COMP 202 Exceptions

CONTENTS:

- Exceptions and Errors
- The try-catch statement
- The try-catch-finally statement
- Exception propagation

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Exceptions

- When such an unusual situation occurs
 - the program *throws* an exception
 - it does not continue with the next statement in the program
- so far, the program actually terminates Instead of letting the program terminate
- - an exception can be *caught* and *handled* by another part of the program
 - that is, the programmer writes special code that is executed whenever an exception is thrown
- A program can therefore be separated into a normal execution flow and an exception execution flow
- An *error* is also represented as an object in Java, but usually represents a unrecoverable situation and should not be caught

Exceptions

- An exception is an object that describes an unusual or erroneous situation
 - division by zero
 - reading the wrong data type from a Scanner
 - accessing a non existing array-element
 - out of bound
 - accessing a null object

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Exceptions

Exceptions:

- java.lang.ArrayIndexOutOfBoundsException
- java.lang.StringIndexOutOfBoundsException
- java.lang.NullPointerException

Errors:

- java.lang.OutOfMemoryError
- java.lang.ClassFormatError
- java.lang.InternalError
- java.lang.VirtualMachineError



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Exception Handling

- If an exception is ignored by the program, the program will terminate and produce an appropriate message
- The message includes a *call stack trace* that indicates on which line the exception occurred
- The call stack trace also shows the method call trail that lead to the execution of the offending line

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The try Statement

- To process an exception when it occurs, the line that throws the exception is executed within a *try block*
- A try block is followed by one or more *catch* clauses, which contain code to process an exception
- Each catch clause has an associated exception type
- When an exception occurs, processing continues at the first catch clause that matches the exception type

Zero.java

Using try-catch

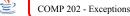
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try {

General format:

```
// code which may throw an exception
} catch(AException ae) {
   // control goes here if an AException occurs
} catch(BException be) {
   // control goes here if a BException occurs
} ...etc
```





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ZeroException

Using try-catch-finally

General format:

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```
try {
    // code which may throw an exception
} catch(AException ae) {
    // control goes here if an AException occurs
} catch(BException be) {
    // control goes here if a BException occurs
} finally {
    // this code is always executed before
    // control flow leaves the try or any catch
```

The finally Clause

- A try statement can have an optional clause designated by the reserved word finally
- If no exception is generated, the statements in the finally clause are executed after the statements in the try block complete
- Also, if an exception is generated, the statements in the finally clause are executed after the statements in the appropriate catch clause complete

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Exception Propagation

- If it is not appropriate to handle the exception where it occurs, it can be handled at a higher level
- Exceptions *propagate* up through the method calling hierarchy until they are caught and handled or until they reach the outermost level
- A try block that contains a call to a method in which an exception is thrown can be used to catch that exception



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Zero2.java

```
public class Zero2
       Deliberately divides by zero to produce an exception.
   public static void main (String[] args)
      int numerator = 10;
      int denominator = 0;
      divide (numerator, denominator);
      System.out.println ("Will this line of main be printed?");
  public static void divide (int num, int den)
       System.out.println (num / den);
       System.out.println ("Will this line of divide be printed?");
```

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Three ways to handle Exceptions

- ignore the exception
 - the program terminates
- handle the exception where it occurs
 - the exception handling code resides in the method that throws the exception
- handle the exception at another place in the program
 - the exception handling code resides somewhere in the calling hierarchy (method calls method that calls method... that calls method that throws the exception)

Zero2Exception.java

```
public class Zero2
   // Deliberately divides by zero to produce an exception.
   public static void main (String[] args)
      int numerator = 10;
      int denominator = 0;
        divide (numerator, denominator);
      catch (ArithmeticException ex) {
        System.out.println("Arithmetic Error: "+ex.getMessage());
      System.out.println ("Will this line of main be printed?");
  public static void divide (int num, int den) {
        System.out.println (num / den);
        System.out.println ("Will this line of divide by printed?");
```

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WildernessIndex.java

public class WildernessIndex

WorldZoom wildIndex = new WorldZoom(); System.out.println("Picking a country..."); wildIndex.theUS(); System.out.println("\nPicking another country..."); wildIndex.canada(); System.out.println("\nDone.");

static public void main (String[] args)



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WorldZoom.java (1/3) class WorldZoom {

public void canada() { System.out.println("Zooming in to Canada."); try

quebec(); catch (ArithmeticException problem) System.out.println ();

System.out.println ("The exception message is: " + problem.getMessage()); System.out.println (); System.out.println ("The call stack trace:"); problem.printStackTrace(); System.out.println ();

System.out.println("Zooming out of Canada.");

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public void theUS() {

try

3/3 System.out.println("Zooming in to the US."); alaska(); catch (ArithmeticException problem) System.out.println (); System.out.println ("The exception message is: " + problem.getMessage()); System.out.println (); System.out.println ("The call stack trace:"); problem.printStackTrace(); System.out.println (); System.out.println("Zooming out of the US.");

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Checked Exceptions

• An exception is either *checked* or *unchecked*

public void quebec() {

public void montreal() {

public void alaska() {

public void kodiak() {

kodiak ();

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System.out.println("Zooming in to Quebec.");

System.out.println("Zooming out of quebec.");

System.out.println("Zooming in to Montreal.");

System.out.println("Zooming out of Montreal.");

System.out.println("Zooming in to Alaska.");

System.out.println("Zooming out of Alaska.");

System.out.println("Zooming in to kodiak island.");

System.out.println("Zooming out of kodiak island.");

System.out.println("The wilderness index is: " + result);

int numPeople = 13000, numBears = 3000;

int result = numPeople / numBears;

System.out.println("The wilderness index is: " + result);

int numPeople = 3000000, numBears = 0;

int result = numPeople / numBears;

- So far unchecked exceptions
- they are the default handling procedure
 - can but do not need to be caught or propagated but
 - if not caught anywhere then program simply terminates
- A checked exception
 - must be caught within within a try/catch block within the method in which it occurs
 - can be propagated to the outer method
 - but then the method that throws the exception must declare this
 - A throws clause must be appended to the header of the method
 - We will see the throws clause when we handle files
 - The compiler will complain if a checked exception is not handled or declared appropriately



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