EXCEPTION HANDLING, DEBUGGING, AND INDEFINITE LOOPS

CSSE 120—Rose Hulman Institute of Technology

Conditional Program Execution

- Programs (scripts)
  - Modules designed to run directly (not imported)
- Libraries
  - Modules imported and designed not to run directly
- Hybrid
  - Can do both
- _ _ name _ _
- >>> if _ _name_ _ = '_ _ main _ _'
  main()

What is Exception Handling?

- Mechanism to deal with special or exceptional cases in a program
  - Developers can write code that
    - Catches exceptions while program is running
    - Deals with the exceptions

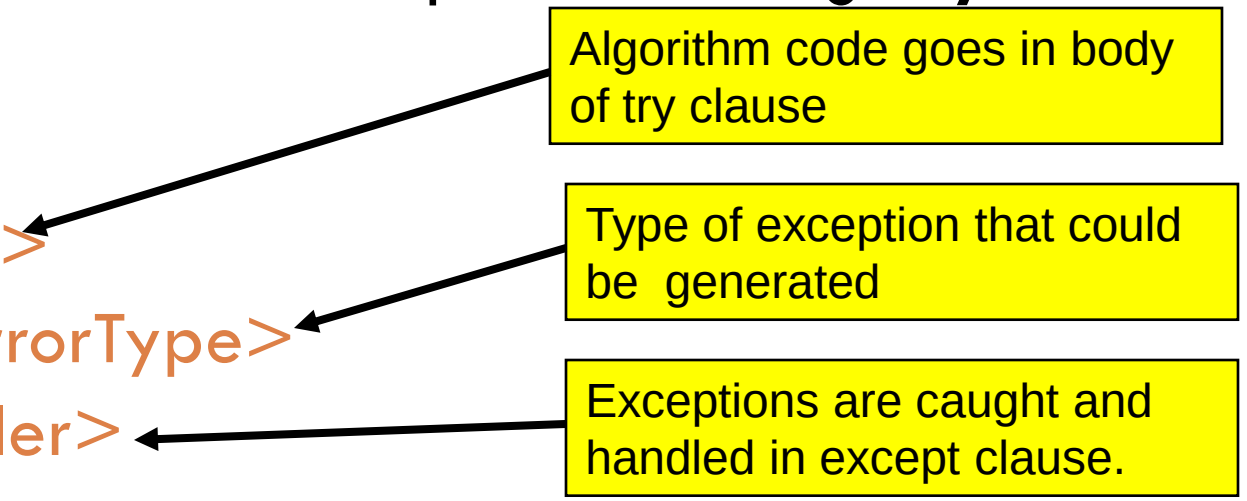
The Need for Exception Handling

- A way to separate code that addresses special cases from algorithm code
- Says "do these steps and if an exception occurs , handle it this way"
- Example problem
  - Download slope.py from Angel: Lessons → Modules to Download in Class → Session 9 → slope.py
  - Run with points (5, 6) and (10, 4)
  - Run with points (3, 6) and (10, 12)
  - Run with points (3, 300) and (3, 500)

Exception Handling: try statement

- Can use **if** statement to take care of this special case.
- We can instead use exception handling: **try** statement

```
try:
        <body>
except <errorType>
        <handler>
```



Using Exception Handling

- Use exception handling code to fix slope.py

```
try:
    deltaY = y2 - y1
    deltaX = x2 – x1
    slope = deltaY / float(deltaX)
    print "\nThe slope of the line is %0.3f." % (slope)
except ZeroDivisionError:
    print “Found division by zero error.”
     print “The line has an infinite slope.”
```

Multiple “except” Clauses

- Like multi-way decisions with if-elif-else statements
- Becomes try-except-except … statement
- Modify slope.py to include an except clause for a name error exception
  - Run with points (3, 300) and (a, 500)
  - >>>dir(__builtins__) # shows names of exceptions
- Modify slope.py to include an except clause for a syntax error exception
  - Run with input (3, 300) and (a 500) missing comma!

