Review 3

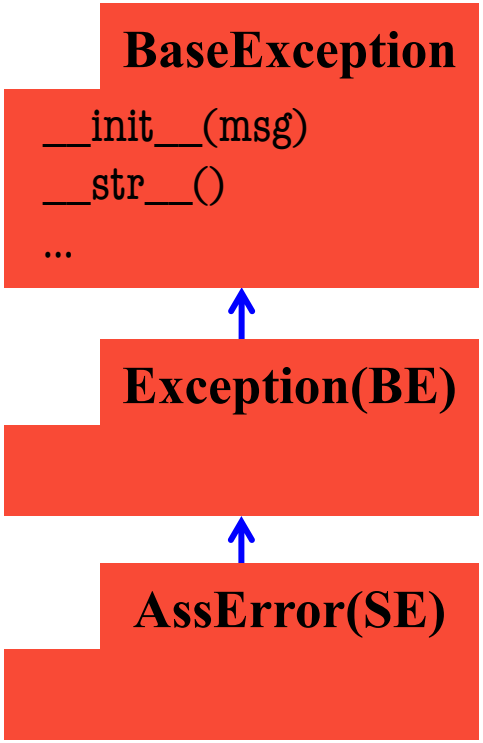
Exceptions and Try-Except Blocks

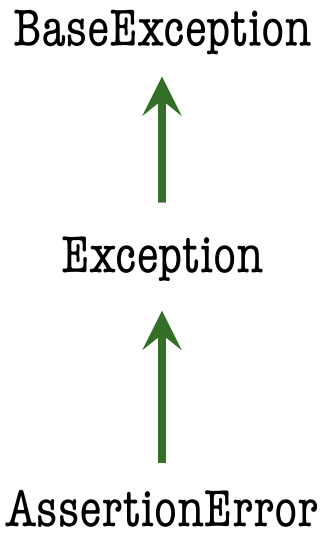
What Might You Be Asked

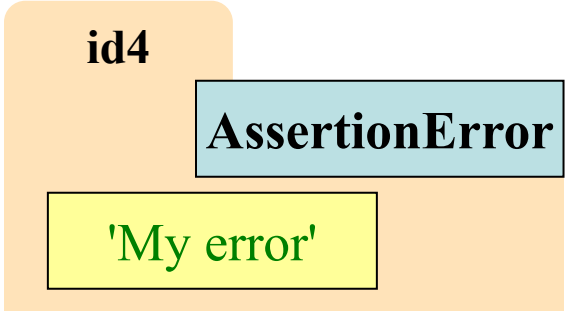
- Create your own Exception class
- Write code to throw an exception
- Follow the path of a thrown exception
  - Requires **understanding** of try-except blocks
  - Simply give us the trace (print statement) results
- Write a simple try-except code fragment
  - Will only confine it to a single function/fragment
  - Look at the sample code `read.py` from Lecture 21

Error Types in Python

- All errors are instances of class BaseException
- This allows us to organize them in a hierarchy

