        }
        catch (Exception exception) // catch exception thrown in method1
        {
            System.err.printf("%s\n\n", exception.getMessage());
            exception.printStackTrace();

            // obtain the stack-trace information
            StackTraceElement[] traceElements = exception.getStackTrace();

```

```

        System.out.printf("%nStack trace from getStackTrace:%n");
        System.out.println("Class\t\tFile\t\t\tLine\tMethod");

        // loop through traceElements to get exception description
        for (StackTraceElement element : traceElements)
        {
            System.out.printf("%s\t", element.getClassName());
            System.out.printf("%s\t", element.getFileName());
            System.out.printf("%s\t", element.getLineNumber());
            System.out.printf("%s%n", element.getMethodName());
        }
    }
} // end main

// call method2; throw exceptions back to main
public static void method1() throws Exception
{
    method2();
}

// call method3; throw exceptions back to method1
public static void method2() throws Exception
{
    method3();
}

// throw Exception back to method2
public static void method3() throws Exception
{
    throw new Exception("Exception thrown in method3");
}
} // end class UsingExceptions

```

Chained Exceptions

Sometimes a method responds to an exception by throwing a different exception type that's specific to the current application. If a **catch** block throws a new exception, the original exception's information and stack trace are lost. Earlier Java versions provided no mechanism to wrap the original exception information with the new exception's information to provide a complete stack trace showing where the original problem occurred. This made debugging such problems particularly difficult. Chained exceptions enable an exception object to maintain the complete stack-trace information from the original exception. Following example demonstrates chained exceptions.

Example: 5 Using chained exceptions

```
// Chained exceptions.

public class UsingChainedExceptions
{
    public static void main(String[] args)
    {
        try
        {
            method1();
        }
        catch (Exception exception) // exceptions thrown from method1
        {
            exception.printStackTrace();
        }
    }

    // call method2; throw exceptions back to main
    public static void method1() throws Exception
    {
        try
        {
            method2();
        }
        catch (Exception exception) // exception thrown from method2
        {
            throw new Exception("Exception thrown in method1", exception);
        }
    } // end method method1
}
```

```

// call method3; throw exceptions back to method1
public static void method2() throws Exception
{
    try
    {
        method3();
    }
    catch (Exception exception) // exception thrown from method3
    {
        throw new Exception("Exception thrown in method2", exception);
    }
} // end method method2

// throw Exception back to method2
public static void method3() throws Exception
{
    throw new Exception("Exception thrown in method3");
}
} // end class UsingChainedExceptions

```

Assertions

When implementing and debugging a class, it's sometimes useful to state conditions that should be true at a particular point in a method. These conditions, called assertions, help ensure a program's validity by catching potential bugs and identifying possible logic errors during development. Preconditions and postconditions are two types of assertions. Preconditions are assertions about a program's state when a method is invoked, and postconditions are assertions about its state after a method finishes.

While assertions can be stated as comments to guide you during program development, Java includes two versions of the **assert** statement for validating assertions programmatically. The **assert** statement evaluates a boolean expression and, if false, throws an `AssertionError` (a subclass of `Error`). The first form of the **assert** statement is

```
assert expression;
```

```
assert expression1 : expression2;
```

which evaluates **expression1** and throws an **AssertionError** with **expression2** as the error message if **expression1** is **false**,

You use assertions primarily for debugging and identifying logic errors in an application.

You must explicitly enable assertions when executing a program, because they reduce performance and are unnecessary for the program's user. To do so, use the java command's **-ea** command-line option, as in

java -ea AssertTest

Example: 5 Using Assertions

```
// Checking with assert that a value is within range.
import java.util.Scanner;

public class AssertTest
{
    public static void main(String[] args)
    {
        Scanner input = new Scanner(System.in);

        System.out.print("Enter a number between 0 and 10: ");
        int number = input.nextInt();

        // assert that the value is >= 0 and <= 10
        assert (number >= 0 && number <= 10) : "bad number: " + number;

        System.out.printf("You entered %d\n", number);
    }
} // end class AssertTest
```