Debugging

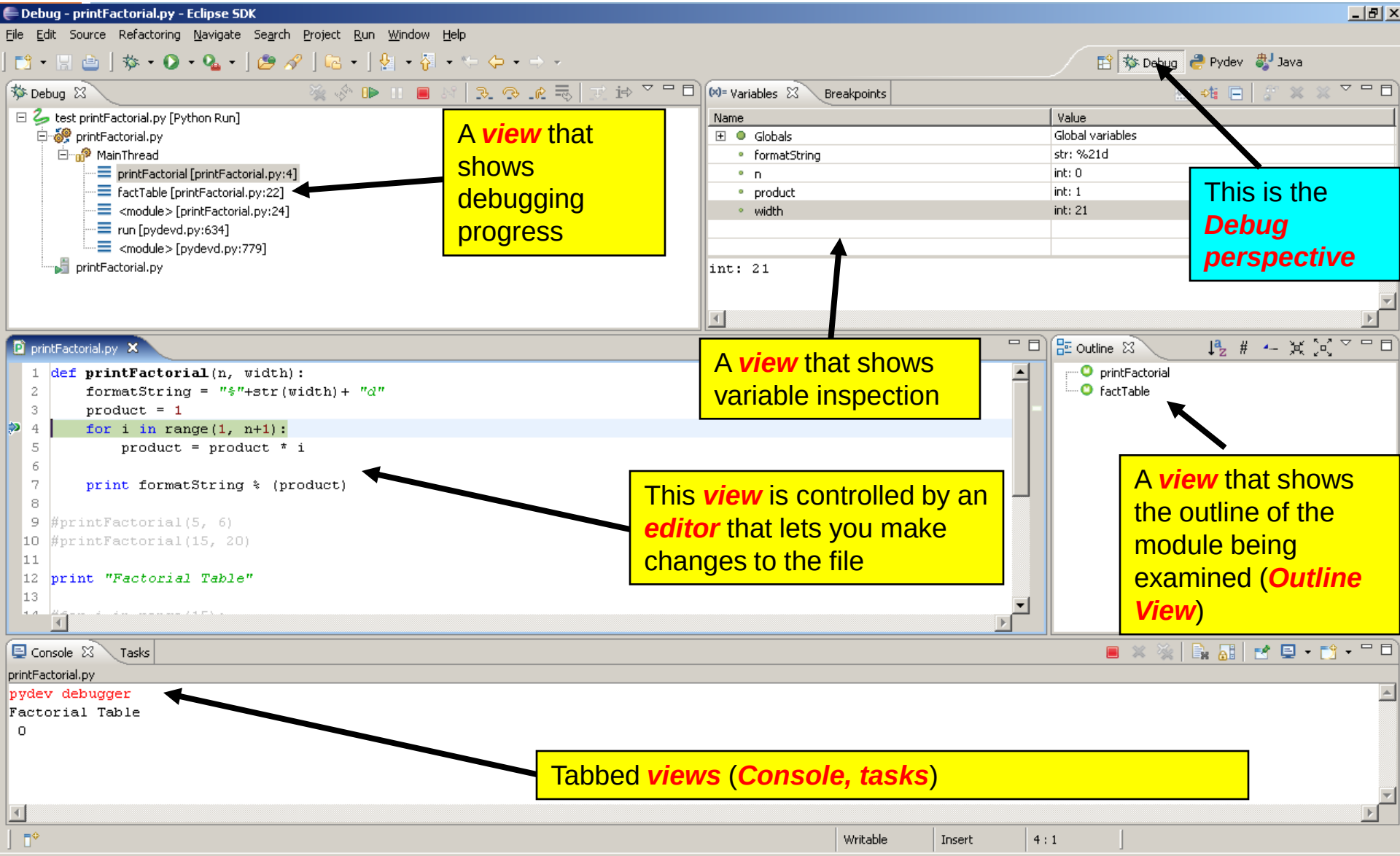
- Testing for the presence of errors and correcting them
- Why is this important?
- Ways to debug
  - Insert logging messages to show program flow
  - Use a debugger

    A program that you can use to execute another program and analyze its runtime behavior

Using a Debugger

- Debugger: A program that you can use to execute another program and analyze its runtime behavior
- Debugging commands
  - Set breakpoints
  - Single step
  - Inspect variables
- Debugging Example
  - Download printFactorial.py

Sample Debugging Session: Eclipse



How to Debug Effectively

- Reproduce the error
- Simplify the error
- Divide and conquer
- Know what your program should do
- Look at the details
- Understand each bug before you fix it
- Practice!

The min-of-n Problem

- Consider a program to return the minimum of three values
- Create a Python program called minimum.py
- Solve the min-of-n problem together by exploring the following approach: comparing each to all
  - if x1 <= x2 <= x3:
    min_val = x1
  - Debug: What is wrong with this approach?

Comparing Each to All

- One solution is comparing each to all
- Complex expression
- Test multiple conditions using and
- It works, but what happens if we need to handle more than 3 values?

Sequential Processing

- Computer keeps track of the min value so far
- Code is simple
  - Only two decisions
  - Elegant and easy to understand

Pair Programming Exercise

- Write a function called minOfN() that solves the general case for the min-of-n values problem
- minOfN() Should
  - Prompt for the number of values
  - Prompt the user to enter each value, one at a time
- Submit to Minimum Value drop Box on Angel in Lessons → In-Class Exercise Drop Boxes folder

Review: Definite Loops

- Review: For loop
  - Definite loop: knows *a priori* the number of iterations of loop body
  - Counted loop: sequence can be generated by range()
  - Example for loop in slideshow.py
- Syntax:
  - for <var> in <sequence>:
    <body>

Is This Loop a Definite Loop?

```
#Open the file
inputFile = open(inputFileName, 'r')

# process each line of file
for line in inputFile:
    image = Image(imageCenter, line.rstrip())
    image.draw(win)
    time.sleep(delay)

win.getMouse()
inputFile.close()
win.close()
```

Indefinite Loops

- Number of iterations is not known when loop starts
- Is a conditional loop
  - Keeps iterating as long as a certain condition remains true
  - Conditions are Boolean expressions
- Implemented using while statement
- Syntax:

  while<condition> :

      <body>

While Loop

- A *pre-test loop*
  - Condition is tested at the top of the loop
- Example use of while loops

Nadia deposits $100 in a savings account each month. Each month the account earns 0.25% interest on the previous balance. How many months will it take her to accumulate $10.000?

While Loops & Exception Handling

```
while True:
    try:
        fileName = raw_input("Enter input file name: ")
        myfile = open(fileName.strip())
        print "myfile =" , myfile
        break
    except IOError:
        print "could not find file", fileName + ".   Try again!"

# do something with open file…

myfile.close()
```

Hint: You'll need code like this for your homework!

Homework

- See Homework 9 instructions on Angel:
  Lessons → Homework → Homework 9
- Homework is due at start of next class session