61A Lecture 25

Wednesday, April 1
Announcements
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• Guerrilla Section 5 this weekend on Scheme & functional programming
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  - Sunday 4/5 12:30pm – 2pm in 271 Soda
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• Homework 7 due Wednesday 4/8 @ 11:59pm
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• Quiz 2 released Tuesday 4/7 & due Thursday 4/9 @ 11:59pm
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- New policy: Go to lab to earn back up to 5 lost midterm 2 points (some conditions apply)
Exceptions
Today's Topic: Handling Errors
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Sometimes, computer programs behave in non-standard ways
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  • A function receives an argument value of an improper type
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- A network connection is lost in the middle of data transmission
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Grace Hopper's Notebook, 1947, Moth found in a Mark II Computer
Exceptions
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Mastering exceptions:
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Mastering exceptions:

Exceptions are objects! They have classes with constructors.
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If f calls g and g calls h, exceptions can shift control from h to f without waiting for g to return.
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Mastering exceptions:

Exceptions are objects! They have classes with constructors.

They enable non-local continuations of control

If f calls g and g calls h, exceptions can shift control from h to f without waiting for g to return.

(Exception handling tends to be slow.)
Raising Exceptions
Assert Statements

Assert statements raise an exception of type AssertionError
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```
assert <expression>, <string>
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Assertions are designed to be used liberally. They can be ignored to increase efficiency by running Python with the "-O" flag; "O" stands for optimized.
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python3 -O
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Whether assertions are enabled is governed by a bool `__debug__`
**Assert Statements**

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```bash
python3 -O
```

Whether assertions are enabled is governed by a bool `__debug__`

(Demo)
Raise Statements

Exceptions are raised with a raise statement
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```
raise <expression>
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<expression> must evaluate to a subclass of BaseException or an instance of one
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Exceptions are constructed like any other object. E.g., TypeError('Bad argument!')
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\texttt{raise <expression>}
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\texttt{TypeError} — A function was passed the wrong number/type of argument
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`TypeError` -- A function was passed the wrong number/type of argument

`NameError` -- A name wasn't found
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- **TypeError** -- A function was passed the wrong number/type of argument
- **NameError** -- A name wasn't found
- **KeyError** -- A key wasn't found in a dictionary
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- **RuntimeError** -- Catch-all for troubles during interpretation
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(Demo)
Try Statements
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```python
try:
    <try suite>
except <exception class> as <name>:
    <except suite>
...
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Execution rule:
Try Statements

Try statements handle exceptions

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Execution rule:

The <try suite> is executed first
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The `<try suite>` is executed first

If, during the course of executing the `<try suite>`, an exception is raised that is not handled otherwise, and
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Execution rule:

The <try suite> is executed first

If, during the course of executing the <try suite>,
an exception is raised that is not handled otherwise, and

If the class of the exception inherits from <exception class>, then

The <except suite> is executed, with <name> bound to the exception
Handling Exceptions
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Exception handling can prevent a program from terminating
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```python
>>> try:
```
Handling Exceptions

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```python
>>> try:
    x = 1/0
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Handling Exceptions

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>>> try:
    x = 1/0
except ZeroDivisionError as e:
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handling a <class 'ZeroDivisionError'>
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**Multiple try statements:** Control jumps to the except suite of the most recent try statement that handles that type of exception
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(Demo)
WWPD: What Would Python Do?

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```python
def invert(x):
    inverse = 1/x  # Raises a ZeroDivisionError if x is 0
    print('Never printed if x is 0')
    return inverse

def invert_safe(x):
    try:
        return invert(x)
    except ZeroDivisionError as e:
        return str(e)
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