USF UNIVERSITY OF SAN FRANCISCO
CHANGE THE WORLD FROM HERE

Exception Handling

CS 272 Software Development

Professor Sophie Engle
Department of Computer Science

Motivation

- Exceptions happen (bugs, network issues, ...)
- Program can operate even if exceptions occur
  - Warn and continue, terminate gracefully, ...
- Separate exception logic from normal functionality
- Group how code reacts to different types of exceptions

https://docs.oracle.com/javase/tutorial/essential/exceptions/advantages.html

Exception Handling in Java

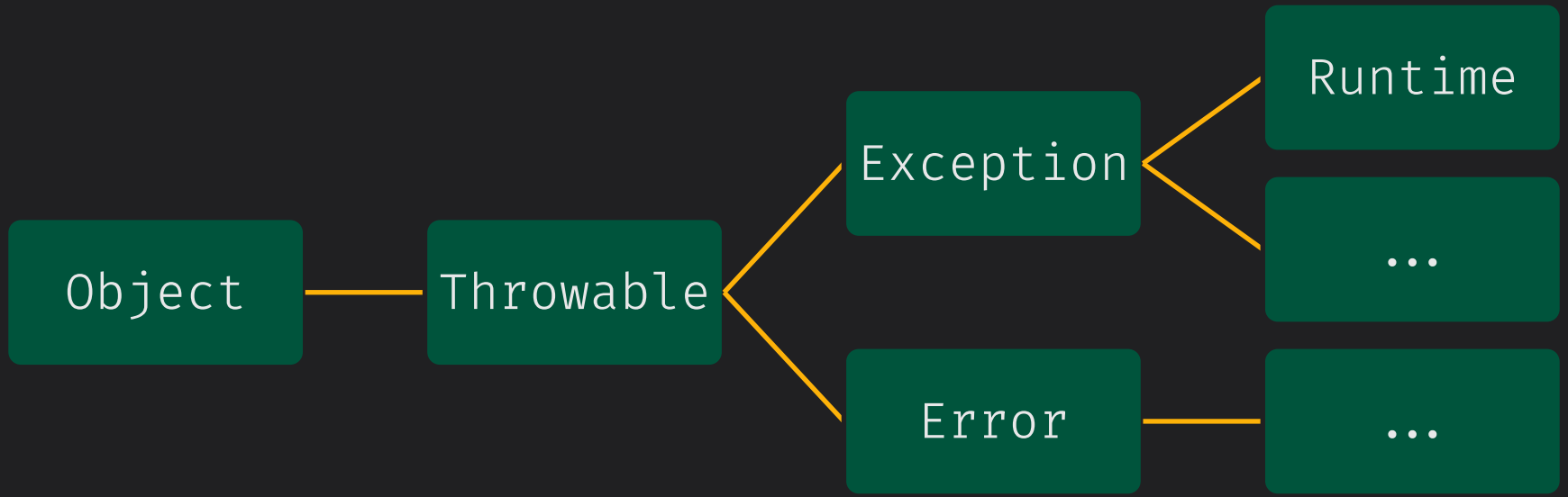
- `Throwable` interface
- `Error` and `Exception` classes
- `try`, `catch`, `finally` keywords
- `throws` keyword

Types of Exceptions

Type	Description	Catch/Throw?
Error	Problem occurred **external** to application (in the JVM)	*Not Usually*
Runtime Exception	Programs **cannot** anticipate or recover, occur during **normal** operation, often bug	Optional
Checked Exception	Programs **should** anticipate and recover from, **checked** by compiler	**Required**

https://docs.oracle.com/javase/tutorial/essential/exceptions/catchOrDeclare.html

Exception Hierarchy



https://docs.oracle.com/javase/tutorial/essential/exceptions/throwing.html

Errors

- Indicate a serious problem external to program (in the JVM) occurred
- Usually not addressed by simple programs
- For example, an **`IOError`** from hard drive failure while reading an open file

https://docs.oracle.com/javase/tutorial/essential/exceptions/throwing.html

Runtime (Unchecked) Exceptions

- Includes all **`Exception`** subclasses under **`RuntimeException`**
- Can be caught or thrown, but not required
- Often indicates code defects
  - e.g. accessing an array out of bounds

https://docs.oracle.com/javase/tutorial/essential/exceptions/catchOrDeclare.html

Common Runtime Exceptions

- ArithmeticException
- IndexOutOfBoundException
  - ArrayIndexOutOfBoundsException
  - StringIndexOutOfBoundsException
- NegativeArraySizeException
- NullPointerException

https://www.cs.usfca.edu/~cs272/javadoc/api/java.base/java/lang/RuntimeException.html

Checked Exceptions

- Includes all **`Exception`** subclasses **except** those under **`RuntimeException`**
- Should be anticipated by programmer
- Must be handled (caught or rethrown) by application
  - e.g. trying to open an non-existent file

https://docs.oracle.com/javase/tutorial/essential/exceptions/catchOrDeclare.html

Common IO Exceptions

- EOFException
- FileNotFoundException
- FileSystemException
- NoSuchFileException
- CharacterCodingException
- MalformedInputException

https://www.cs.usfca.edu/~cs272/javadoc/api/java.base/java/io/IOException.html

Handling Checked Exceptions

- Use **`try`**, **`catch`**, **`finally`** blocks to handle
- Use **`try`**-with-resources blocks
  - Added in Java 7 to auto-close resources
- Use **`throws`** keyword and **`catch`** elsewhere
  - Catch where makes sense to handle exception

Catching Exceptions

- Any exception type (even unchecked) can be caught
- Can specify multiple `catch` blocks for each `try`
  - Will execute first matching `catch` block
- Related to inheritance, discussed more later
- Can catch more than one exception per handler
- Can throw exceptions within handlers

API Example

nextInt

`public int nextInt()`

Scans the next token of the input as an `int`.

An invocation of this method of the form `nextInt()` behaves in exactly the same way as the invocation `nextInt(radix)`, where `radix` is the default radix of this scanner.

Returns:

the `int` scanned from the input

Throws:

`InputMismatchException` - if the next token does not match the *Integer* regular expression, or is out of range

`NoSuchElementException` - if input is exhausted

`IllegalStateException` - if this scanner is closed

https://www.cs.usfca.edu/~cs272/javadoc/api/java.base/java/util/Scanner.html#nextInt()

Questions?