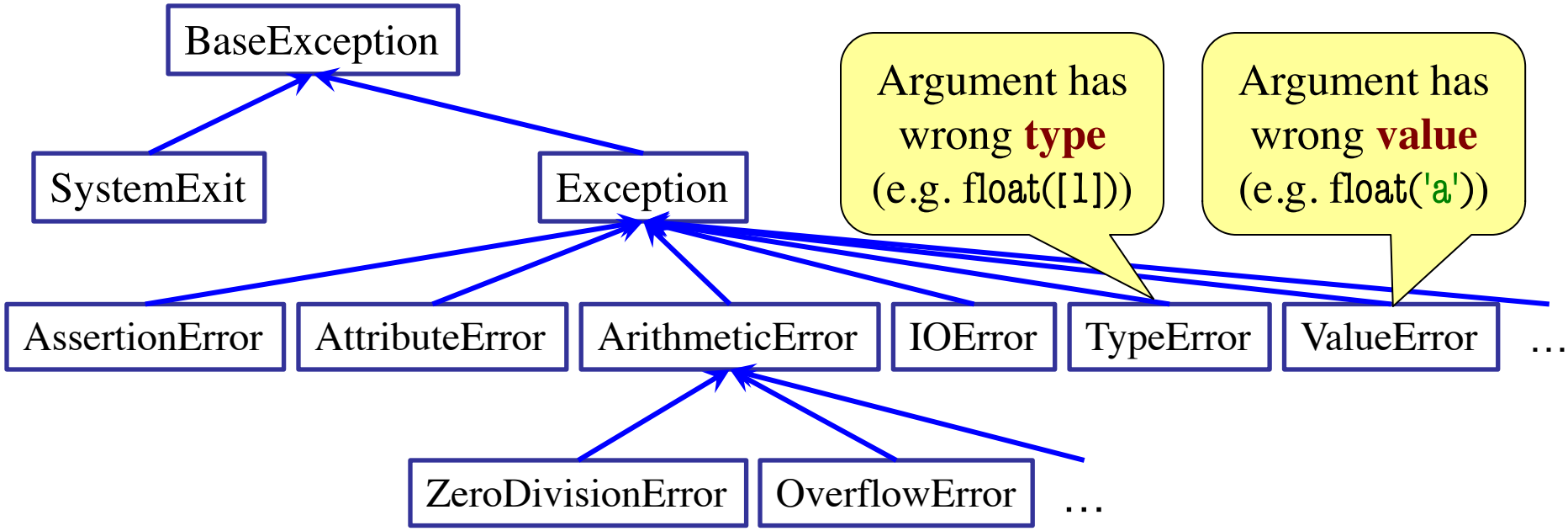






→ means "extends" or "is an instance of"

Python Error Type Hierarchy



http://docs.python.org/library/exceptions.html

You will **NOT** have to memorize this on exam.

Creating Your Own Exceptions

```
class CustomError(Exception):
    """An instance is a custom exception"""
    pass
```

Only issues is choice of parent error class. Use `Exception` if you are unsure what.

This is all you need

- No extra fields
- No extra methods
- No constructors

Inherit everything

When Do Exceptions Happen?

Automatically Created

```
def foo():
    x = 5 / 0
```

Python creates Exception for you automatically

Manually Created

```
def foo():
    raise Exception('I threw it')
```

You create Exception manually by **raising** it

Raising Errors in Python

- **Usage**: raise <exp>
  - exp evaluates to an object
  - An instance of Exception
- Tailor your error types
  - **ValueError**: Bad value
  - **TypeError**: Bad type
- **Examples**:
  - raise ValueError('not in 0..23')
  - raise TypeError('not an int')
- Only issue is the type

```
def foo(x):
    assert x < 2, 'My error'
    ...
```

Identical

```
def foo(x):
    if x >= 2:
        m = 'My error'
        raise AssertionError(m)
    ...
```

Try-Except: Possible Exam Question

What does foo() evaluate to?

```
def foo():
    x = 1
    try:
        x = 2
        raise Exception()
        x  = x+5
    except Exception:
        x = x+10
    return x
```

Try-Except: Possible Exam Question

```
def foo():
    x = 1
    try:
        x = 2
        raise Exception()
        x  = x+5
    except Exception:
        x = x+10
    return x
```

executes this line normally

executes this line normally

never reaches this line

but does execute this line

and executes this line

Try-Catch: Possible Exam Question

```
def foo():
    x = 1
    try:
        x = 2
        raise Exception()
        x  = x+5
    except Exception:
        x = x+10
    return x
```

What does foo() evaluate to?

Answer: 12 (2+10)

More Exception Tracing

```
def first(x):
    print('Starting first.')
    try:
        second(x)
    except:
        print('Caught at first')
    print('Ending first')

def second(x):
    print('Starting second.')
    try:
        third(x)
    except:
        print('Caught at second')
    print('Ending second')
```

```
def third(x):
    print('Starting third.')
    assert x < 1
    print('Ending third.')
```

What is the output of first(2)?

More Exception Tracing

```
def first(x):
    print('Starting first.')
    try:
        second(x)
    except:
        print('Caught at first')
    print('Ending first')

def second(x):
    print('Starting second.')
    try:
        third(x)
    except:
        print('Caught at second')
    print('Ending second')
```

```
def third(x):
    print('Starting third.')
    assert x < 1
    print('Ending third.')
```

What is the output of first(2)?

'Starting first.'

'Starting second.'

'Starting third.'

'Caught at second'

'Ending second'

'Ending first'

More Exception Tracing

```
def first(x):
    print('Starting first.')
    try:
        second(x)
    except:
        print('Caught at first')
    print('Ending first')

def second(x):
    print('Starting second.')
    try:
        third(x)
    except:
        print('Caught at second')
    print('Ending second')
```

```
def third(x):
    print('Starting third.')
    assert x < 1
    print('Ending third.')
```

What is the output of first(0)?

More Exception Tracing

```
def first(x):
    print('Starting first.')
    try:
        second(x)
    except:
        print('Caught at first')
    print('Ending first')

def second(x):
    print('Starting second.')
    try:
        third(x)
    except:
        print('Caught at second')
    print('Ending second')
```

```
def third(x):
    print('Starting third.')
    assert x < 1
    print('Ending third.')
```

What is the output of first(0)?

'Starting first.'

'Starting second.'

