Exceptions

Reference:
`java.sun.com/docs/books/tutorial/essential/exceptions/`

Issues

- What to do when you catch an exception?
- How and when to generate exceptions.
- **`RunTime`** exceptions.
- Custom Exception types.
- Using **`finally.`**

Exception Reminder

```
try {
   readFromFile("datafile");
} catch (FileNotFoundException e) {
   System.err.println("Error: File not found");
}
```

Exception Handling: Some Options

- Print something
- Throw a new exception
- Re-Throw the exception
- Fix the problem
- Exit

Exception Handling: Printing

- You can print a stack trace by calling the exception method **`printStackTrace()`**
- Sometimes it's better to send error messages to **`stderr`**:
  - `System.err.println("Error: invalid thingy");`
- Some applications log error messages
  - file
  - logging service (syslog).

Exception Handling: **`throw`**

- You can **`throw`** an exception from an exception handler (a **`catch`** block).
  - Allows you to change exception type and/or error message.
  - You can also alter the base of the stack trace
    - **`fillInStackTrace()`**

Sample code: ThrowUp.java

Exception Handling: Re-`throw`

- You can **`throw`** an exception from an exception handler (a **`catch`** block) without changing anything:
  - called *rethrowing*
  - The caller needs to deal with the exception.
  - This also happens if you don't catch the exception!
    - sometimes you need to take some action and then rethrow the exception.

Another way to re-throw

- You can allow selected types of exceptions to be propogated to the caller of your method:

```
void blah() throws IOException {
```

- Within **`blah()`** you don't need to catch these exceptions (to be able to compile).

Exception Handling: Fix the problem.

- You can't fix things and then *resume* execution automatically
  - you can do this in C++.
- You can have a loop the retries the code again.

Sample code: Wait.java

Exception Handling: exiting

- Sometimes the error is fatal, and you want to stop the program immediately.

```
System.exit();
```

Sample code: Wait.java

How/when do you *generate* exceptions?

- Use throw:

```
throw new Exception("broken!");
```

- You can use throw anywhere.
  - you detect some error that means the following code should not be executed.
- In some cases, you can think of throw as a alternate `return`

Exception Enforcement

- In general, you do the following:
  - specify what exceptions each method can generate.
  - write code to catch all exceptions that can be generated by a method call.
- The compiler (usually) enforces this
  - it is a compilation error to call a method without catching it's declared exception types.

Sample code: NullPointer.java

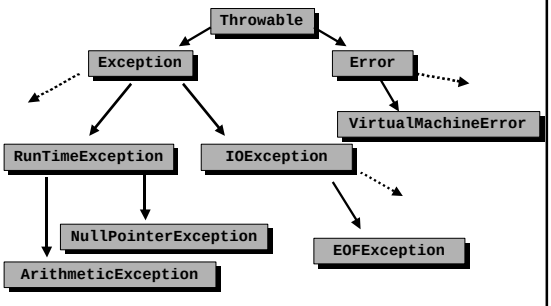
RunTime Exceptions

- There are exceptions that are generated by the system (that are usually caused by programming mistakes):
  - NullPointerException (null references)
  - ArrayIndexOutOfBoundsException
- If you don't catch these, a stack trace will be generated and the program will terminate.
- The compiler does not force you to catch these exceptions.

Exception Types

- Exceptions are objects!
- Exception types are classes.
  - A (quite large!) hierarchy of classes.
- All exception types are derived from the class **`Exception`**
  - there are some methods defined in this base class.

Exception Type Hierarchy (partial)



Some Exception Methods

- These are actually inherited from **`throwable`**

`printStackTrace()`

`fillInStackTrack()`

`getMessage()`

Creating Your Own Exception Types

- It is often useful to create your own type of exception.
  - generally all you create is a name.
  - you can get fancy and add new methods to your exception class(es).

Sample code: CmdLine.java CmdLine2.java

Custom Exception Type

```
class FooException extends Exception {}


class BlahException extends Exception {
    BlahException(){}
    BlahException(String s) { super(s); }
}

throw new BlahException("Invalid blah");
```

using **`finally`**

```
try {
   statements . . .
} catch (ExceptionType1 ename1) {
   error handling statements . . .
} catch (ExceptionType2 ename2) {
   error handling statements . . .
} finally {
   … this code always executed …
}
```


Why **`finally`**?

- What is there to clean up?
  - No memory cleanup required in Java!
  - No destructors to call!
- Sometimes you need to set the state of things (fields) to some *stable (acceptable)* state.

Sample code: FinallyPlay.java