



Chapter 3 Java Exception



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- A Notion of Exception
- Java Exceptions
- Exception Handling
- User-defined Exceptions
- How to Use Exception



Exceptional Condition

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- Exceptional Condition
 - Divided by 0
 - No input or output file
 - Visit a Null reference
- A Sound Program Should
 - Declare the possible exceptional condition
 - Handle the exceptions at right time and in right place



Exceptional Condition

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- **Exceptional Condition VS. Normal Condition**
 - End of file is a normal condition
 - Normal condition does not lead to program halt
 - Exceptional conditions lead to program halt
- **Exceptional Condition VS. Error Condition**
 - JVM crash is an error condition
 - Error conditions cannot be handled by program
 - Exceptional conditions can and should be handled by program



Significance of Exception

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- Java Exception
 - Offering a clear grammar for handling program correctness
 - Balancing between **Clarity** and **Correctness**

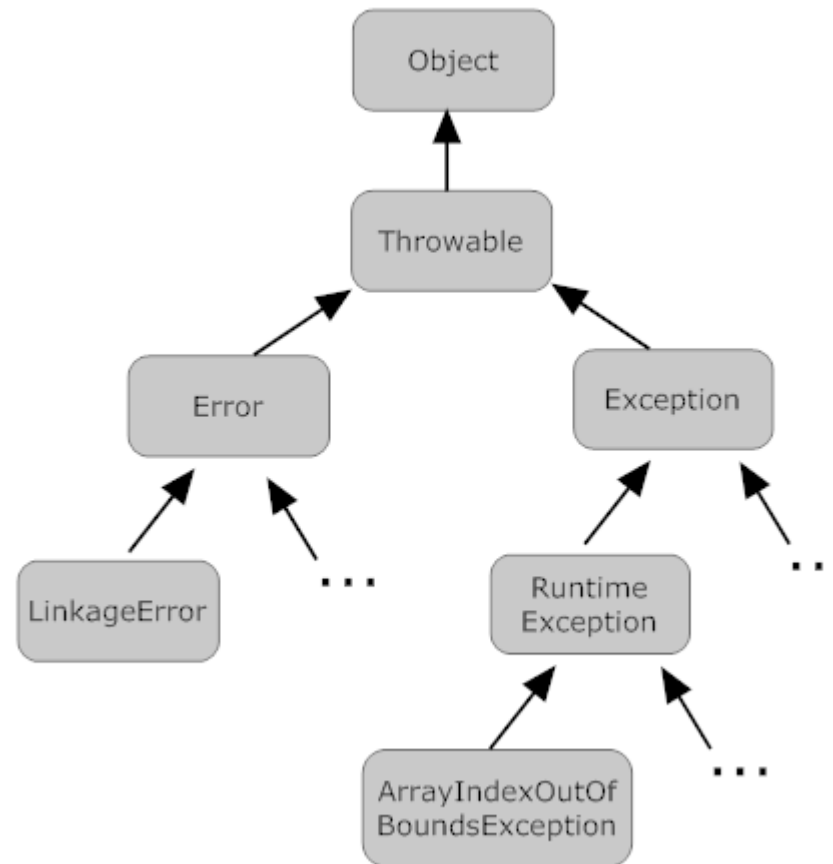
```
public void getShape(Person p){  
    if(p==null){  
        ...  
    }else if(p.weight==0){  
        ...  
    }else{  
        double ratio = p.height / p.weight;  
        // Calculate and print the body shape of Person p  
    }  
}
```

```
public void getShape(Person p)  
    throws NullPointerException, ArithmeticException{  
    double ratio = p.height / p.weight;  
    // Calculate and print the body shape of Person p  
}
```



Java Exception

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Runtime Exception

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- Throwable Exceptions in Normal Run-time
- Related to Execution of Program
- Not Related to the Business Logic
- Difference: DO NOT HAVE TO Declare
- Example:
 - NullPointerException
 - ArithmeticException



Java Exception Handling

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- Java Use Following Exception Handling Process:
 - Block A meets an exceptional condition
 - Block A halt
 - One or more exception objects generated
 - Exception objects are **thrown**
 - JVM looks for proper codes to **catch** these objects
 - Exceptional condition is handled
 - Program continues from exceptional handling code



Java Exceptions

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Exception	Superclass of all exceptions
DataFormatException	Error data format
ClassNotFoundException	Exception in class loading
IOException	IO operation error
SQLException	Database operation error
TimeoutException	Timeout error
SocketException	Socket operation error
<i>ArrayIndexOutOfBoundsException</i>	Exception in visiting array
<i>NullPointerException</i>	Visiting null reference