'Starting third.'

'Ending third'

'Ending second'

'Ending first'

Exceptions and Dispatch-On-Type

```
def first(x):
    print('Starting first.')
    try:
        second(x)
    except IOError:
        print('Caught at first')
    print('Ending first')

def second(x):
    print('Starting second.')
    try:
        third(x)
    except AssertionError:
        print('Caught at second')
    print('Ending second')
```

```
def third(x):
    print('Starting third.')
    if x < 0:
        raise IOError()
    elif x > 0:
        raise AssertionError()
    print('Ending third.')
```

What is the output of first(-1)?

Exceptions and Dispatch-On-Type

```
def first(x):
    print('Starting first.')
    try:
        second(x)
    except IOError:
        print('Caught at first')
    print('Ending first')

def second(x):
    print('Starting second.')
    try:
        third(x)
    except AssertionError:
        print('Caught at second')
    print('Ending second')
```

```
def third(x):
    print('Starting third.')
    if x < 0:
        raise IOError()
    elif x > 0:
        raise AssertionError()
    print('Ending third.')
```

What is the output of first(-1)?

```
Starting first.
Starting second.
Starting third.
Caught at first.
Ending first.
```

Exceptions and Dispatch-On-Type

```
def first(x):
    print('Starting first.')
    try:
        second(x)
    except IOError:
        print('Caught at first')
    print('Ending first')

def second(x):
    print('Starting second.')
    try:
        third(x)
    except AssertionError:
        print('Caught at second')
    print('Ending second')
```

```
def third(x):
    print('Starting third.')
    if x < 0:
        raise IOError()
    elif x > 0:
        raise AssertionError()
    print('Ending third.')
```

What is the output of first(1)?

Exceptions and Dispatch-On-Type

```
def first(x):
    print('Starting first.')
    try:
        second(x)
    except IOError:
        print('Caught at first')
    print('Ending first')

def second(x):
    print('Starting second.')
    try:
        third(x)
    except AssertionError:
        print('Caught at second')
    print('Ending second')
```

```
def third(x):
    print('Starting third.')
    if x < 0:
        raise IOError()
    elif x > 0:
        raise AssertionError()
    print('Ending third.')
```

What is the output of first(1)?

```
Starting first.
Starting second.
Starting third.
Caught at second.
Ending second.
Ending first.
```

Programming With Try-Except

```
def isFloat(s):
    """Returns: True if string
    s represents a float.
    False otherwise"""
    # Implement Me
```

float(s) returns an error if s does not represent a float

Programming With Try-Except

```
def isFloat(s):
    """Returns: True if string
    s represents a float.
    False otherwise"""
    try:
        x = float(s)
        return True
    except:
        return False
```

Conversion to a float might fail

If attempt succeeds, string s is a float

Otherwise, it is not

Programming With Try-Except

```
def isFloat(s):
    """Returns: True if string
    s represents a float.
    False otherwise"""
    try:
        x = float(s)
        return True
    except ValueError as e:
        print(e)
        return False
```

Conversion to a float might fail

If attempt succeeds, string s is a float

Otherwise, it is not

Example from Older Version of A7

```
def fix_bricks(args):
    """Changes constants BRICKS_IN_ROW,
    BRICK_ROWS, and BRICK_WIDTH to
    match command line arguments

    If args does not have exactly 2 elements,
    or they do not represent positive integers,
    DON'T DO ANYTHING.

    If args has exactly two elements, AND
    they represent positive integers:
      1. Convert the second element to an int
         and store it in BRICKS_IN_ROW.
      2. Convert the third element to an int
         and store it in BRICK_ROWS.
      3. Recompute BRICK_WIDTH formula

    Precondition: args is a list of strings."""
    pass
```

- Examples:

```
>>> fix_bricks(['3', '4'])      # okay
>>> fix_bricks(['3'])           # error
>>> fix_bricks(['3','4','5']) # error
>>> fix_bricks(['a', '1'])      # error
```

Example from Older Version of A7

```
def fix_bricks(args):
    """Change constants BRICKS_IN_ROW, BRICK_ROWS, and BRICK_WIDTH"""
    global BRICKS_IN_ROW, BRICK_ROWS
    global BRICK_WIDTH
    if len(args) != 2:
        return
    try:
        b_in_row = int(args[0])
        b_rows   = int(args[1])
        if (b_in_row <= 0 or b_rows <= 0):
            return
        BRICKS_IN_ROW = b_in_row;
        BRICK_ROWS  = b_rows;
        BRICK_WIDTH = (GAME_WIDTH - BRICK_SEP_H * (b_in_row+1)) / b_in_row
    except:
        pass
```

Need to change global variables

Will not reach here if conversion fails