

Recreation

- A student adds a JUnit test:

```
@Test
public void mogrifyTest() {
    assertEquals("mogrify fails", new int[] { 2, 4, 8, 12
},
                MyClass.mogrify(new int[] { 1, 2, 4, 6 }));
}
```

The test always seems to fail, no matter what mogrify does. Why?

- A student sees this in an autograder log:

```
Fatal: no proj0/game2048 directory.
```

What is likely to be the problem?

- A student does not see his proj0 submission under the Scores tab.
What can be the problem?

CS61B Lecture #12: Exceptions

What to do About Errors?

- Large amount of any production program devoted to detecting and responding to errors.
- Some errors are external (bad input, network failures); others are internal errors in programs.
- When method has stated precondition, it's the client's job to comply.
- Still, it's nice to detect and report client's errors.
- In Java, we *throw exception objects*, typically:

```
throw new SomeException (optional description);
```

- Exceptions are objects. By convention, they are given two constructors: one with no arguments, and one with a descriptive string argument (which the exception stores).
- Java system throws some exceptions implicitly, as when you dereference a null pointer, or exceed an array bound.

Catching Exceptions

- A **throw** causes each active method call to *terminate abruptly*, until (and unless) we come to a **try** block.
- Catch exceptions and do something corrective with **try**:

```
try {  
    Stuff that might throw exception;  
} catch (SomeException e) {  
    Do something reasonable;  
} catch (SomeOtherException e) {  
    Do something else reasonable;  
}  
Go on with life;
```

- When *SomeException* exception occurs in "Stuff...", we immediately "do something reasonable" and then "go on with life."
- Descriptive string (if any) available as `e.getMessage()` for error messages and the like.

Exceptions: Checked vs. Unchecked

- The object thrown by **throw** command must be a subtype of `Throwable` (in `java.lang`).
- Java pre-declares several such subtypes, among them
 - `Error`, used for serious, unrecoverable errors;
 - `Exception`, intended for all other exceptions;
 - `RuntimeException`, a subtype of `Exception` intended mostly for programming errors too common to be worth declaring.
- Pre-declared exceptions are all subtypes of one of these.
- Any subtype of `Error` or `RuntimeException` is said to be *unchecked*.
- All other exception types are *checked*.

Unchecked Exceptions

- Intended for
 - Programmer errors: many library functions throw `IllegalArgumentException` when one fails to meet a precondition.
 - Errors detected by the basic Java system: e.g.,
 - * Executing `x.y` when `x` is null,
 - * Executing `A[i]` when `i` is out of bounds,
 - * Executing `(String) x` when `x` turns out not to point to a `String`.
 - Certain catastrophic failures, such as running out of memory.
- May be thrown anywhere at any time with no special preparation.

Checked Exceptions

- Intended to indicate exceptional circumstances that are not necessarily programmer errors. Examples:
 - Attempting to open a file that does not exist.
 - Input or output errors on a file.
 - Receiving an interrupt.
- Every checked exception that can occur inside a method must either be handled by a try statement, or reported in the method's declaration.
- For example,

```
void myRead() throws IOException, InterruptedException { ... }
```

means that myRead (or something it calls) *might* throw IOException or InterruptedException.

- Language Design: Why did Java make the following illegal?

```
class Parent {  
    void f() { ... }  
}  
  
class Child extends Parent {  
    void f () throws IOException { ... }  
}
```

Good Practice

- Throw exceptions rather than using print statements and `System.exit` everywhere,
- ...because response to a problem may depend on the *caller*, not just method where problem arises.
- Nice to throw an exception when programmer violates preconditions.
- Particularly good idea to throw an exception rather than let bad input corrupt a data structure.
- Good idea to document when methods throw exceptions.
- To convey information about the cause of exceptional condition, put it into the exception rather than into some global variable:

```
class MyBad extends Exception {  
    public IntList errs;  
    MyBad(IntList nums) { errs=nums; }  
}
```

```
try {...  
} catch (MyBad e) {  
    ... e.errs ...  
}
```