Decision Structures and Debugging

Rose-Hulman Institute of Technology
Computer Science and Software Engineering

Check out 08-DecisionStructures from SVN

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Mail box number on your quiz

Q1

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Grading Status

- Everything through HW6 is graded
- See ANGEL for grades
- Update your projects and look for CONSIDER: comments

Debugging

- Debugging includes:
  - Discovering errors
  - Coming up with a hypothesis about the cause
  - Testing your hypothesis
  - Fixing the error
- Ways to debug
  - Insert print statements to show program flow and data
  - Use a debugger:
    - A program that executes another program and displays its runtime behavior, step by step
    - Part of every modern IDE

Q2

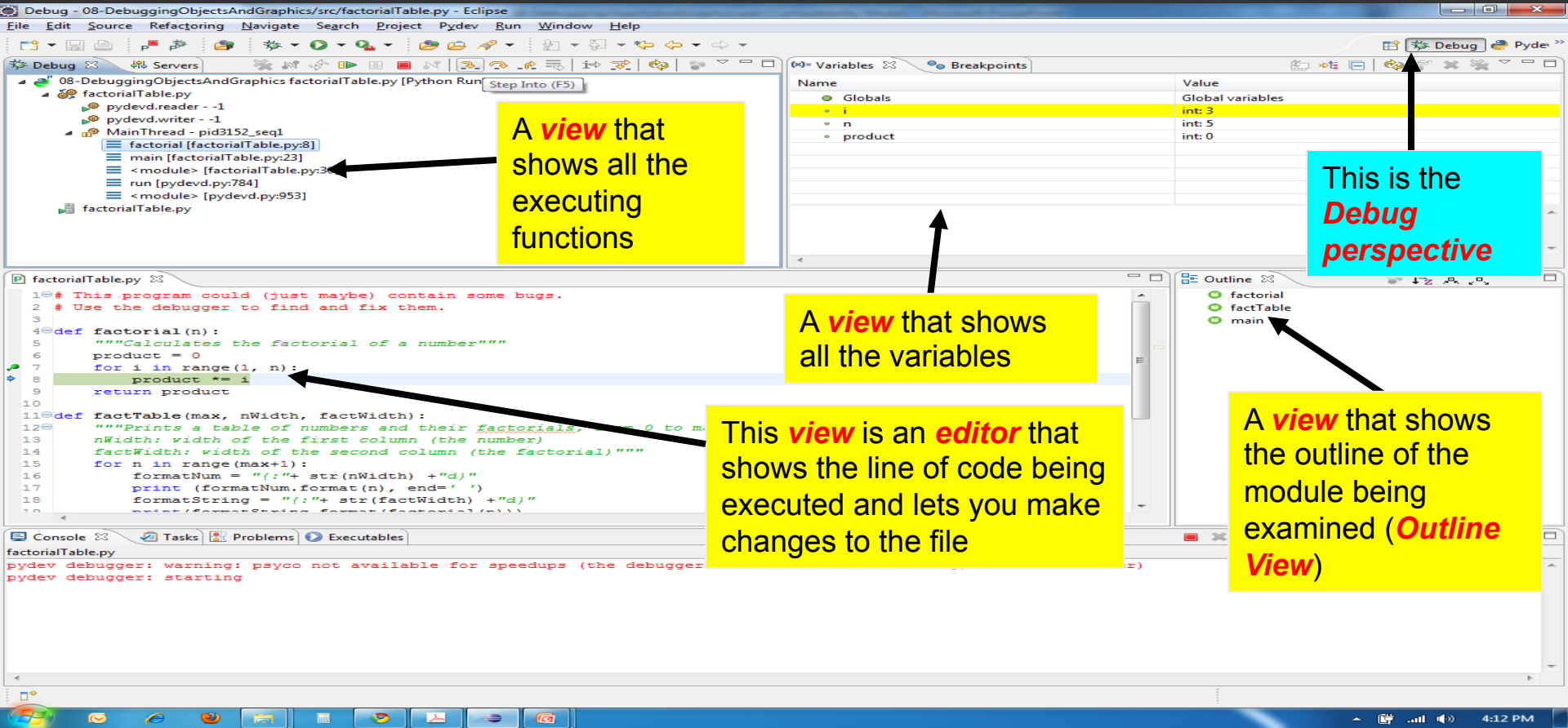
Using a Debugger

- Typical debugger commands:
  - *Set a breakpoint*—place where you want the debugger to pause the program
  - *Single step*—execute one line at a time
  - *Inspect* a variable—look at its changing value over time
- Debugging Example
  - In the **factorialTable.py** file
  - Start a debugging session:
    - Window → Open Perspective→ other→ Debug → Okay
    - Click debug icon (top-left side of work bench)

Using the debugger in Eclipse

- Set a breakpoint
  - Double click in left margin of editor view
- Step over (when you know a function works)
  - Click step-over icon or use F6 key
- Variable inspection
  - Look at the new value of i, cir after each time though the loop

Sample Debugging Session: Eclipse



Tips 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!