Declare Exception

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- **throw** and **throws** – Declare Possible Exceptions
- **throw** throws exceptions in method body
- **throws** defines **Exception Specification**

```
public void checkFile(File file) throws IOException, IllegalArgumentException{  
    if(!file.exists()){  
        throw new IOException("File doesn't exist!");  
    }else if(file.isDirectory()){  
        throw new IllegalArgumentException("Not a file!");  
    }  
}
```



Catch and Handling of Exceptions

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- **try**, **catch** and **finally**
- **try** is used to monitor method invocation
- **catch** is used to catch thrown exceptions
- **finally** is used for execute essential code – whether there are exceptions or not
- Multiple **catch** clause
- At least one **catch** or **finally** clause

```
public void test(File file){  
    try{  
        this.checkFile(file);  
    }catch(IOException e){  
        System.out.println(e.getMessage());  
    }catch(IllegalArgumentException e){  
        System.out.println("Please provide a file");  
    }catch(Exception e){  
        System.out.println("Other exceptions occur");  
    }finally{  
        file.delete();  
    }  
}
```



Deep Into **FINALLY**

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The finally block always executes when the try block exits. This ensures that the finally block is executed even if an **unexpected exception** occurs. But finally is useful for more than just exception handling — it allows the programmer to **avoid having cleanup code accidentally bypassed by a return, continue, or break.** Putting cleanup code in a finally block is always a good practice, even when no exceptions are anticipated.

Note: If the JVM exits while the try or catch code is being executed, then **the finally block may not execute.** Likewise, if the thread executing the try or catch code is interrupted or killed, the finally block may not execute even though the application as a whole continues.

- No catch
- Return in catch



Deep Into **FINALLY**

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- Guess the result:

```
public void test(){
    try{
        System.out.println("try block");
        return;
    }finally{
        System.out.println("finally block");
    }
}
```



Deep Into FINALLY

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- Guess the result:

```
public int test(){
    try{
        System.out.println("try block");
        int i = 1 / 0;
        return 1;
    }
    catch(Exception e){
        System.out.println("catch block");
        return 2;
    }
    finally{
        System.out.println("finally block");
    }
}
```




Deep Into FINALLY

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- <http://www.ibm.com/developerworks/cn/java/j-lo-finally/>



Rethrow Exceptions

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```
public void test(File file) throws IOException{
    try{
        this.checkFile(file);
    } catch(IOException e){
        throw e;
    } catch(IllegalArgumentException e){
        throw e;
    } catch(Exception e){
        System.out.println("Other exceptions occur");
    } finally{
        file.delete();
    }
}
```

Is there something wrong?



Exception Handling

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- **Message**
 - new Exception(String message)
 - getMessage()
- **Cause**
 - initCause()
 - new Exception(Exception cause)
 - getCause()
- **StackTrace**
 - printStackTrace()



User-defined Exception

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```
public class BadObjectException extends Exception{  
    private Object badObject;  
  
    public BadObjectException(Object object, String msg){  
        super(msg);  
        this.badObject = object;  
    }  
  
    public Object getBadObject(){  
        return this.badObject;  
    }  
}
```



Lab Work

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- hashCode() + cloneable + exception

```
Person p1 = new Person("tom", 18);
Person p2 = new Person("tom", 18);
Person p3 = new Person("jack", 18);
Person p4 = p1;
Person p5 = null;
try{
    p5 = (Person)p1.clone();
}catch(Exception e){
    e.printStackTrace();
}
Person source = p1;
Person target = p3;
try{
    if(source.hashCode()!=target.hashCode()) throw(new BadObjectException(target));
    else System.out.println("Same Hashcode.");
}catch(BadObjectException e){
    System.out.println("The Souce Hashcode: " + source.hashCode());
    System.out.println("Bad Object Hashcode: " + ((Person)e.getBadObject()).hashCode());
}
```

We want to let the hashCode of p1 = hashCode of p2 p4 p5, but different with p3, how to write the code?



Think

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- Exception in Overriding
- Which is allowed?

```
public class A{  
    public void test() throws IOException, SQLException{  
        ...  
    }  
}
```

```
public class B extends A{  
    public void test() throws Exception{  
        ...  
    }  
}
```

```
public class C extends A{  
    public void test() throws SQLException{  
        ...  
    }  
}
```



Self-study

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- Assertions(断言)

- Used for Software Testing

```
i++;  
assert i < max;
```

- Regular Expression(正则表达式)

- java.util.regex

```
Pattern p = Pattern.compile("a*b");  
Matcher m = p.matcher("aaaaab");  
boolean b = m.matches();
```



Forecast

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- Java I/O Introduction
- File and Directory
- Byte-stream and Character-stream
- Bridge between b-s and c-s
- Random Access File
- Standard I/O
 - System.in
 - System.out
- java.nio Pilot