Java Exception Handling `try`, `throw`, and `catch`

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Outline

Exceptions (a.k.a oops!)

Background

- Exceptions are all subclasses of the class `throwable`.
- Error subclass is for “hard” errors such as catastrophic error.
- Run-time exceptions are for run-time errors that may (or may not) be fixed on the fly.

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The Class throwable

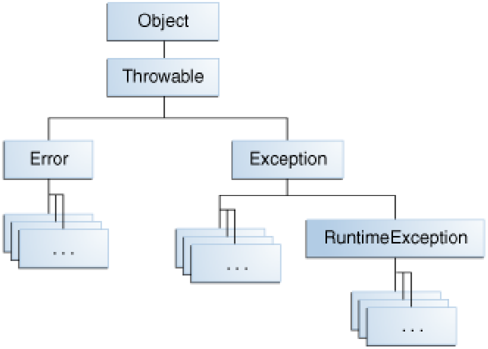

Figure: The Class `throwable`

Three Types of Exceptions

- `error` subclasses
  - Technically, you can throw errors. Don't.
  - These are catastrophic failures and usually can't be fixed by the user
- `runtime error` subclasses
  - Technically, you can throw these as well. Don't.
  - These are usually JAVA errors
- `exception errors`
  - Java has many exceptions you might want to throw/catch
  - This is the best place to create your own exceptions

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What to throw

- You should never `throw` an `error`, only an `exception`
- What exceptions a method can throw must be documented
- What exceptions a method can throw are part of the method signature
- You must instantiate an exception when you throw it
- A good place to start looking:

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Creating an Exception to `throw`

You should write your own exception classes if you answer yes to any of the following questions; otherwise, you can probably use someone else's.

- Do you need an exception type that isn't represented by those in the Java platform?
- Would it help users if they could differentiate your exceptions from those thrown by classes written by other vendors?
- Does your code throw more than one related exception?
- If you use someone else's exceptions, will users have access to those exceptions?
- A similar question is, should your package be independent and self-contained?

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Guidelines for Your Exceptions

- For readable code, it's good practice to append the string Exception to the names of all classes that inherit (directly or indirectly) from the Exception class.
- If a client can reasonably be expected to recover from an exception, make it a checked exception. If a client cannot do anything to recover from the exception, make it an unchecked exception.

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Creating a StackEmptyException

Suppose you wish to create an exception if a user tries to `pop()` an empty stack.

- Change the method signature: `element method pop() throws StackEmptyException`
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pop() with Error

```
 public element pop() throws
StackEmptyException {
if (this.isEmpty())
{
throw new StackEmptyException;
}
⋮
}
```

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Using Exceptions

- There are two types of exceptions (for now)
- Checked Exceptions (exceptions the user can fix)
- If the user can fix it, `catch` it
- Unchecked Exceptions (exceptions the user can't fix)
- No one can help, don't `catch` it.
- Exceptions that are not caught abort execution.

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try Blocks

If you can fix the error (with or without user “help”) you should surround statements that can cause the error with a `try` block.

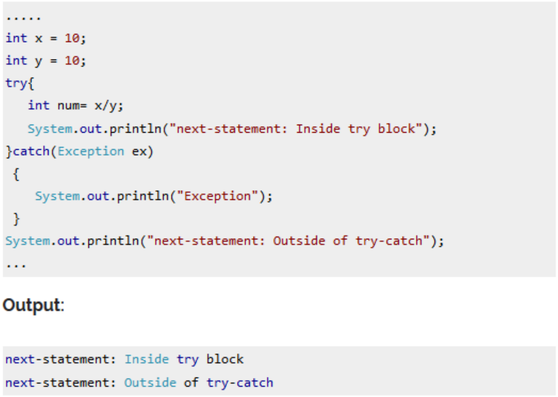
```
try {
target = myStack.pop();
}
```

catch Blocks

Once an exception has been thrown, you have three choices

- Ignore the error and allow the program to terminate
- `catch` the error and fix it
- `catch` the error and have the user fix it (enter a different file name????)

try-catch Blocks



```
.....
int x = 10;
int y = 10;
try{
   int num= x/y;
   System.out.println("next-statement: Inside try block");
}catch(Exception ex)
 {
    System.out.println("Exception");
 }
System.out.println("next-statement: Outside of try-catch");
...
```

Output:

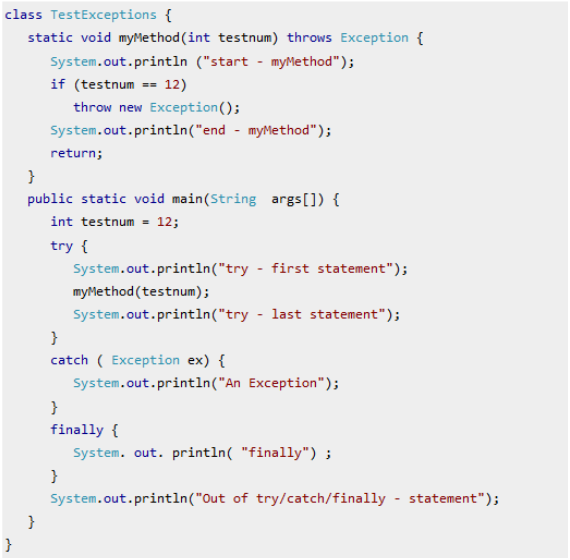
```
next-statement: Inside try block
next-statement: Outside of try-catch
```

Figure: From: http://beginnersbook.com/2013/05/flow-in-try-catch-finally/

Multiple catch Blocks

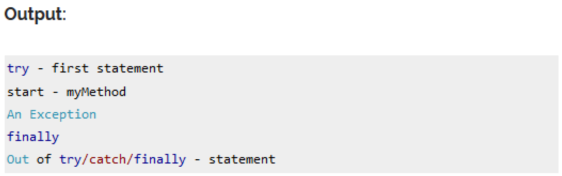
If a `try` block can throw more than one exception that you can fix, you will need a `catch` block for each one.
If you wish some common code to be executed after exceptions occur, you can place that in a `finally` block.

Example of try-catch-finally Blocks



```
class TestExceptions {
   static void myMethod(int testnum) throws Exception {
      System.out.println ("start - myMethod");
      if (testnum == 12)
         throw new Exception();
      System.out.println("end - myMethod");
      return;
   }
   public static void main(String  args[]) {
      int testnum = 12;
      try {
         System.out.println("try - first statement");
         myMethod(testnum);
         System.out.println("try - last statement");
      }
      catch ( Exception ex) {
         System.out.println("An Exception");
      }
      finally {
         System. out. println( "finally") ;
      }
      System.out.println("Out of try/catch/finally - statement");
   }
}
```

Output from Example


Output:

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try - first statement
start - myMethod
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Figure: Output from the Example