It's the scientific method!
- hypothesize,
- experiment,
- fix bug,
- repeat experiment

Q3

Control Freaks

- Typical: statements execute in order
- Sometimes we want other orders
  - What examples have we seen of this?
- Statements that alter the flow are called *control structures*

Decision, Decisions

- *Decision structures* are control structures that allow programs to "choose" between different sequences of instructions

Simple Decisions

- The **if** statement
  - **if <condition>:**
    <body>
- Semantics: "if the condition is **True**, run the body, otherwise skip it"

- Simple conditions
  - **<expr> <relop> <expr>**
  - 6 * 7 >= 42

Math	Python
<	<
≤	<=
>	>
≥	>=

Math	Python
=	==
≠	!=

Q4

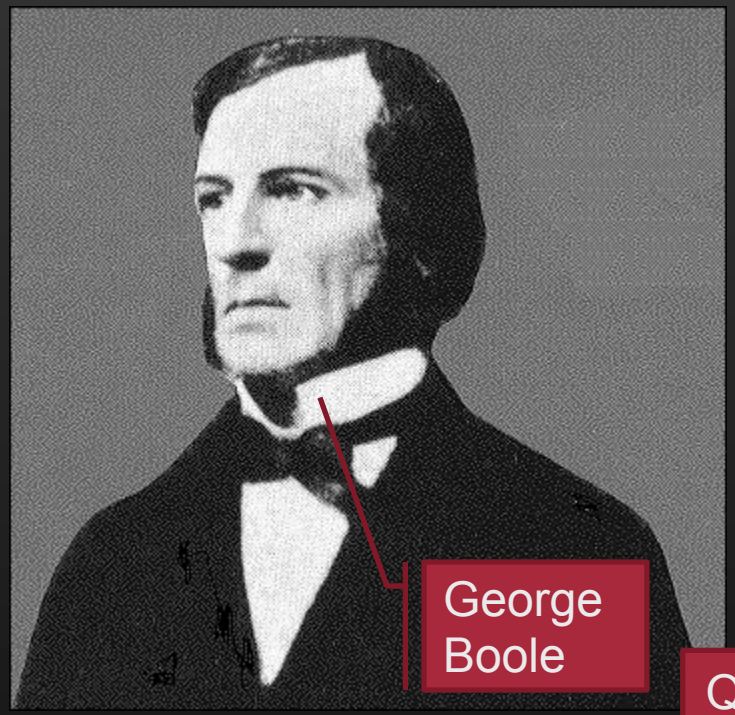
Exercise

- In module **grade.py**, define a function **grade(score)**
  - where score is from 0 to 100
  - and result is "perfect", "passing", or "failing" based on the score

More on Comparisons

- Conditions are Boolean expressions
  - Evaluate to **True** or **False**
- Try these:

```
>>> 3 < 4
>>> 42 > 7**2
>>> "ni" == "Ni"
>>> "A" < "B"
>>> "a" < "B"
```



Q5

Boolean Operators

- and, or, not

P	Q	P and Q
T	T	T
T	F	F
F	T	F
F	F	F

P	Q	P or Q
T	T	T
T	F	T
F	T	T
F	F	F

P	not P
T	F
F	T

Q6

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Having It Both Ways: if-else

- Syntax:
  if <condition>:
  <statementsForTrue>
  else:
  <statementsForFalse>
- Semantics:
  "If the condition is true, execute the statements for true, otherwise execute the statements for false"

Q7

A Mess of Nests

- Can we modify the grade function to return letter grades—A, B, C, D, and F?

Multi-way Decisions

- Syntax:

```
if <condition1>:
        <case 1 statements>
elif <condition2>:
        <case 2 statements>
elif <condition 3>:
        <case 3 statements>
…
else:
        <default statements>
```

Reach here if condition1 is false

Reach here if condition1 is false and condition2 is true

Reach here if both condition1 and condition2 are false

Cleaning the Bird Cage

- Advantages of **if-elif-else** vs. nesting
  - Number of cases is clear
  - Each parallel case is at same level in code
  - Less error-prone
- Implement **gradeFixed** to use **if-elif-else** statement instead of nesting

Q8

Wrap up the quiz before starting homework

Finish the quiz

Q9,10

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Complete the TODOs in countPassFail.py

Individual Exercise on Decisions

If you finish this, continue with rest of HW08

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