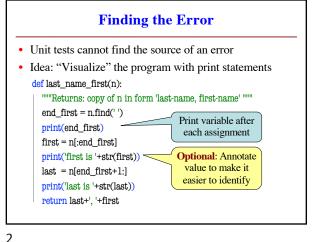
Types of Testing Black Box Testing White Box Testing • Function is "opaque" • Function is "transparent" ■ Test looks at what it does Tests/debugging takes place inside of function • Fruitful: what it returns Focuses on where error is Procedure: what changes Example: Use of print • Example: Unit tests **Problems:** • Problems: Much harder to do Are the tests everything? Must remove when done ■ What caused the error?



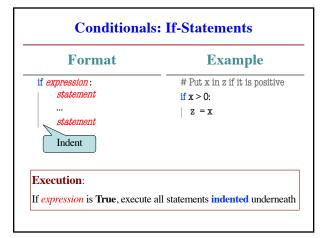
1

How to Use the Results

- Goal of white box testing is error location
 - Want to identify the **exact line** with the error
 - Then you look real hard at line to find error
 - What you are doing in lab this week
- But similar approach to black box testing
 - At each line you have **expected** print result
 - Compare it to the **received** print result
 - Line before first mistake is *likely* the error

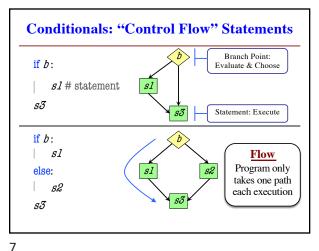
Structure vs. Flow **Program Structure Program Flow** Order code is **presented** Order code is **executed** Order statements are listed Not the same as structure Inside/outside of function Some statements duplicated Will see other ways... Some statements skipped Defines possibilities over Defines what happens in a multiple executions single execution Have already seen this difference with functions

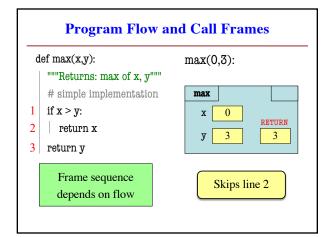
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Testing and Code Coverage

- Typically, tests are written from specification
 - This is because they should be written first
 - You run these tests while you implement
- But sometimes tests leverage code structure
 - You know the control-flow branches
 - You want to make sure each branch is correct
 - So you explicitly have a test for each branch
- This is called code coverage

Watches vs. Traces

Watch

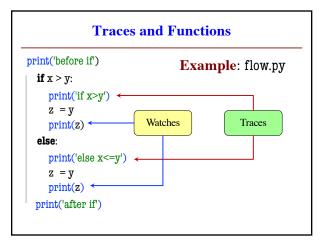
- Visualization tool
- Often print/log statement
- May have IDE support
- Looks at variable value
 - Anywhere it can change
 - Often after assignment
- Trace
- Visualization tool
 - Often print/log statement
 - May have IDE support
- Looks at program flow
 - Anywhere it can change

■ Before/after control

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Conditionals: If-Elif-Else-Statements Notes on Use Format if expression: • No limit on number of elif statement Can have as many as want ■ Must be between if, else elif expression: The else is always optional statement if-elif by itself is fine Booleans checked in order else: Once it finds first True, skips over all others • else means all are false

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